



Tort Law and Economics

EDITED BY
MICHAEL FAURE

VOLUME 1
ENCYCLOPEDIA OF LAW AND ECONOMICS,
SECOND EDITION

TORT LAW AND ECONOMICS

ENCYCLOPEDIA OF LAW AND ECONOMICS, SECOND
EDITION

General Editor: Gerrit De Geest
School of Law, Washington University, St. Louis, MO, USA

1. Tort Law and Economics
Edited by Michael Faure

Future titles will include:

Labor and Employment Law and Economics
Edited by Kenneth G. Dau-Schmidt, Seth D. Harris and Orly Lobel

Criminal Law and Economics
Edited by Nuno Garoupa

Antitrust Law and Economics
Edited by Keith Hylton

Procedural Law and Economics
Edited by Chris William Sanchirico

Regulation and Economics
Edited by Roger Van den Bergh

Contract Law and Economics
Edited by Gerrit De Geest

Methodology of Law and Economics
Edited by Thomas S. Ulen

Property Law and Economics
Edited by Boudewijn Bouckaert

Corporate Law and Economics
Edited by Joseph A. McCahery and Erik P.M. Vermeulen

Production of Legal Rules
Edited by Francesco Parisi

Intellectual Property Law and Economics
Edited by Ben Depoorter

For a list of all Edward Elgar published titles visit our site on the World Wide Web at
<http://www.e-elgar.co.uk>

Tort Law and Economics

Edited by

Michael Faure

Professor of Comparative and International Environmental Law, University of Maastricht and Professor of Comparative Private Law and Economics, Erasmus University Rotterdam, The Netherlands

ENCYCLOPEDIA OF LAW AND ECONOMICS, SECOND
EDITION

Edward Elgar

Cheltenham, UK • Northampton, MA, USA

© The Editor and Contributors Severally 2009

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system or transmitted in any form or by any means, electronic, mechanical or photocopying, recording, or otherwise without the prior permission of the publisher.

Published by
Edward Elgar Publishing Limited
The Lypiatts
15 Lansdown Road
Cheltenham
Glos GL50 2JA
UK

Edward Elgar Publishing, Inc.
William Pratt House
9 Dewey Court
Northampton
Massachusetts 01060
USA

A catalogue record for this book
is available from the British Library

Library of Congress Control Number: 2009921525



ISBN 978 1 84720 659 6

Printed and bound by MPG Books Group, UK

Contents

<i>List of contributors</i>	xvii
<i>List of abbreviations</i>	xviii
<i>General introduction</i>	xxi

PART I EFFICIENT LIABILITY RULES

1 Strict liability versus negligence	3
<i>Hans-Bernd Schäfer and Frank Müller-Langer</i>	
1.1 Introduction	3
1.2 Unilateral accidents	5
1.2.1 Rule of no liability	6
1.2.2 Negligence	6
1.2.3 Relaxing assumptions	7
1.2.4 Strict liability	10
1.2.5 Relaxing assumptions for strict liability	10
1.2.6 Liability and uncertain legal standards of due care	13
1.3 Bilateral accidents	15
1.3.1 The ‘cheapest cost avoider’	16
1.3.2 Rule of no liability	17
1.3.3 Negligence	17
Simple negligence	17
Negligence with the defence of contributory negligence	18
Comparative negligence rule	18
1.3.4 Strict liability	19
Simple strict liability	19
Strict division of losses	19
Strict liability with the defence of contributory negligence	20
Strict liability with the defence of relative negligence	20
1.3.5 Relaxing assumptions	20
1.4 Litigation costs	24
1.5 The decentralisation effect of strict liability and negligence	24
1.6 The information-generating consequence of negligence	27

1.6.1	Negligence generates public information on safety technology	27
1.6.2	Information generated by the negligence rule alleviates principal-agent problems	28
1.7	Strict liability versus negligence if the injurer's wealth is lower than the damage	29
1.8	Liability and contracts	30
1.9	Negligence under the disguise of strict liability, liability for design defects	31
1.10	Multiple tortfeasors	32
1.11	Risk aversion, liability law and insurance	33
1.12	Relaxing behavioural assumptions of rational choice	35
1.13	Comparing strict liability and negligence	36
	Bibliography	39
2	Contributory and comparative negligence in the law and economics literature	46
	<i>Mireia Artigot i Golobardes and Fernando Gómez Pomar</i>	
2.1	Introduction	46
2.2	The world of negligence	47
2.3	Contributory and comparative negligence: concepts and evolution	48
2.3.1	Contributory negligence: origin, development and later trend towards comparative negligence	48
2.3.2	Comparative negligence: pure and modified forms	52
2.4	Incentives to take care	53
2.4.1	Initial literature: contributory negligence and the least-cost avoider	53
2.4.2	Haddock and Curran and Shavell: the equivalence between contributory and comparative negligence	58
2.4.3	Relaxing some of the initial assumptions and moving away from first-best analysis	59
2.4.3.1	Evidentiary uncertainty and court error	59
2.4.3.2	Stochastic due care and the losses of injurers and victims	66
2.4.3.3	Heterogeneous agents	67
2.4.3.4	Asymmetric information and liability rules as mechanisms to reveal information	70
2.4.3.5	Convergence to equilibrium	72

2.5	Other grounds for criticism of comparative negligence	73
	Ability to apportion negligence	73
	Risk coverage	73
	The role of jurors	74
	The costly mechanism of adjusting the defendant's liability share both with respect to the plaintiff and with respect to the other defendants	74
2.6	Empirical studies on the performance of contributory and comparative negligence rules, and on pure comparative versus modified comparative negligence	74
2.7	Conclusions	77
	Bibliography	77

PART II CAUSATION AND MULTIPLE TORTFEASORS

3	Causation and foreseeability	83
	<i>Omri Ben-Shahar</i>	
3.1	Introduction	83
3.2	Causation in early economic analysis of law	84
3.3	Prospective causation	85
3.4	Causation and socially optimal care	86
3.5	Causation under strict liability	87
	3.5.1 The effect of the scope of liability on the level of care	87
	3.5.2 The effect of the scope of liability on the level of activity	88
3.6	Causation under the negligence rule	89
	3.6.1 The determination of the optimal standard of care	89
	3.6.2 The effect of the scope of liability on the actual level of care	89
	3.6.3 The scope of liability in an imperfectly operating negligence system	89
3.7	Uncertainty over causation	91
3.8	The case for threshold probability rules	92
3.9	The case for the proportional liability rule	93
3.10	Risk-based liability and safety regulation	96
3.11	Causal apportionment among joint tortfeasors	97
3.12	Foreseeability in tort law	100
3.13	Foreseeability in contract law	102
3.14	Causation and litigation costs	104
	Bibliography	105

4	Joint and several liability	109
	<i>Lewis A. Kornhauser and Richard L. Revesz</i>	
4.1	Introduction	109
4.2	Legal regimes	109
4.3	Settlements	110
4.3.1	Several only liability	112
4.3.2	Joint and several liability with two defendants	113
4.3.2.1	Independent probabilities	113
4.3.2.2	Perfectly correlated probabilities	115
4.3.2.3	The effects of limited solvency	115
4.3.3	Joint and several liability with $n > 2$ defendants	117
4.4	Deterrence: opening remarks	119
4.4.1	Full solvency	120
4.4.1.1	Negligence	120
4.4.1.2	Strict liability	122
4.4.2	Limited, exogenously determined solvency	122
4.4.3	Endogenous solvency	124
4.5	Fairness: several remarks	125
4.6	Size of the plaintiff's recovery	126
4.7	Division of the plaintiff's recovery	126
4.8	The effects of settlements	127
4.9	Division of the burden of insolvency	128
4.10	Insurance under joint and several liability	129
4.11	Conclusions	130
	References	130
5	Vicarious and corporate civil liability	134
	<i>Reinier H. Kraakman</i>	
5.1	Introduction	134
5.2	The standard case for vicarious liability	135
5.3	Factors militating against strict vicarious liability	137
5.4	The interaction between principal and agent liability	140
5.5	Negligence and composite vicarious liability regimes	142
5.6	Reaching beyond the principal: alternative liability targets	144
5.7	Corporate civil liability versus criminal liability	145
	Bibliography	147

PART III DAMAGES

6 Tort Damages	153
<i>Louis T. Visscher</i>	
6.1 Introduction	153
6.2 Full compensation of harm?	156
6.3 Pecuniary and nonpecuniary losses	158
6.4 Assessment of losses	159
6.5 Damages for fatal accidents	160
6.5.1 Introduction	160
6.5.2 Optimal amount that injurers should pay	160
6.5.3 Optimal amount that the surviving relatives should receive	162
6.6 Compensation for nonpecuniary losses?	163
6.7 Uncompensated losses	165
6.8 Punitive damages	166
6.9 Pure economic loss	168
6.10 Harm to the victim or gain to the injurer?	170
6.11 Future losses	171
6.12 Role of defendants' wealth	172
6.13 Mitigation of losses	173
6.14 Judicial moderation, limitation of damages and insolvency	174
6.15 Loss of a chance	176
6.16 Multiple tortfeasors	178
6.17 Secondary accident cost reduction	180
6.18 Empirical research	181
6.19 Conclusion	182
Bibliography	184
7 Pure economic loss	201
<i>Jef De Mot</i>	
7.1 Introduction	201
7.2 A taxonomy of pure economic loss cases	202
7.3 The insufficiency of explanations not based on efficiency	203
7.4 Private versus social loss	204
7.5 Private loss, social loss and market structure	206
7.6 Strict liability versus negligence	207
7.6.1 Unilateral precaution accidents	207
7.6.2 Bilateral and trilateral precaution accidents	208
7.7 Intentional versus negligent torts	209

x *Tort law and economics*

7.8	Economic analysis of the various types of cases	209
7.8.1	Ricochet loss cases	209
7.8.2	Transferred loss cases	209
7.8.3	Closure of public service and infrastructures cases	210
7.8.4	Flawed professional advice cases	210
7.9	Conclusion	211
	Bibliography	211
8	Non pecuniary losses	215
	<i>Siewert D. Lindenbergh and Peter P.M. van Kippersluis</i>	
8.1	Introduction	215
8.2	Tort law and economics	216
8.3	Why should non pecuniary losses be compensated?	217
8.3.1	Why compensation?	217
8.3.2	Prevention	218
8.3.3	Efficient distribution and insurance	220
8.4	Valuation of non pecuniary loss	223
8.5	Risks of high awards	224
8.6	Conclusions	225
	Bibliography	226
9	Punitive damages	228
	<i>A. Mitchell Polinsky and Steven Shavell</i>	
9.1	Introduction	228
9.2	Optimal damages when injurers are found liable for sure: the basic theory of deterrence	229
9.3	Optimal damages when injurers might escape liability	231
9.4	Optimal damages when harm is underestimated	232
9.5	Optimal damages when injurers' gains are socially illicit	233
9.6	Optimal damages when parties can bargain and transact in the marketplace	234
9.7	Optimal damages and punishment	235
9.8	Optimal damages in the light of both objectives	237
9.9	Extensions of the analysis	238
	Bibliography	242
PART IV SPECIFIC CASES		
10	Environmental liability	247
	<i>Michael Faure</i>	
10.1	Introduction	247

10.2	Goals of environmental liability	249
10.3	Coase	249
10.4	Negligence versus strict liability	252
10.5	The influence of regulation on liability	253
	10.5.1 Criteria for regulation	253
	10.5.2 Necessity of the combination	253
	10.5.3 Violation of regulation and liability	254
	10.5.4 Compliance with regulation and liability	254
	10.5.5 Liability and incentive-based instruments	255
10.6	Damage and damages	255
10.7	Moving beyond the original polluter	257
	10.7.1 Causal uncertainty	257
	10.7.2 Joint and several liability	258
	10.7.3 Channelling of liability	260
	10.7.4 Liability of lenders and producers	260
10.8	Latency and retroactive liability	261
	10.8.1 Retroactive liability?	261
	10.8.2 Changes in the level of care	262
10.9	Insurance of environmental liability	263
	10.9.1 Moral hazard	264
	10.9.2 Adverse selection	265
	10.9.3 Latency and retroactive liability	265
	10.9.4 Causal uncertainty	266
	10.9.5 Compulsory insurance	266
	10.9.6 Disaster insurance	267
10.10	Other compensation mechanisms	267
10.11	Environmental federalism and environmental liability	269
10.12	The nuclear risk	270
10.13	Marine oil pollution	272
10.14	Concluding remarks	274
	Bibliography	277
11	Products liability	287
	<i>Mark A. Geistfeld</i>	
11.1	Introduction	287
11.2	The basic model for analyzing the efficiency properties of contracting and tort liability	289
11.3	The significance of imperfectly competitive markets	290
11.4	The role of consumer information about product risk	291
11.5	Do consumers undervalue product safety?	292
11.6	Informational mechanisms in product markets	293

xii *Tort law and economics*

11.7	Product warranties	295
11.8	Insurance costs and warranty liability	297
11.9	The regulatory problem	298
11.10	The choice between negligence and strict liability	300
11.11	Empirical studies of the effect of seller liability on product safety	301
11.12	The impact of tort liability on innovation and productivity	304
11.13	Products liability and the market for liability insurance	306
11.14	Introduction to the main doctrines of products liability	308
11.15	The requirement of defect	309
11.16	Construction or manufacturing defects	310
11.17	Design defects	311
11.18	Warning defects	313
11.19	Extended seller liability	315
11.20	Defenses based on consumer conduct	316
11.21	The enforceability of contractual waivers of seller liability	316
11.22	Bystander injuries	317
11.23	Compensatory damages	318
11.24	Punitive damages	319
11.25	The evolution of products liability, and the evolution of economics	320
	Bibliography	321
12	Medical malpractice	341
	<i>Steve Boccara</i>	
12.1	Introduction	341
12.2	The development of medical malpractice liability	342
12.3	The economic analysis of medical malpractice liability	343
	12.3.1 The nature of the doctor–patient relationship	343
	12.3.2 Incentive and compensation	344
	12.3.3 Medical malpractice and the law and economics approach	346
	12.3.4 Tort law, regulation and insurance	347
12.4	The main topics of medical malpractice	349
	12.4.1 Negligence versus strict liability	349
	12.4.2 Standard of care	351
	12.4.3 Is the tort system relevant?	351
	12.4.4 Defensive medicine	354
12.5	The medical malpractice crisis	356
	12.5.1 The context	356

12.5.2	Malpractice insurance and the underwriting cycle	359
12.6	Some proposals to end the medical malpractice crisis	360
12.6.1	Tort reforms	360
12.6.2	Shifting toward a no-fault system	362
12.7	Conclusions	364
	Bibliography	365

PART V ALTERNATIVE COMPENSATION SYSTEMS

13	Tort law and liability insurance	377
	<i>Gerhard Wagner</i>	
13.1	Introduction	377
13.2	The economic rationale of insurance	377
13.2.1	The demand for insurance	377
13.2.1.1	Risk aversion	377
13.2.1.2	Consequences for the deterrence function of tort law	379
13.2.1.3	Insuring liability for fault	380
13.2.1.4	Non-pecuniary losses	381
13.2.2	The supply of insurance	382
13.2.2.1	Pooling: the law of large numbers	382
13.2.2.2	Subdivision of risk	383
13.3	Compensation of victims as a purpose of liability insurance?	384
13.4	Economic problems of liability insurance	386
13.4.1	Asymmetric information and imperfect insurance	386
13.4.2	Adverse selection	388
13.4.3	Moral hazard	389
13.4.3.1	Effect: destruction of incentives generated by tort law	389
13.4.3.2	Source: informational asymmetry	390
13.4.3.3	Remedy: partial insurance	391
13.4.3.4	Activity levels	392
13.5	Economic virtues of liability insurance	393
13.5.1	Unlimited liability on paper, limited liability in reality	393
13.5.2	The pervasiveness of limited liability	394
13.5.3	Limited liability and the incentive to take care	394
13.5.4	Limited liability and the incentive to insure	395
13.5.5	Limited liability and activity levels	397
13.5.6	Compulsory insurance	397

13.5.7	Alternative means	398
13.6	The limits of insurance: insurability	399
13.6.1	Uninsurability as an argument in political discourse	399
13.6.2	Elements of insurability	399
13.6.3	Insurability as a flexible concept	400
13.7	The impact of liability insurance on tort law	401
	Bibliography	402
14	No-fault compensation systems	406
	<i>Karine Fiore</i>	
14.1	Introduction	406
14.2	No-fault systems: the priority given to the protection of victims	407
14.2.1	Definition of no-fault systems	407
14.2.2	The theoretical rationale of no-fault systems	409
14.2.2.1	Higher compensation	409
14.2.2.2	Lower transaction costs	409
14.2.2.3	Lower insurance premiums	410
14.2.3	Disadvantages of no-fault systems	411
14.2.4	Examples and empirical evaluations	412
14.2.4.1	Automobile insurance	412
14.2.4.2	A universal no-fault system: the case of New Zealand	413
14.3	No-fault versus strict liability systems	416
14.3.1	Definition of the strict liability system	416
14.3.2	The advantages of strict liability	416
14.4	The efficiency of compensation systems: the necessary conditions	418
14.4.1	Unlimited liability/compensation amounts	418
14.4.2	Safety regulation	420
14.4.3	Compulsory insurance	421
14.5	Examples of compensation systems (based on strict liability) for catastrophic risks	422
14.5.1	Compensation for nuclear accidents	423
14.5.2	Compensation for marine oil pollution accidents	425
14.6	Conclusions	427
	Bibliography	427

PART VI OTHER PERSPECTIVES ON TORT LAW

15 Harmonizing tort law: a comparative tort law and economics analysis	435
<i>Willem H. van Boom</i>	
15.1 Introduction	435
15.2 Tort law as domestic preference	436
15.3 Domestic preferences and the market for tort law systems	438
15.4 Differences in European tort law systems and the harmonization of tort law	439
15.4.1 General	439
15.4.2 Economic analysis in the harmonization debate	440
15.4.3 Tort law an obstacle for the mobility of persons and goods?	442
15.4.4 Regulatory competition versus culture	443
15.4.5 Cross-border externalities argument	444
15.4.6 Race to the bottom argument	445
15.4.7 Reduction of (transaction) cost	446
Bibliography	447

PART VII EMPIRICS

16 Empirics of tort	453
<i>Ben C.J. van Velthoven</i>	
16.1 Introduction	453
16.2 Prerequisites for empirical analysis	456
16.2.1 Variation	456
16.2.2 Data	458
16.2.3 Methods	459
16.3 The tort litigation system	461
16.3.1 Base rate	462
16.3.2 Claiming rate	463
16.3.3 Disposition of claims	465
16.3.4 Punitive damages	468
16.3.5 Administrative costs	470
16.4 Effects of tort reform on litigation and insurance	471
16.5 Safety effects	473
16.5.1 Automobile accidents	474
No-fault	474
Other changes in liability rules	477

	Other safety measures	477
16.5.2	Industrial accidents	479
	From negligence to workers' compensation	480
	Trends in workers' compensation	480
16.5.3	Product liability	482
	Empirical findings	483
	Asbestos	484
16.5.4	Medical malpractice	485
	Defensive medicine	486
16.6	Cost-benefit analysis	488
	Bibliography	490
	<i>Index</i>	499

Contributors

Mireia Artigot i Golobardes, Universitat Pompeu Fabra, Spain

Omri Ben-Shahar, University of Chicago, United States of America

Steve Boccara, Université d'Aix-en-Provence, France

Jef De Mot, Ghent University, Belgium

Michael Faure, Maastricht University and Erasmus University Rotterdam, the Netherlands

Karine Fiore, Université d'Aix-en-Provence, France

Mark A. Geistfeld, New York University School of Law, United States of America

Fernando Gómez Pomar, Universitat Pompeu Fabra, Spain

Lewis A. Kornhauser, New York University School of Law, United States of America

Reinier H. Kraakman, Harvard Law School, United States of America

Siewert D. Lindenberg, Erasmus University Rotterdam, the Netherlands

Frank Müller-Langer, University of Hamburg, Germany

A. Mitchell Polinsky, Stanford University, United States of America

Richard L. Revesz, New York University School of Law, United States of America

Hans-Bernd Schäfer, University of Hamburg, Germany

Steven Shavell, Harvard Law School, United States of America

Willem H. van Boom, Erasmus University Rotterdam, the Netherlands

Peter P.M. van Kippersluis, Erasmus University Rotterdam, the Netherlands

Ben C.J. van Velthoven, Leiden University, the Netherlands

Louis T. Visscher, Erasmus University Rotterdam, the Netherlands

Gerhard Wagner, Bonn University, Germany

Abbreviations

ACC	Accident Compensation Corporation
ACCI	American Council on Consumer Interests
AEI	American Enterprise Institute for Public Policy Research
ALI	American Law Institute
a.M.	am Main
AMA	American Medical Association
AMI	Acute Myocardial Infarction
AO	Administrative Office
ATRA	American Tort Reform Association
BGB	Bürgerliches Gesetzbuch
BJS	Bureau of Justice Statistics
CA	California
CBO	Congressional Budget Office
CCECQA	Le Comité de Coordination de l'Evaluation Clinique et de la Qualité en Aquitaine
CEO	Chief Executive Officer
CERCLA	Comprehensive Environmental Response Compensation and Liability Act
CHA	California Healthcare Association
CMA	California Medical Association
CMPA	Canadian Medical Protective Association
CPSC	Consumer Product Safety Commission
DC	District of Columbia
DCE	Designated Compensable Event
DCFR	Draft Common Frame of Reference
DES	Diethylstilbestrol
DOT	Department of Transportation
DPT	Diphtheria, Pertussis and Tetanus
DREES	Direction de la recherche, des études et de l'évaluation et des statistiques
EC	European Community
ECU	European Currency Unit
EEC	European Economic Community
EG	Europäische Gemeinschaft
ENEIS	Étude nationale sur les événements Indésirables graves liés aux Soins
EU	European Union

FDA	Food and Drug Administration
FIG	Frontier Insurance Group
HMPS	Harvard Medical Practice Study
IAEA	International Atomic Energy Agency
ICJ	Institute for Civil Justice
IGAS	Inspection Générale des Finances, Inspection Générale des Affaires Sociales
IHD	Ischaemic Heart Disease
IL	Illinois
IMO	International Marine Organization
IOPC	International Oil Pollution Compensation Funds
ISO	International Organization for Standardization
IZA	Forschungsinstitut zur Zukunft der Arbeit GmbH
<i>JAMA</i>	<i>The Journal of the American Medical Association</i>
<i>JLEO</i>	<i>The Journal of Law, Economics and Organization</i>
<i>JLS</i>	<i>The Journal of Legal Studies</i>
LGDJ	Librairie Générale de Droit et de Jurisprudence
MA	Massachusetts
MAI	Medical Adversity Insurance
MLDA	Minimum Legal Drinking Age
MN	Minnesota
NAIC	National Association of Insurance Commissioners
NBER	National Bureau of Economic Research
NCSC	National Center for State Courts
NEA	Nuclear Energy Agency
NEBA	Net Environmental Benefit Analysis
NGO	Non Governmental Organisation
NHS	National Health Service
NICE	National Institute for Clinical Excellence
NJ	New Jersey
NSC	National Safety Council
NY	New York
OECD	Organization for Economic Cooperation and Development
ONIAM	L'Office National d'Indemnisation des Accidents Médicaux
OSHA	Occupational Safety and Health Administration
OTA	Office of Technology Assessment
P&I Clubs	Protection and Indemnity Clubs
PIAA	Physicians Insurers Association of America
PRP	Potentially Responsible Party
QALY	Quality Adjusted Life Year

R&D	Research & Development
<i>RTDC</i>	<i>Revue Trimestrielle de Droit Civil</i>
<i>Stan. L. Rev.</i>	<i>Stanford Law Review</i>
STOPIA	Small Tanker Oil Pollution Indemnification Agreement
TOPIA	Tanker Oil Pollution Indemnification Agreement
UCLA	University of California, Los Angeles
UK	United Kingdom
UNFCCC	United Nations Framework Convention on Climate Change
UPCAM	Université Paul Cézanne–Aix-Marseille III
USA/US	United States of America
VSL	Value of a Statistical Life
VSLY	Value of a Statistical Life Year
WC	Workers' Compensation
WW II	World War II

General introduction

1 Goal of this book

A central goal of this book is to provide a state of the art overview of the literature with respect to the economic analysis of tort law. The organisation of this book, whereby in 16 chapters various aspects of tort law are examined, is such that the reader not familiar with the area will get an overview of the relevant economic literature. The authors have always attempted to show the evolution of the literature in the particular domain, the further refinements of economic models and the main conclusions from this literature for the policy maker. Hence, the overviews should enable the reader to get acquainted easily with the often vast literature in the particular domain. For those who are interested in further study or reading, every chapter contains a detailed bibliography with a selection of the literature on that particular topic.

This book fits into a general series of books which together constitute the *Encyclopedia of Law and Economics*. It builds further on the *Bibliography of Law and Economics* (Bouckaert and De Geest, 1992), which merely contained literature references to the various domains of law and economics, as well as on the earlier version of the *Encyclopedia of Law and Economics* which was published in 2000. That *Encyclopedia* was published both in hard copy as well as electronically (Bouckaert and De Geest, 2000). However, an update of this project was needed because since 2000, there have been many evolutions and further refinements in the literature.

Whereas the economic analysis of tort law originated in the US and also acquired followers in the late 1980s and 1990s, the movement has clearly expanded to other continents as well. A large part of the literature on the economics of tort now also comes from Europe and Asia. A consequence of this increasing popularity of applying economic concepts to tort caused, however, the problem that over a period of almost ten years, the literature has developed so quickly that a new issue of the *Encyclopedia* had become necessary.

Some topics related to the economics of tort were already present in the 2000 version of the *Encyclopedia*. However, since this new *Encyclopedia* could contain a special issue completely devoted to tort, many other topics could be added as well. Since the literature has developed so rapidly, contributors have not been asked to provide what in their view would be a complete list of all the references with respect to a particular topic.

Contributors have rather been invited to provide a list of the most important references which will allow the reader to engage in further reading.

2 The authors

The authors who wrote the various chapters in this book are leading experts either in tort law or in the law and economics of tort in a particular field and constitute a mix of both lawyers and economists as well as comprising authors from the US as well as from Europe. Many contributions constitute updates by the authors who contributed to the 2000 version of the Encyclopedia. Where these authors were willing to update their previous versions, they were invited to do so. In case the authors of the chapters in the 2000 Encyclopedia were not able to revise their chapters, new authors have been approached to write a completely new chapter, of course taking into account the findings in the 2000 Encyclopedia. For topics which were not contained in the 2000 Encyclopedia (like, for example, the empirical perspective, medical malpractice or pure economic loss), new authors have been approached.

A complete list of the authors and their affiliations is provided in the list of contributors included after the table of contents.

3 The topics and structure

The 16 chapters in this book have been brought together in seven different parts in an attempt to bring together related papers and impose a structure on this volume.

Part I deals with the central question of efficient liability rules. It deals with the basic literature on what is a central question in tort law and economics, namely under what circumstances a strict liability rule will be more efficient than negligence. This is the topic of chapter 1 by Hans-Bernd Schäfer and Frank Müller-Langer. A related issue is how in bilateral accident situations (where the victim can also have an influence on the accident risk) incentives can be provided to all parties in the accident setting. It is the question which in the literature is known as the study of the comparative efficiency of contributory and comparative negligence rules and is dealt with by Mireia Artigot i Golobardes and Fernando Gómez Pomar in chapter 2.

Part II deals with causation and multiple tortfeasors. The chapters brought together in this part have in common that they study problems that arise when there is no clear linear and simple relationship between a certain behaviour and a tortfeasor. When complications arise, uncertainties may appear, for example in the relationship between the behaviour and the damage. These issues of causation and foreseeability are dealt with by Omri Ben-Shahar in chapter 3. Clearly related are issues of multiple tortfeasors where more than one person has contributed to the harm. The rules dealing with the apportionment of damages in those situations

(joint and several liability or several only liability) are examined by Lewis Kornhauser and Richard Revesz in chapter 4. Also vicarious liability is one way of moving beyond the original tortfeasor and making for example a principal liable for the misconduct of an agent. Reasons for moving beyond the original tortfeasor towards for example a corporation are critically discussed by Reinier Kraakman in chapter 5 dealing with vicarious and corporate civil liability.

Part III deals with the broad notion of damages from an economic perspective. The central idea of the function of damages as providing incentives to the tortfeasor (and the victim) and the consequences for the types and amounts of damages to be compensated by the legal system are discussed in general by Louis Visscher in chapter 6 on tort damages. The complicated question of whether pure economic loss should be compensated as well as an economic appraisal of why legal systems have apparently different attitudes to this question is dealt with by Jef De Mot in chapter 7. The economic reasons for compensating non-pecuniary losses (deterrence and/or compensation) are critically discussed in chapter 8 by Siewert Lindenbergh and Peter van Kippersluis. A. Mitchell-Polinsky and Steven Shavell discuss the main social goals for awarding punitive damages (deterrence and punishment) in chapter 9.

Part IV deals with the application of the general findings of the economic literature on tort (dealt with in the first three parts) to a few specific cases. Tort law has undoubtedly recently also been expanding to other domains where its application gives rise to specific questions. One area where tort law is gaining popularity is undoubtedly environmental liability, which is dealt with by Michael Faure in chapter 10. Mark Geistfeld deals with the well-known area of product liability in chapter 11 and Steve Boccara with medical malpractice in chapter 12.

Part V deals with compensation systems other than the tort system and thus addresses the question to what extent alternatives can be worked out if victim compensation is a policy goal. In this respect, Gerhard Wagner deals with the relationship between tort law and insurability and also addresses to what extent insurance issues may be decisive for the liability question. Next, Karine Fiore addresses no-fault compensation systems in chapter 14, thereby analysing both the compensatory and deterrence potential of those alternative compensation schemes.

Part VI deals with perspectives on tort law other than the economic approach. Willem van Boom deals with comparative tort law and economics.

Finally, part VII deals with the highly important issue of the empirical evidence concerning the effectiveness of the tort law system. The literature in this respect is summarized in chapter 16 by Ben van Velthoven.

Of course, there is some unavoidable overlap since questions, such as for example the optimal liability rule, may be discussed in a number of chapters, but each time from a different perspective.

In this introduction, some of the main findings presented in the chapters will be summarized. Of course, it is not at all useful to attempt to rehearse what has been mentioned and discussed in the chapters. However, some similarities and differences between the approaches presented in the chapters will be sketched in order to attempt to identify a few common lines of development in the economic analysis of torts.

4 Historic evolution of tort law and economics: the basic ideas

After Ronald Coase implicitly started the law and economics movement with his seminal paper on ‘The problem of social cost’ (Coase, 1960), it was the lawyer Guido Calabresi who with his publication ‘Some thoughts on risk distribution and the law of torts’ (Calabresi, 1961) started to develop the economic analysis of tort law. In his *The Costs of Accidents*, Calabresi developed a framework for dealing with accidents through torts and alternative instruments, for the first time using insights from economic theory (Calabresi, 1970). Calabresi used the economic notion that accident costs constitute externalities which have to be internalised by the wrongdoer. Moreover, Calabresi used the simple economic wisdom that ‘our society is not committed to preserving life at any cost’.¹ He thus called for the application of cost-benefit analysis to tort law and argued that ‘we use relatively safe equipment rather than the safest imaginable because – and it is not a bad reason – the safest costs too much’.²

As Artigot i Golobardes and Gómez Pomar show in chapter 2, Judge Learned Hand had in fact already in 1947 used a proportionality test to conclude that a party should be required to take care only up to the point where the costs of such care become equal to or greater than the expected cost of the accident.

In later years, the economic analysis of tort law has gone through a rapid development starting with Posner’s *JLS* paper on a theory of negligence in 1972, followed the next year by J.P. Brown’s ‘Toward an economic theory of liability’ (Posner, 1972; Brown, 1973). Whereas Posner used economic tools to explain certain developments in case law by common law judges (arguing that they were in fact acting as if they were promoting economic efficiency), J.P. Brown developed the first economic model addressing the question of how various liability rules (more

¹ Calabresi (1970, 17).

² Calabresi (1970, 18).

particularly strict liability and negligence) could achieve the social goal of the minimisation of accident costs, already identified by Calabresi. The basic assumption in what later became known as the neo-classical model of tort law was that injurers and victims (hence the participants in a potential accident setting) are rational individuals who react to applicable tort rules striving to maximise their utility. Since then, economic models have always relaxed the assumptions and become more refined in order to make predictions concerning the efficiency of liability rules closer to the reality of the accident setting. For example, in 1974, Diamond added the importance of the activity level (in addition to care) in determining the accident risk (Diamond, 1974) and Shavell's 1980 *JLS* paper on strict liability versus negligence formalised optimal liability rules in both unilateral (when only one party can influence the accident risk) as well as bilateral (when both injurer and victim can influence the accident risk) accident situations, addressing the influence of both care and the activity level (Shavell, 1980). Many further refinements were provided *inter alia* by Grady (Grady, 1983).

The first chapter by Schäfer and Müller-Langer nicely shows how precisely on this crucial point of the comparative efficiency of strict liability versus negligence assumptions have always been further relaxed, leading to the point where the literature can now provide rather detailed advice to the policy maker on situations in which one liability rule might be better suited than the other. They stress that in principle (but under strict assumptions concerning the ability of the judge to correctly assess damages) strict liability with a defence of contributory or comparative negligence should be preferred to negligence since the latter rule only leads to efficient results if courts are able to fix the required level of due care equal to the efficient level of care. However, they equally show that when assumptions concerning the ability of the judge to assess damages correctly are relaxed, some of the advantages of strict liability disappear, which is also the case if injurers are judgement proof.

A similar evolution concerning the literature is shown with respect to bilateral accident situations by Artigot i Golobardes and Gómez Pomar in chapter 2, showing that whereas the literature initially held that contributory negligence (which means that when the victim's level of care falls short of the desired level no compensation is owed by the injurer) would be preferred to a comparative negligence rule (whereby the victim's claim on compensation would simply be reduced in proportion to the victim's contribution to the loss), but then after publications in the 1980s scholars demonstrated that in fact under both rules injurers and victims are given incentives to take efficient care. However, they equally show that developments never end since the most recent literature (from 2003)

is again increasingly critical concerning the performance of comparative negligence.³

5 Causation and multiple tortfeasors

Part II brings together papers which all deal in some way with linking a particular type of damage to an actor. Omri Ben-Shahar shows in chapter 3 that originally the early economic analysis of law denied the importance of the causation requirement. He equally shows that early scholars held that the causation requirements served goals other than efficiency. He argues that since a 1975 *University of Chicago Law Review* article by Calabresi causation was also put on the agenda of economic analysis (Calabresi, 1975). Difficulties more particularly arise in case of uncertainty concerning the causal relationship. Ben-Shahar discusses the disadvantage of the approach whereby the probability that event A caused damage B has to pass a certain (usually 50 percent) threshold. The latter is often referred to as an 'all or nothing' approach to causation and of course has the obvious disadvantage that it may distort the incentives for parties to take care, more particularly if the probability of causation is systematically below the threshold probability. Economic analysis (and more particularly Shavell) have therefore held that a proportional liability rule whereby the injurer is held to compensate the damage equally to the probability of causation leads to socially optimal levels of care.

Somewhat related is the issue discussed in many publications and equally in chapter 4 by Kornhauser and Revesz of the way in which the legal system should deal with multiple tortfeasors. They sketch the various scenarios of on the one hand a joint and several liability rule and on the other hand a several only (non-joint) liability, comparing both the incentives to settle and the effects on deterrence. They show that under full solvency and a negligence regime, the joint and several liability rule will produce socially optimal results, whereas several only liability leads to underdeterrence. In case of joint tortfeasors, however, they argue that strict liability leads to underdeterrence, regardless of whether it is coupled with joint and several liability or several only liability. Conclusions are different, however, under a potential insolvency, whereby the deterrence effects depend upon the specific assumptions made. They moreover show that, on the basis of the literature, it is held that joint and several liability may increase the uncertainty for insurers about the size of the award that will be paid, thus potentially increasing insurance premiums.

In chapter 5 Kraakman discusses situations where a party other than

³ They more particularly refer to Bar-Gill and Ben-Shahar (2003).

the original tortfeasor may be held liable to compensate the victim. This is more particularly the case under vicarious and corporate civil liability. He discusses the traditional argument in favour of vicarious (and corporate) liability being that agents (more particularly employees) are more likely to suffer from insolvency than principals (employers). Thus vicarious liability for ordinary torts is, so Kraakman argues, more likely to increase social welfare as the disparity between the agent's assets and the magnitude of prospective tort liability increases. Similar arguments are also advanced in favour of corporate criminal liability even though there is literature which is equally increasingly critical of corporate criminal liability, *inter alia* since it may have potentially perverse effects.⁴

6 Damages

The chapters brought together in part III discuss the economic function of damages and more particularly the question of how damages should be assessed if optimal deterrence (of both injurers and victims) were the social goal of accidents. Visscher provides a broad overview of all issues involved in the determination of damages and describes *inter alia* the economic method for the assessment of losses in case of death. He shows, using Kaplow and Shavell, that the abstract method of damage assessment is more efficient than the concrete method since the administrative costs are lower. Moreover, since the injurer cannot *ex ante* assess how much loss he will cause, a better (more accurate) assessment *ex post* will not change his behaviour *ex ante* (Kaplow and Shavell, 1996). Visscher equally discusses many other aspects of damage assessment, *inter alia* the point often made in the economic literature that damages for fatal accidents are often too low from an economic perspective. He argues that incorporating the literature estimating the value of a statistical life could lead to a better assessment of damages in the case of fatal accidents, at least with better incentives for injurers.

Many of Visscher's points are worked out in further detail in subsequent chapters, for example in chapter 8 by Lindenbergh and van Kippersluis discussing compensation for non-pecuniary losses. They make a distinction between various functions of compensating non-pecuniary losses. The economic literature has argued that since victims would not self-insure against non-pecuniary losses, compensation cannot be an adequate reason to force injurers to pay for pain and suffering. From an economic perspective, deterrence is the appropriate reason to force injurers to compensate non-pecuniary losses as well. However, since a rational victim would not

⁴ So more particularly Arlen (1994).

self-insure against those losses, liability could be decoupled since injurers could then still be exposed to pay damages (for optimal deterrence) but not necessarily to the victim.

The complicated issue of whether compensation should be awarded for so-called pure economic loss is addressed by De Mot in chapter 7. He shows that traditional explanations seeking to justify the denial of compensation for pure economic loss in many legal systems which are not based on notions of efficiency all lead to practical inconsistencies. Economic analysis traditionally provided a more powerful explanation (based on the fact that an economic loss would merely lead to a private loss for the victim but not necessarily to a social loss). Compensation of an economic loss which would not at the same time constitute a social loss would thus only lead to a waste of administrative costs. However, De Mot holds that more recent literature comes to more nuanced conclusions and shows that also large differences still exist between legal systems as far as the recoverability of pure economic loss is concerned, which can so far also not be fully explained on economic grounds.

Chapter 9 by Polinsky and Shavell discusses the deterrence and punishment-based explanations of punitive damages. They show that according to the basic economic theory of torts, punitive damages are basically used to outweigh the situations where the probability of being found liable is less than one. To outweigh this lower probability, damages have to be higher than compensatory in order still to reach deterrence. Several other economic explanations, also relating to the fact that harm can be underestimated or gains can be socially illicit, are presented as well. They also argue that the punishment objective may conflict somewhat with the deterrence objective since for punishment, the level of damages is likely to be higher if the chance of being found liable is high, whereas for deterrence, damages should be high precisely if the probability of being found liable is low. The optimal level of damages overall, thus maximising both deterrence and punishment, may therefore result in a compromise between both objectives.

7 Specific cases

Part IV contains a few chapters dealing with specific types of tort. In these cases, basically the general models are applied and some specificities related to the cases are stressed. A common feature in two specific tort cases (products liability and medical malpractice) is that a contractual relationship exists between the potential injurer and the victim. As Geistfeld shows in chapter 11, this potentially gives rise to contractual solutions as a result of which the producer would adopt an efficient care and activity level. However, he equally makes clear that contracting will not lead

to efficient outcomes when information costs prevent consumers from being adequately informed about product risk. In that respect, Geistfeld notices (again) a remarkable development and refinement of the economic models. Where in the mid-1970s economic analysis of product liability was based on the study of the market behaviour of perfectly informed, completely rational actors, this has since completely changed. Economists now regularly address the type of (informational and other) problems that courts have long had to confront without the aid of economic analysis. A similar development can be noticed in the field of medical malpractice as sketched by Boccara in chapter 12. The first law and economics publications in this domain which emerged in the mid-1970s, mostly by Epstein (1976), also suggested that private agreements between the physician and the victim could lead to optimal solutions concerning the level of care and desired allocation of risk, taking into account varying preferences. Later the literature took into account the difficulties for the patient of assessing the physician's care as well as the difficulties for the physician in passing on liability costs via the price system. Especially in Europe where healthcare services are highly regulated, this (Coasean) idea of passing on liability costs via the price system is in practice often not feasible. Still both chapters 11 and 12 show that the starting point for the analysis is different where (as in the fields of product liability and medical malpractice) a contractual relationship between the injurer and potential victim exists. In cases where the potential victim would be informed about the allocation of risk, society should in principle worry less about efficient liability rules since these could result from Coasean bargaining between the parties. Even when this bargaining may not be feasible, given information problems, the contractual relationship remains important since providing information on the risks may in some cases be a more appropriate tool than immediately regulating the liability rule to be applied.

Another specific case on which quite a bit of economic analysis has emerged concerns environmental liability. Chapter 10 makes clear that environmental liability is for obvious reasons a good candidate for economic analysis: whereas traditional lawyers will sometimes challenge the starting point from economic analysis that potential parties in an accident setting will adopt their behaviour on the basis of an applicable liability rule, this assumption seems to be less of a problem in environmental liability. The idea that potential polluters adapt their behaviour when confronted with liability costs is now common also among many environmental lawyers. Environmental liability is for example a field where the traditional choice between strict liability and negligence (explained in chapter 1 by Schäfer and Müller-Langer) clearly leads to favouring a strict liability regime since these cases can mostly be considered as unilateral or at least

as situations where the injurer has more influence on the accident risk than the victim. However, given a potentially important insolvency risk inherent in environmental pollution cases, strict liability may be inefficient when the magnitude of the damage exceeds the polluter's assets. This provides a strong case for imposing duties on the potential polluter to provide financial guarantees to cover his liability such as for example compulsory insurance. Moreover, environmental liability is also a field where often the fundamental question arises as to what the particular function of a liability system is. If the deterrence of polluting behaviour is the main goal of environmental liability, applying new liability rules to past pollution (so-called retroactive liability) is clearly inefficient. Nevertheless, one can notice in many environmental liability rules (such as those which emerged under CERCLA, also known as the superfund legislation) that potentially responsible parties are held liable also for pollution with a source in a distant past. This clearly shows that the policy maker in this area also has other objectives than preventing environmental pollution through deterrence. Also the problem of causal uncertainty discussed by Ben-Shahar in chapter 3 can play an important role in environmental liability cases in as far as the causal relationship between for example a particular emission and (health) damage cannot be established with certainty. Again, the solution proposed by Shavell and discussed in chapter 3 by Ben-Shahar which would provide efficient incentives to potential polluters aiming at welfare maximisation is a proportional liability rule.

8 Alternative compensation systems

Even though traditional lawyers still see victim compensation as the main task of tort law, it has been an important achievement of economic analysis to show lawyers that tort law is a particularly ill-suited instrument to reach victim compensation. Already in 1965 Calabresi held that 'if compensation were the only goal, then by far the most effective and efficient method of accomplishing it would be through a system of general social insurance, which would externalise the costs of accidents from any market decisions'.⁵ Even though Calabresi of course recognised that risk-spreading is an autonomous goal of tort law as well (referred to by Calabresi as the so-called secondary cost reduction), many alternatives have also been worked out which can precisely achieve this goal of victim compensation at lower costs. The chapters in part V deal more specifically with these alternative compensation systems and more specifically with their relationship to the tort system as well. Wagner sketches in general in chapter 13 how various

⁵ Calabresi (1965).

insurance arrangements can guarantee adequate victim compensation. In this respect, he also stresses the traditional argument made by many economists that first party insurance may even be better able to provide victim compensation since it would allow for a better risk differentiation than third party insurance. However, insurance can also be considered as an important instrument to improve deterrence, more particularly in the situation where injurers could be underdeterred through their insolvency. This is, as Wagner shows, the traditional economic argument in favour of compulsory insurance, even though alternative means (such as minimum asset requirements) could serve this goal as well. The benefits of compulsory insurance are also stressed in chapter 14 by Fiore, dealing more generally with no-fault compensation systems. She equally stresses the inability of the tort system to provide victim compensation and thus sketches the road which has been followed in many jurisdictions towards so-called no-fault compensation systems. Even though these systems are supposed to provide higher compensation at lower cost, the major disadvantage is that potential injurers are no longer exposed to liability (in cases where no fault systems would be exclusive), which could potentially lead to underdeterrence.

Both chapters 13 and 14 also address the influence of insurance or other alternative compensation mechanisms on tort law and Wagner *inter alia* analyses whether the mere fact of having liability insurance should have a bearing on the liability issue which is denied from an economic perspective. These chapters also pay attention to the question of how the tort system should be shaped to promote the insurability of particular risks. This is an issue which is also addressed in many other contributions. For example, Kornhauser and Revesz show in chapter 4 that joint and several liability, even though it can (depending upon the levels of solvency of the defendants) in some cases be argued to promote efficiency, may lead to higher insurance costs. The simple reason is that joint and several liability increases uncertainty about the size of the award that will be paid. Considerations concerning insurance and alternative compensation mechanisms also play an important role with some of the specific cases discussed in part IV. For example in chapter 10 it is argued that problems of causal uncertainty or retroactive liability could endanger the insurability of environmental risks. Given difficulties of insurance, one can notice that more particularly for environmental damage many alternative compensation systems (for example in the field of oil pollution damage) have been developed. A similar conclusion about the inability of the tort system to adequately compensate victims is reached by Geistfeld with respect to products liability in chapter 11. He also argues that requiring sellers to pay for product-caused injuries is likely to increase the average costs of injury compensation as compared to alternative insurance arrangements. Also

in the medical malpractice area, Boccara discusses in chapter 12 alternative compensation mechanisms that have been developed in many legal systems. However, empirical evidence seems to indicate that a shift towards a no-fault compensation system negatively affects the incentives for care.

9 Importance of regulation

Whereas we just indicated that many scholars point to the superiority of alternative mechanisms (such as insurance) to provide victim compensation, at least when compared to the tort system, many contributors have also shown that in particular circumstances the tort system may not be optimal in providing efficient incentives for prevention. The reasons are well known and have been identified in Shavell's criteria for regulation (Shavell, 1984). Ben-Shahar in chapter 3 (but also many other contributors) stress that the tort system may not be able to exercise its preventive function more particularly when for example because of causal uncertainty there is a likelihood that the injurer will not be held to compensate for the harm he has actually caused. In those cases where victims may not be able to bring a liability suit and public authorities may have superior information, *ex ante* standard setting through regulation may provide better results for prevention than the tort system.⁶ Not surprisingly, the chapters dealing with specific cases also stress the shortcomings of the tort system as far as providing incentives for prevention is concerned and hence point to the superiority of *ex ante* regulation. This is for example stressed in chapter 10 as far as environmental liability is concerned, but equally by Geistfeld in chapter 11 for the area of product liability (and product safety) and by Boccara in chapter 12 for the domain of medical malpractice. However, notwithstanding some weaknesses of the tort system, many contributors equally stress that regulation may not be perfect either. For example in the medical malpractice area it is rightly stressed that the self-regulation imposed upon physicians can often contain standards of care which are lower than the optimal ones. Hence, liability rules may still have an important function in addition to regulation, more particularly to function as a stop gap to cover imperfections in regulatory standards. The fact that in most legal systems liability suits are still possible in addition to the regulatory system also raises important questions concerning the mutual interdependence of regulation and the tort system.⁷

⁶ This is also stressed by Fiore in chapter 14 when dealing with no-fault compensation systems.

⁷ Some of these issues have recently been addressed by Van Boom, Lukas and Kissling (2007).

10 Fairness in tort

A classic argument against the economic analysis of tort that was (in the past) sometimes advanced by traditional lawyers is that tort law should not be analysed in terms of economic efficiency since its goal should not be efficiency (minimisation of accident costs) but rather fairness. The weakness of this argument has been convincingly shown in general by Kaplow and Shavell (2001). In the area of tort, 'traditional' tort lawyers have increasingly become convinced of the importance of economic analysis. Even if they still see victim compensation as the main goal of tort law, they accept the argument that economics can teach how this victim compensation can be achieved at the lowest cost possible. Moreover, the basic economic idea that the tort system does not only have a compensatory effect (if at all), but also aims at providing incentives to the parties involved in the accident setting towards efficient care is a notion that is increasingly accepted by lawyers. The chapters dealing with environmental liability, product liability and medical malpractice, for example, show that the belief that the exposure to liability may have a deterrent effect plays an important role in the tendency towards an expanding liability in those areas.

Moreover, many contributions to this book show also that in economic analysis attention can be paid to the distributional effects of the choice of a particular tort law regime. Even if one does not accept the importance of the efficiency criterion at a normative level, economics remains important in showing the distributional effects of various liability rules and the potential costs involved in these distributional choices. In some cases, the distributional effects will of course be decisive for the legislator. Many examples are provided. For example, Schäfer and Müller-Langer show in chapter 1 that the classic choice between strict liability and negligence is at the policy level not only determined by the effects on incentives to take efficient care of the parties involved in the accident setting, but also by the fact that (if the insolvency problem can be cured) strict liability in principle guarantees compensation of the victim whereas a negligence rule does not. That difference has of course been an important reason for the popularity of this rule, for example in the area of environmental liability (where it is based on the polluter-pays principle), but also in the area of enterprise liability. Kraakman shows in chapter 5 that tendencies in case law towards an increasing personal liability of managers for corporate torts can be understood as protecting tort victims against undercapitalised firms.

Also the decline of contributory negligence (whereby the victim completely loses his claim on compensation if the accident was (also) due to his fault) has to a large extent been based on fairness considerations. Artigot i Golobardes and Gómez Pomar show in chapter 2 that the harshness of a pure contributory negligence rule was considered unfair since it leads to

making the victim bear the entire loss even when that loss was caused in part by others. Also Kornhauser and Revesz show in chapter 4 that joint and several liability may have been based on the idea that the victim should not be faced with the burden of having to sue various defendants in order to obtain full compensation of his loss. However, they show that (dependent upon the solvency of the actors involved) joint and several liability may in some cases lead to increasing a tortfeasor's expected liability beyond the level of harm he actually caused. Placing such a disproportionate burden on the injurer may thus be questioned on fairness grounds. The latter example also shows that introducing the notion of fairness into tort law leads to the difficulty that in some cases fairness seems to be equated with victim compensation. This may thus lead for example to imposing a retrospective liability on tortfeasors or shifting the burden of proof in case of causal uncertainty to tortfeasors. These policy decisions, which are often based on deep pocket considerations (in case the defendants are corporate actors), can, however, equally be challenged on fairness grounds to the extent that they increase the defendant's expected liability beyond the level of harm caused by that particular injurer. That is why Ben-Shahar for example argues in chapter 3 that a proportionate liability rule (in dealing with causal uncertainty) may be superior to an 'all or nothing' approach and this both from a deterrence as well as from a fairness perspective.

This shows that to the extent that fairness considerations are not restricted to a rather short-sighted desire to provide victims' compensation at all costs, but also include other considerations (like not exposing the injurer to more expected losses than he contributed to by his activity) the results of economic analysis in most cases do not diverge strongly from what would be considered fair (in this broader sense).

11 Empirical evidence

A crucial question is of course to what extent the assumptions of economic analysis, for example concerning the preventive effects of the tort system, can be backed up with empirical evidence. The same question also arises for the claim of lawyers that tort law would be suitable as an instrument of victim compensation.

Many contributions provide suggestions in that respect and the empirical literature is moreover summarised in chapter 16 (in part VII).

Some studies, even though they remain rare, provide empirical evidence of the incentive effects of liability rules. Artigot i Golobardes and Gómez Pomar discuss in chapter 2 a well-known empirical study by White (1989). This research shows that the incentive to avoid accidents was influenced by the shift from contributory to the comparative negligence rule. Especially for mediocre or bad drivers, the incentive to drive carefully was stronger

under the contributory negligence than under the comparative negligence rule, since under the first rule, the drivers faced higher expected liability. The shift from contributory to comparative negligence therefore reduced drivers' incentives to increase care. This was also confirmed by other studies. Even though many difficulties exist in measuring the exact effects of a change in a liability rule, Geistfeld shows in chapter 11 that for the area of product liability, there are many studies showing that producer liability reduces the frequency of accidents and that it, moreover, has had a significant impact on product-design decisions.

van Velthoven summarises in chapter 16 many other studies that have all attempted to analyse the safety effects of liability rules. Well-known are studies analysing the effect of leaving the tort system and moving to a no-fault compensation system. van Velthoven holds that (even though there are of course differences) many studies show that the reductions in accident liability produced by no-fault laws lead to an increase in traffic fatalities. Also for other domains than traffic liability, van Velthoven finds evidence that liability rules do affect the behaviour of potential injurers. However, van Velthoven equally shows that it is difficult to interpret the precise consequences of these data. For example, in the area of medical malpractice, he concludes that increasing liability has affected the behaviour of health-care providers, leading to a decrease in the supply of medical services. To the extent that medical malpractice liability drives some physicians out of the market and makes other healthcare providers defensively adapt the treatment of their patients, this might, so van Velthoven argues, be detrimental to social welfare. This danger of defensive medicine is, however, a specific problem for the area of medical malpractice.

Empirical studies have equally analysed the ability of the tort system to provide adequate compensation. In this respect, Visscher discusses in chapter 6 many studies showing that the amount of tort damages in reality often falls short of the theoretical ideal of full compensation. In this respect, he quotes the many studies summarised in the well-known book by Dewees, Duff and Trebilcock (1996), who had equally shown the shortcomings of the tort system as far as providing compensation to victims is concerned. Boccara reports in chapter 12 on various studies with respect to medical malpractice showing that there are many so-called false negatives (a true victim should receive compensation but does not) as well as false positives (a patient receives compensation but in fact should not). These weaknesses of the tort system in providing compensation are also confirmed in many studies summarised in chapter 16 by van Velthoven. He quotes for example studies in the medical malpractice area showing that only between 1.5 and 2.5 percent of all victims who suffered injury due to negligence filed a malpractice claim. van Velthoven equally discusses

empirical studies showing that average damage awards in product liability or medical malpractice cases are substantially higher (\$350,000 to \$600,000) than in automobile accident cases (\$164,000 in federal and \$16,000 in state courts). van Velthoven therefore concludes that a large fraction of valid claims is never filed, but moreover that equally many valid claims that are filed do not get honoured. This, in combination with the fact that compensation awards are often less than what they should be on the basis of economic analysis, leads to the conclusion that the tort system may fail both with respect to its compensatory as well as with respect to its deterrent function.

However, this rather pessimistic conclusion should not immediately lead to arguing in favour of the alternative (safety regulation in compensation with a no-fault compensation scheme). We already indicated that there is an impressive amount of evidence showing the shortcomings of no-fault compensation systems. They are summarised in chapter 14 by Fiore who reports the various studies that show that one dramatic result of the introduction of no-fault compensation system for automobile accidents has been an increase in road fatalities. This also follows from the studies discussed in the contribution by van Velthoven in chapter 16. Fiore also discusses studies with respect to the New Zealand universal no-fault compensation scheme, introduced in 1974: it has equally led to an increase in injury rates and accidents. Therefore, even though the tort system may not be perfect in providing compensation to victims, the empirical evidence presented in the various contributions (and more particularly in chapter 16 by van Velthoven) seems to indicate that, as far as providing incentives for prevention is concerned, the tort system still does a lot better than the alternatives (such as a no-fault compensation scheme). However, as far as compensation is concerned, alternatives (like the New Zealand no-fault compensation schemes) do better than the tort system.

12 A few challenges

The various contributions contained in this book make clear that the economic analysis of tort has gone through an impressive development: since the early publications of Calabresi, Brown, Posner and Shavell, discussed above, an impressive body of literature has emerged. As a result, important doctrinal issues (like the choice between strict liability and negligence) have been the subject of further refinement and study and the general theory has been applied and refined with respect to particular areas of tort law like environmental liability, product liability or medical malpractice. Moreover, both the general assumptions of economic theory and the functioning of the tort law system with respect to compensation and deterrence have been tested empirically. In that respect, no one can

deny that economics has provided powerful insights for tort lawyers. Its theoretical foundations have allowed complicated areas of tort law to be studied and explained and have thus provided the theoretical framework for a better understanding of the functioning of liability rules. Moreover, the empirical research has also allowed a ‘demystification’ of tort law, for example showing that tort law is stronger in its preventive function than in providing compensation.

Yet many challenges remain for this fascinating area of economic analysis of law. One such challenge has been identified by van Boom in chapter 15 and deals more particularly with the question of how insights from the economic analysis of tort can be combined with comparative law. Indeed, many contributors have sketched a variety of different approaches among legal systems, for example as far as the compensation of victims of traffic accidents is concerned, but also as far as compensation for pure economic loss (chapter 7) or non-pecuniary losses (chapter 8) is concerned. The interesting question for a positive analysis is to what extent these varying approaches in legal systems can be explained by differing preferences of the citizens (for example, as far as the demand for compensating pain and suffering is concerned). van Boom makes clear that in some cases, it is not always obvious whether the differences between the tort law systems actually do reflect differing preferences or are merely the result of a path dependency resulting from a development in the particular legal culture. He rightly argues that to some extent lawyers may of course have an interest in keeping differences alive, thus increasing costs for citizens in knowing the contents of the law and increasing the need for legal advice. In addition, the question also arises to what extent the differences which can be observed do reflect varying preferences or differences in legal cultures or are rather the result of pressures by interest groups affected by the tort system. A powerful interest group already mentioned is of course the tort lawyers themselves. In addition, the exposed potential tortfeasors (healthcare providers, manufacturers, enterprises) as well as their insurers may also constitute powerful interest groups that will lobby in favour or against particular tort rules or tort law reforms. Many contributors show that there is ample evidence of interest group influence in legislation with respect to tort law (reform). This is for example obvious in the area of medical malpractice (discussed by Boccara in chapter 12) where, not surprisingly, it is healthcare providers that lobby strongly in favour of a no-fault compensation scheme (discussed by Fiore in chapter 14), thus limiting their exposure to liability.

A challenge related to this issue is whether differences between tort law systems cannot only be explained positively, but whether it would equally be possible to identify to what extent these differences are normatively

desirable or not. That question is of course highly relevant where tort law is applied in large federal systems such as Europe or the US. In some areas like product liability for example, the transboundary nature of externalities has often been advanced as an argument in favour of a harmonisation of tort rules at a central level. Some go further, however, and argue that differences between states concerning for example environmental liability may also lead to a race to the bottom (in that particular case towards pollution havens). Others on the other hand argue that an integrated market within a federal system can also function perfectly well with a decentralised tort law.⁸ The question is highly relevant since in both the US and Europe tendencies exist towards a further harmonisation of tort rules. These harmonisation attempts are of course based not only on notions of efficiency, but also on fairness considerations, arguing that citizens should for example all receive a similar compensation for non-pecuniary losses. An interesting challenge therefore consists in further examining the consequences of the economics of federalism for the desired degree of harmonisation of tort rules within federal systems. Even if some (economic or other) arguments in favour of (some) centralisation could be formulated, the question still arises what type of rules should be harmonised and what area of tort law can still be decided at the decentralised level.

A second challenge is suggested in the contribution by Schäfer and Müller-Langer (chapter 1) who point at the potential importance of behavioural law and economics for the area of tort law. All the contributions in this book make clear that the economic literature on tort basically starts from the assumption that the potential parties in an accident setting are rational individuals striving for the maximisation of their utility and that they can thus be affected by a finding of liability. Schäfer and Müller-Langer point to the behavioural literature which shows that individuals can be subject to a variety of so-called heuristics and biases as a result of which they may not always act in the way predicted by the rational actor model. An interesting challenge is how this behavioural literature affects the economic analysis of tort law. One question is how these biases affect the choice between strict liability and negligence; another is how biases may equally affect the judiciary. For example, some have pointed to the so-called hindsight bias, being the tendency of a decision maker (the judge) to attach an excessively high probability to an event simply because it ended up occurring (Jolls, Sunstein and Thaler, 1998). The question arises as to how this affects the ability of judges to reach a proper negligence

⁸ See in that respect *inter alia* Van den Bergh and Visscher (2006).

determination because they are likely to believe that precautions that could have been taken would have been more cost effective than they actually appeared *ex ante*.

Some attention has been paid to the influence of behavioural biases on the economics of tort law. Teitelbaum (2007) has paid some attention to this issue, but a real challenge for the economic analysis of accident law is to analyse how (if at all) the traditional models of accident law change under the influence of behavioural insights. The more difficult question is of course whether, if there were to be changes, this should also lead to implications at the normative level, for example as far as the choice of the efficient liability rule is concerned.

A third challenge implicit in many of the contributions to this book is the general point of how on the one hand it is possible to ever further refine economic analysis of tort and on the other hand for it still to remain practical. To put it bluntly: how can the economic analysis of tort on the one hand still evolve towards ever further refinements and on the other hand not lose the lawyers? This is a realistic question for the simple reason that, as many contributions have also shown, economic analysis tends to reach a very high level of abstraction whereby models are increasingly (mathematically) refined but sometimes sight is lost of the question to what extent these further refinements lead to a better understanding of the reality of accident law. Nevertheless, there is no reason to be pessimistic in that respect yet: many contributions show that notwithstanding the strong evolutions in the literature, the result has been that economic models can now predict the effects of various liability rules with greater accuracy, as has been shown by the overview of the empirical material in chapter 16 by van Velthoven. The further refinements also allow economic analysis to provide answers to complex policy questions posed by lawyers. For example, the complex question of how the law should deal with uncertainty over causation, dealt with by Ben-Shahar in chapter 3, has been dealt with in several economic studies clearly pointing to the superiority of a proportionate liability rule (rather than a so-called all or nothing approach). Interestingly, this economic literature has now influenced the decision making of for example the Supreme Court in the Netherlands which accepted a proportional approach in a March 2006 decision concerning causal uncertainty in the case of an employee who had been exposed to asbestos but was also a heavy smoker and suffered from lung cancer. The real challenge for scholars in economic analysis of tort is to on the one hand indeed continue to refine economic models but on the other hand to still attempt to explain the relevance of these refinements to lawyers so that they can potentially contribute to more sophisticated decision making by the policy maker (legislator or judge).

13 Topics for further research

In addition to the few challenges just mentioned, there are a few issues explicitly referred to in the contributions to this book on which further research can still be undertaken. Just to mention a few examples: Kraakman points in chapter 5 to the necessity to further address corporate criminal liability and more particularly the desirability of combining the criminal liability of the corporation with the liability of individuals within the corporation. This issue is of particular interest since some literature has pointed to the potentially perverse effects of corporate criminal liability on the incentives of agents within the corporation. The question therefore arises of how an optimal combination of liability by a corporation with the personal liability of agents within that corporation can be achieved, providing optimal incentives to all parties involved.

An equally interesting point for further research pointed at by Visscher in chapter 6 is how the law of damages, more particularly in Europe, could be reformed in such a way that the compensation awarded in tort law, especially in the case of fatal accidents, would be more in line with economic analysis. That question is more pertinent since refined systems for valuing statistical life (such as Quality Adjusted Life Years – QUALY) have been developed. The practice of compensation (also of non-pecuniary losses) in reality is often much lower than what is proposed by these economic models. The question therefore arises whether it is possible to reform the law of damages in such a way that the current undercompensation (more particularly in case of fatal accidents) can be reduced.

An important topic for further research related to the comparative tort law and economics mentioned under the challenges above is of course to what extent differences observed between legal systems can be explained by using economic analysis. The topics of the compensation for pure economic loss (discussed by De Mot in chapter 7) or non-pecuniary losses (discussed by Lindenbergh and Kippersluis in chapter 8) are interesting examples in that respect. Again, as mentioned above, it would be interesting to analyse in those particular domains whether the observed differences can be explained and/or supported on economic grounds.

Finally, a central topic for further research, mostly following from van Velthoven's interesting chapter 16 presenting empirical evidence, is of course what the precise function of the tort system should be. The empirical evidence seems to indicate (of course depending upon the area and the empirical studies involved) that the tort system does provide incentives for prevention. This could constitute an important argument in favour of retaining the tort system. However, the studies summarised by Van Velthoven in chapter 16 equally show that the tort system does relatively poorly as far as compensation is concerned: only a small fraction of

victims actually receives compensation from the tort system and moreover the question can be asked whether compensation through the tort system is adequate. Many have therefore examined whether alternatives (such as insurance discussed in chapter 13 or no-fault compensation discussed in chapter 14) can be advanced to provide compensation to victims and thus remedy this weakness of the tort system. However, the empirical evidence equally shows that to the extent that these alternatives replace the tort system and thereby dilute the deterrent effect of the tort system, the accident rate actually increases. An important general point for further research remains therefore whether it is possible to work out an alternative to the tort system that provides adequate compensation to victims (which the tort system is apparently not able to do), but at the same time keeping the incentive function of the tort system. Empirical evidence of attempts to do this (like the introduction of a no-fault system) show that alternatives that lead to more compensation usually have negative effects as far as prevention is concerned. An interesting point for further research therefore remains whether it is possible to work out an alternative that on the one hand provides better compensation and on the other hand still provides adequate incentives for prevention to potential tortfeasors as well.

14 Word of thanks

I owe thanks to the many contributors for their willingness either to update their contribution to the 2000 Encyclopedia or to contribute entirely new chapters to this volume. Thanks to the willingness of these contributors, we have been able to provide an impressive overview showing the richness of the literature in this domain of the economic analysis of tort. I owe special thanks to the general editor of this Encyclopedia, Gerrit de Geest, for his encouragement and stimulating suggestions.

I owe special thanks to Franziska Weber (Maastricht) for useful research assistance and for reviewing the footnotes and referencing. Yleen Simonis of the secretariat of the Maastricht European Institute for Transnational Legal Research (METRO) provided editorial assistance in the preparation of this book for publication. Finally, I am, as always, very grateful to Edward Elgar for professional and effective support in the publication of this volume.

The texts were finalised in March 2008, so that developments after that date could not be taken into account.

Michael Faure
Maastricht-Rotterdam, June 2008

References

- Arlen, J.H. (1994), 'The potentially perverse effects of corporate criminal liability', *Journal of Legal Studies*, 23, 832–67.
- Bar-Gill, O. and O. Ben-Shahar (2003), 'The uneasy case for comparative negligence', *American Law and Economics Review*, 5, 433–69.
- Bouckaert, B. and G. De Geest (eds) (1992), *Bibliography of Law and Economics*, Dordrecht: Kluwer Academic Publishers.
- Bouckaert, B. and G. De Geest (eds) (2000), *Encyclopedia of Law and Economics*, Cheltenham: Edward Elgar, 5 volumes. See also <<http://encyclo.findlaw.com/>>.
- Brown, J.P. (1973), 'Toward an economic theory of liability', *Journal of Legal Studies*, 2(2), 323–49.
- Calabresi, G. (1961), 'Some thoughts on risk distribution and the law of torts', *Yale Law Journal*, 70, 499–553.
- Calabresi, G. (1965), 'The decision for accidents: an approach to non-fault allocation of costs', *Harvard Law Review*, 78(4), 713–45.
- Calabresi, G. (1970), *The Costs of Accidents: A Legal and Economic Analysis*, New Haven: Yale University Press.
- Calabresi, G. (1975), 'Concerning cause and the law of torts: an essay for Harry Kalven', *University of Chicago Law Review*, 43, 69–100.
- Coase, R.H. (1960), 'The problem of social cost', *Journal of Law & Economics*, 3, 1–44.
- Deweese, D., Duff, D. and Trebilcock, M. (1996), *Exploring the Domain of Accident Law. Taking the Facts Seriously*, New York: Oxford University Press.
- Diamond, P.A. (1974), 'Single activity accidents', *Journal of Legal Studies*, 3, 107–64.
- Epstein, R.A. (1976), 'Medical malpractice: the case for contract', *American Bar Foundation Research Journal*, 1(1), 87–149.
- Grady, M.F. (1983), 'A new positive economic theory of negligence', *Yale Law Journal*, 92, 799–829.
- Jolls, C., Sunstein, C.R. and Thaler, R. (1998), 'A behavioural approach to law and economics', *Stanford Law Review*, 50, 15–23.
- Kaplow, L. and S. Shavell (1996), 'Accuracy in the assessment of damages', *Journal of Law & Economics*, 39, 191–210.
- Kaplow, L. and S. Shavell (2001), 'Fairness versus welfare', *Harvard Law Review*, 114, 961–1388.
- Posner, R. (1972), 'A theory of negligence', *Journal of Legal Studies*, 1(1), 29–69.
- Shavell, S. (1980), 'Strict liability versus negligence', *Journal of Legal Studies*, 9, 1–25.
- Shavell, S. (1984), 'Liability for harm versus regulation of safety', *Journal of Legal Studies*, 13, 357–74.
- Teitelbaum, J.C. (2007), 'A unilateral accident model under ambiguity', *Journal of Legal Studies*, 36, 431–77.
- van Boom, W.H., M. Lukas and C. Kissling (2007), *Tort and Regulatory Law*, Vienna: Springer.
- Van den Bergh, R. and L. Visscher (2006), 'The principles of European tort law: the right path to harmonization?', *European Review of Private Law*, 14(4), 511–43.
- White, M. (1989), 'An empirical test of the comparative and contributory negligence rules in accident law', *Rand Journal of Economics*, 20(3), 308–30.

PART I

EFFICIENT LIABILITY RULES

1 Strict liability versus negligence

Hans-Bernd Schäfer and Frank Müller-Langer

1.1 Introduction

The purpose of this chapter is to compare negligence rules and strict liability rules. They are the major rules of liability used in tort law to deal with situations where one person (the injurer) causes harm to another person (the victim). In England, France and Germany, for instance, the usual forms of liability are the comparative negligence rule and strict liability with the defence of relative negligence, and in the US it is the comparative negligence rule, the negligence rule with the defence of contributory negligence, and strict liability with the same defence. The details of these rules will be discussed below. Zweigert and Kötz (1996, sections 40–43) provide a rigorous description of tort law in England, France and Germany. For the US, a good reference is Keeton et al. (1984, chapters 5, 11, 13).

Historically, it is interesting to observe the changes in the relative importance of different liability rules. Before the nineteenth century, for instance, strict liability was predominant in most common law jurisdictions. In the early and mid-nineteenth century, however, this changed, with negligence and fault becoming the prevailing standard of tort liability, as Schwartz (1981) notes. Since the twentieth century, rules of strict liability have enjoyed a renaissance and have been applied more and more to determine who should bear the costs of an accident and to what extent. A good example of this phenomenon is the shift back to strict liability in products liability cases.

Moreover, tort law is the subject of much debate because of the increasing number of cases where compensation for losses might substantially exceed the actual damage. In the US, for instance, damages awarded may exceed the losses sustained in the presence of ‘punitive’ damages where parties acted with ill will, that is, when the harm was intentional, whereas in Germany higher awards are provided to give victims ‘satisfaction’ and to compensate them for nonpecuniary losses. The scope of harm and the size of judgments have become exceedingly expansive, and manufacturers pay extremely high premiums for products liability insurance to protect themselves against these awards. Many of them have withdrawn from the market entirely. This and various other results on the issue are presented by Priest (1991). Many economists and lawyers conclude that the tort system is in need of reform. Again, we need to understand the basic principles of

4 *Tort law and economics*

how different liability regimes work to be able to evaluate the alternatives to reform.

Tort law is one of those areas in the law where (micro)economic models can be successfully applied. Tort is about damages and has important economic implications. The economic approach to tort is therefore mainly concerned with examining the allocative effects, that is, welfare effects, resulting from the application of different liability regimes. Landes and Posner (1987, p. 6) suggest that liability rules can be interpreted as a legal attempt to establish incentives for parties to achieve social efficiency objectives. One of the path-breaking studies in the development of the economic approach to tort is Calabresi (1970). The aim of tort law, he proposes, apart from the requirement for justice, is to minimise the social costs of a tort, defined as the sum of total accident costs, administration costs, costs of properly allocating accident losses by means of insurance, and accident prevention costs of both the injurer and the victim. Again, the comparison between strict liability and negligence helps to determine which tort system is most suitable to improve welfare by, first, encouraging individuals to engage in safer activities by providing an incentive to do so, and second, encouraging individuals to make a given activity safer.

Throughout, we will be considering models of accidents involving two individuals, the injurer and the victim. Both of them are engaged in some activity, and both of them exercise a certain level of care. The decisions the parties have to make are twofold. They have to decide how much care they want to exercise and how much they want to engage in an activity. It is plausible to assume that accident prevention costs increase with the amount of care taken, and that expected damages decrease with the level of care, but increase with the amount of activity the parties engage in.

In the remainder of this chapter, we will first discuss unilateral accidents because they describe those situations where one party, that is, the victim, has no influence on the probability and the size of damages. Also, it is easier to understand the more complicated discussion of the bilateral case which follows. Each section starts with a discussion of the rule of no liability before moving on to various forms of negligence and ending with various strict liability rules. At the end of each section, there is also a discussion on how results change when relaxing certain assumptions. In later sections we concentrate on several more specific topics of interest. First, we analyse the rules if standards of due care are ill-defined. Second, we analyse the question as to whether the costs of litigation are higher or lower under strict liability as compared to negligence. Third, we elaborate on the decentralisation effect of strict liability and of negligence. Fourth, we provide a discussion of the information-generating consequence of negligence. Fifth,

we analyse the effect of under-compensation if the tortfeasor is judgment-proof. Sixth, we provide an analysis of the allocative effects of various liability rules when agents enter into a contractual relationship, which also implies a brief discussion of the distinction between tort law and contract law. Seventh, we elaborate on product liability. Eighth, we provide an analysis of cases of ‘joint liability’, that is, situations where more than one tortfeasor contributes to the occurrence of an accident. Ninth, we extend the analysis by allowing for risk-averse individuals and imperfect insurance markets. Tenth, we analyse the effect of optimistic and pessimistic behaviour on the part of the injurer on the efficiency of strict liability versus negligence. In the last part the various aspects of the comparison between liability rules are summarised, focusing on the question of whether the outcome under a specific liability regime is efficient or not.

1.2 Unilateral accidents

The discussion here is mainly based on Shavell (1987) and Schäfer and Ott (2005). In the case of unilateral accidents, which we focus on in this section, it is assumed that the victim cannot influence the amount of expected damages. Also, to keep things simple, we further assume that the level of activity is constant. (This assumption will be relaxed below.) Therefore, if we denote accident prevention costs by c , the level of care by x , and if d measures the total amount of expected damages, then, abstracting from administration costs and assuming risk neutrality, the social objective function takes the form of:

$$\min c(x) + d(x) \tag{1.1}$$

Setting the first derivative with respect to x equal to zero we obtain the following solution:

$$c'(x) = -d'(x) \tag{1.2}$$

which simply states that the marginal cost to the injurer of taking an additional unit of care (left-hand side of equation (1.2)) should equal the marginal benefit to the victim represented by a reduction in the total amount of expected damages (hence the negative sign on the right-hand side of equation (1.2)). It should now be clear why microeconomic models can be applied so easily in law and economics as equation (1.1) is an extremely simple example of a standard optimisation problem recurring very frequently in any area of economic analysis.

We now consider the behaviour of the injurer under various liability rules, providing important insights as to the efficiency of these rules.

6 *Tort law and economics*

1.2.1 *Rule of no liability*

If the injurer cannot be held liable for the harm she causes, and if she therefore does not have to bear the costs of an accident, she will choose the lowest possible level of precaution in order to minimise her costs. Since we assume that the total amount of damages is a decreasing function of the precaution level, the accident costs will be extremely high. As a result, the outcome of this liability rule is clearly not socially optimal.

1.2.2 *Negligence*

Under the negligence rule, the injurer will be held liable only if she exercised precautions below a level usually determined by the law and/or by the court. This level is called reasonable care or due care. Posner (1972) proposed an economic efficiency criterion which could be used to identify the efficient precaution level to establish it as the legal standard. It should be borne in mind that one of the most important objectives of tort law is to give the injurer an incentive to apply the efficient level of care that fulfils the optimality condition (1.2). Interestingly enough, the first person to describe this legal standard of care was not an economist, but a judge. Learned Hand (1947) suggested that an injurer is liable if her burden B of adequate precautions is less than the probability P that an accident occurs, multiplied by the size L of the injury. Note that Judge Hand's statement of the rule is unclear as to whether it refers to total or marginal levels of benefits and costs of caretaking, but we assume that he had marginal values in mind. Stated in algebraic terms, an injurer is negligent if the condition

$$B < PL \tag{1.3}$$

holds; and equality denotes optimality.

If the injurer has exercised due care, she will not be held liable for the costs of the accident. Let us now suppose that the court or the law would set the level of due care equal to the socially optimal level of care. Would the negligence rule result in the socially optimal level of care being taken? The answer is yes, as can be seen very easily by noting that a self-interested person will choose her level of precaution to minimise her private costs. Would she therefore want to choose a precaution level above the level of due care? No, because any care taken in excess of the standard set by the court would be more costly without reducing the costs of compensation since due care is enough to be non-labile. Would she, on the other hand, want to choose a precaution level below due care? No, because she is now running the risk of bearing the total amount of the expected damages.

1.2.3 Relaxing assumptions

Note that in the previous section we made a few simplifying assumptions. First, we assumed that the court would set the level of due care equal to the socially optimal level. Second, it was assumed that the legal sanction imposed equals the harm actually caused and, third, the level of activity was held constant. We will now examine how the results change if we relax these assumptions one by one, that is, we will discuss the effects of relaxing only one assumption at a time. Some of these issues are clearly presented by Cooter and Ulen (2004, chapters 8 and 9).

Let us first examine the question of how the results of the previous section change when the court sets a level of due care that is not equal to the socially optimal level. Suppose, for instance, that the court does not require any precaution at all. Under these circumstances, it is obviously cheapest for the injurer not to exercise any care because she will escape liability even without taking any care at all. Taking greater care would have no advantage, but would involve additional costs. Put more generally, the potential injurer will satisfy the legal standard even if it is pegged below the socially efficient level. The same applies to a legal standard above the socially efficient level, with one important exception, though. If the amount of precaution costs at the legal standard exceeds the total amount of precaution and expected damage costs at the socially optimal care level, then the potential injurer will ignore the legal standard and set her care-taking level at the lower socially optimal care level. This result changes if the injurer is not held liable for the entire accident losses, but only for the amount of damage in addition to the damage that would have been caused if the injurer had exercised the level of care set by the courts (partial liability). See, for instance, § 249 BGB under German law. For the US, see Kahan (1989). The first authors to describe this case are Schäfer and Ott (1986). Here, it is optimal for the injurer to exercise socially optimal care even if the legal standard is pegged above the socially efficient level. This is because by exercising the efficient level of care instead of the higher legal standard, precaution costs decrease by more than the imposed legal sanction increases. In general, however, we can say that in order to obtain an efficient outcome the court needs to set the due level of care equal to the socially optimal level of care.

Note also that it is very difficult for courts, legislatures and authorities to identify the efficient level of care in order to establish it as the legal standard. Due or reasonable care is usually identified by comparing what a reasonable person would have done under the circumstances with the actual precautionary activity of the injurer. An illustration of the reasonable person standard is provided by Posner (2007, p. 171). However, this standard is very vague and 'flexible'. Therefore, an alternative to deciding

whether an injurer was negligent or not without a specific standard of care would be, first, to ask what an injurer could have done (alternatively or in addition) to prevent the damage or to reduce the probability that it occurs. Then, the costs of the alternative or of the additional precaution activity are determined. If either the difference between the actual precaution costs and the costs of the alternative precaution activity or the costs of the additional precaution activity are less than the reduction in the total amount of expected damages as a result of the alternative or additional activity, the injurer will be liable.

Another assumption we made in the previous section is that the legal sanction imposed equals the harm actually caused. What will happen if we relax this assumption? Endres (1991, pp. 51–87) provides a rigorous and rather formal analysis of this question which is beyond the scope of this chapter. From a more intuitive and less formal perspective we can say that, under the negligence rule, equality between harm and sanction is not essential as long as the sanction is sufficiently large so that the private costs of the injurer are minimised by conforming to the legal standard. However, once the legal sanction falls below a certain level, the injurer will minimise her costs by taking a level of precaution below the legal standard.

Under-compensation is one possibility, but over-compensation can also occur. This applies especially in cases of pure economic losses. It is well established that tortuous acts might *uno actu* lead to gains of one party and to losses of another party. To illustrate: if a chartered accountant overlooked that real estate is grossly overvalued in the balance sheet and that consequently the company is over-indebted and must file for bankruptcy, this might lead to an overvaluation of the company's shares the stock market. Some shareholders buy these overvalued shares and later suffer a loss, but those who sold the share at an overvalued price make a gain. They would have made a loss if the accountant had been careful. Both the loss and the gain were caused by the mistake of the accountant. If in that case the accountant is liable for the losses, his damage compensation is much higher than the social loss he caused. Whether this over-compensation results in over-deterrence depends on how the level of care is defined (Schäfer, 2004). If the level of care is well known and precisely defined, over-compensation cannot result in over-deterrence because the tortfeasor can reach the due level of care and escapes any compensation. We will show later that this result does not apply if the standard of due care is 'muddy' and only known as a distribution function. Then over-compensation is likely to result in over-deterrence.

Finally, we relax the assumption of a constant level of activity to study the effects of an increase in the injurer's level of activity that will result in a proportional increase in the total amount of expected accident damages,

given a specific level of care. This is essential when it comes to assessing the social utility of an activity. Finsinger and Pauly (1990) point out that the total net utility of a risky activity ought to be positive.

The first aspect can be dealt with quite easily by slightly modifying the optimisation problem as represented in equation (1.1). The social objective function now has to take into account that various levels of activity influence the utility u of the actor who is the injurer. It is plausible to assume that utility is an increasing function of activity. Those who are familiar with optimisation problems should also note that for a unique solution to exist, it is necessary to assume further that the utility function is well-behaved. From the total amount of utility we need, of course, to subtract the total costs of care, which are assumed to be equal to the level of activity, a , multiplied by the level of care, x . Finally, we need to subtract the total amount of expected damages d . Thus we obtain as the social objective function

$$\max u(a) - ax - ad(x) \tag{1.4}$$

To solve this maximisation problem we first have to determine the optimal level of care x^* by minimising the total costs of taking care as represented by the second and third terms in equation (1.4). Substituting into (1.4) and differentiating with respect to the level of activity we obtain

$$u'(a) = x^* + d(x^*) \tag{1.5}$$

which is the equivalent of equation (1.2) in the case of a constant level of activity. The interpretation is straightforward. The injurer should raise her activity as long as the marginal increase in utility she derives from raising activity exceeds the increment to total costs caused by doing so.

We can now move on to discussing whether the negligence rule can guarantee that an activity is socially useful. A simple example might illustrate this point. Assume that the utility of an activity is 100. The costs of the optimal level of precaution are 80, and the amount of total damages is 30. Since the victim has to bear the costs of the accident when the injurer exercises due care and, therefore, is not liable, the injurer has a benefit of 20 from engaging in her activity. However, the net utility of the activity is clearly negative, meaning that the injurer should not engage in the activity in the first place. Since injurers will escape liability by taking due care, they have no reason to consider the effect that their activities have on accident damages. As a result, the rule of negligence can create incentives to exercise an optimal level of precaution, but it is unable to ensure that the social utility of an activity is positive.

Yet, there are exceptions where it can be easy for courts to observe the (lack of) social utility of an activity. In these cases, courts can set legal standards for both the optimal level of care and the optimal level of activity. However, because of information costs, it is generally difficult for courts to set both standards of caretaking and/or activity levels. Shavell (1987) and Landes and Posner (1987) focus on this issue.

1.2.4 *Strict liability*

We will now consider the major alternative to the rule of negligence: the rule of strict liability. Again, we start off by assuming that the legal sanction equals the actual damage and that the activity level is constant. Under strict liability, the courts do not have to set any level of due care because the injurer has to bear the costs of the accident regardless of the extent of her precaution. In this case, the expected amount of costs to the injurer of taking care x is

$$c(x) + d(x) \tag{1.6}$$

that is, the injurer faces the total amount of costs caused by the accident. Since it is the self-interested injurer's objective to minimise her *private* costs and since, under strict liability, the total *social* costs just *equal* her private costs, the injurer will have an interest in minimising total accident costs. In other words, the social objective function (1.1) and the private objective function resulting from minimising equation (1.6) are obviously identical. Therefore, under the rule of strict liability in the case of unilateral accidents, the injurer will choose the socially optimal level of care. As a result, both the rule of strict liability and the rule of negligence achieve a socially optimal level of care. There are, however, also quite a few differences. For instance, the division of costs under each rule is different. Under strict liability, the injurer has to bear the total amount of expected damages, whereas under the negligence rule, the victim has to bear the accident costs if the injurer has exercised due care. Further differences appear when relaxing the assumptions we made.

1.2.5 *Relaxing assumptions for strict liability*

As mentioned in the previous section, the courts do not have to set a level of due care. Under strict liability, all the courts need to do is to determine the size of the damage and to establish causation, whereas, under the negligence rule, the courts also need to determine the level of due care as a legal standard for the socially optimal level, and they have to determine the level of care actually taken in order to see whether the injurer was negligent or not. Proving negligence, however, can be difficult and costly.

Shavell (1987, p. 264) argues that under strict liability the number of claims is likely to be higher than under negligence because the victim has an incentive to make a claim whenever her damages exceed the costs of making the claim. Under negligence, on the other hand, the injurer can escape liability by demonstrating that she has not violated the legal standard of care. Since under the rule of strict liability it is not necessary to establish that the injurer was negligent, the probability of trial should be lower because it is easier to predict who is likely to win the case. Consequently, voluntary payments made in the shadow of the law should be much more probable. There is not only more potential for disagreement leading to trial under the negligence rule, it is also plausible to assume that the average administrative cost per claim is higher under negligence because the issue of negligence must be adjudicated, as was mentioned above. As a result, one can expect the average costs of resolving claims to be higher under negligence because of both a higher probability of trial and higher costs per trial.

Another advantage of the rule of strict liability is that it is the injurer who has to bear the cost of searching for the optimal level of care, as Finsinger and von Randow (1991, p. 89) suggest. In many cases, he is better at deciding what precautions to exercise and to what extent he should do so because he is likely to be familiar with the hazardous activity.

An assumption we made is that the legal sanction equals the damage actually caused. In the previous section we saw that equality is not essential as long as the sanction is sufficiently large for the injurer to conform to the legal standard. Under strict liability, this result changes quite drastically. Whenever damages are not perfectly compensatory, that is, compensation is below the level that would make the victim indifferent between no accident and an accident with compensation, the potential injurer does not have an efficient incentive to exercise a socially optimal level of care.

The easiest way to see this is by recalling optimality condition (1.2), which states that the marginal cost to the injurer of taking an additional unit of care should equal the marginal benefit to the victim represented by a reduction in the total amount of expected damages. Let us assume that the cost of taking care is a linear and increasing function of the level of care, that is, any increase in the level of care leads to a proportional increase in accident prevention costs. We also assume that the functional relationship between the level of care and the reduction in accident damages is such that the exercise of precaution reduces expected damages, but at a decreasing rate. Expressed in more mathematical terms, the first derivative of this function is positive and the second derivative is negative. We now assume that the potential injurer knows and expects that the legal sanction generally does not equal the total amount of the accident damages, but that it

equals a fraction of them only, because the tortfeasor remains anonymous, damages are higher than her personal wealth, victims are fully insured by first party or social insurance, or the damage is dispersed, which leaves the victim little incentive to litigate. This leads to a proportional downward shift of the damage reduction function. The crucial impact of the proportional shift is that, holding the level of care constant, the marginal reduction in damage and thus the marginal benefit of taking an additional unit of care is less than in the case of full compensation. Since, on the other hand, the cost function of taking care is assumed to be linear, the marginal cost of taking care remains constant. As a result, the optimality condition is no longer met under the circumstances given. In order for the cost-minimising condition to be satisfied again, the potential injurer will reduce her level of care, which leads to an increase in the marginal reduction in damage by taking care. As a result, the potential injurer does not exercise the socially optimal level of care when damages are not perfectly compensatory.

Suppose that the tort-liability system works imperfectly in the sense that only a fraction of all victims actually bring suit and recover. Let us call the ratio of compensated victims to the total number of victims the enforcement error. The efficiency loss due to enforcement errors can be offset by augmenting compensatory damages with punitive damages. In order to restore efficient incentives for the potential injurer to exercise optimal care, we need a punitive multiple (a multiplicative factor by which compensatory damages are adjusted to offset the enforcement error) that equals the inverse of the enforcement error. If, for instance, only half of the total number of victims actually bring suit, then the courts should double compensatory damages when calculating total damages. Thus, compensatory damages and punitive damages add up to total damages. References for issues related to punitive damages and their allocative effects are Cooter (1982) and Kolstad, Ulen and Johnson (1990).

Finally, we relax the assumption of a constant level of activity. Recall that under negligence the net utility of an activity could be negative because the injurer had no reason to consider the effect that her activity had on others as she can escape liability by taking due care. Under strict liability, however, the injurer has to bear the total social costs of an accident, that is, the sum of the total precaution costs and the total accident damages, regardless of the level of precaution she takes. She cannot escape liability, and the effects of activity on risk and accident costs are fully internalised. Therefore, the injurer will engage in an activity if and only if the net utility of that activity is positive.

More generally, given the possibility of escaping liability, the injurer will not be motivated to consider the effect on the total amount of harm of the level at which she engages in her activity. She will consider her private

benefits only. Any increase in activity, however, will raise the total amount of expected accident damages given the level of care. Thus, the injurer will choose too high a level of activity (see for example Polinsky, 1980). Under strict liability, the injurer internalises the total amount of social costs and reduces the level of activity to the socially optimal level. This conclusion was first clearly stated by Shavell (1980).

1.2.6 Liability and uncertain legal standards of due care

In the real world, legal standards of due care are frequently uncertain. Factors leading to uncertainty are, amongst others, courts' errors in determining due levels of care, courts' errors in assessing a party's true level of care, and parties' inability to control their momentary level of care. Craswell and Calfee (1984) focus on this issue. These sources of uncertainty change the deterrent impact of legal rules by creating two opposing effects. These effects can give even risk-neutral parties an incentive to over-comply or under-comply. Over-compliance enables potential injurers to increase the chance that they will not be held responsible for the social costs of their behaviour, thus giving themselves a margin of error to be sure that they avoid liability. However, uncertainty also reduces incentives to comply by creating a positive chance that someone who exerts less than efficient care will not be held liable.

In order to determine whether the net incentives are to under-comply or to over-comply, we need to know the relative strength of these two effects.

If the level of due care (x) is ill-defined, the tortfeasor only knows the probability distribution function, which attaches a probability of being liable (h) in case of an accident to every cost of care $c(x)$. This probability ($h(x)$) decreases with x . In that case the cost function of the tortfeasor is

$$\min c(x) + d(x)h(x) \tag{1.7}$$

This yields the first-order condition

$$c'(x) + d'(x)h(x) + h'(x)d(x) = 0 \tag{1.8}$$

It is easy to see that this might lead to over- or under-deterrence. Efficient deterrence will be provided only if the first-order condition is met at the efficient level (cost) of care (x^*), that is, if

$$c'(x^*) + d'(x^*)h(x^*) + h'(x^*)d(x^*) = 0 \tag{1.9}$$

In other words: muddy standards of due care might result in over-deterrence or under-deterrence. The intuition behind this is as follows.

Whenever the tortfeasor increases her care level, she faces three rather than two effects. Her costs of care increase, the expected damages she causes decrease and the probability of being held negligent also decreases. Depending on whether at the efficient level of care the two cost-decreasing effects or the cost-increasing effect of one more monetary unit of care is higher, the tortfeasor will reach a level of care which is either higher or lower than the efficient level of care.

We have already pointed out that the damage compensation might be lower or – as in the case of pure economic losses – higher than total damages. To analyse the incentive effect of over- or under-compensation we assume that damage compensation is md with $m \neq 1$. Then with $m < 1$ we have under-compensation, otherwise over-compensation. Consequently, the cost function to be minimised becomes

$$\min c(x) + md(x)h(x) \quad (1.10)$$

This yields the first-order condition

$$d'(x)h(x) + h'(x)d(x) = -c'(x)/m \quad (1.11)$$

In the case of under-compensation it is still uncertain whether under- or over-deterrence results, depending on the probability distribution function and the damage function. It is, however, certain, that with decreasing m , under-deterrence must result if m becomes lower than a certain threshold value. If, for instance, m tends towards zero, it is obvious that the right-hand side of (1.11) reaches a very high absolute value and therefore the equation is fulfilled only at very low values of x , indicating under-deterrence.

In the case of over-compensation, which we discussed for pure economic loss, we get a symmetric result. Over-compensation does not lead to over-deterrence in the negligence regime, as long as the standard of due care is precisely defined. If the standard is known only as a probability distribution, over-compensation must result in over-deterrence if m becomes large enough.

Over-deterrence or under-deterrence becomes certain in the case of over-compensation under the strict liability rule. With damage compensation of md , and $m \neq 1$ the maximisation problem is

$$\min c(x) + md(x) \quad (1.12)$$

This yields the first order condition

$$c'(x) + md'(x) = 0 \quad (1.13)$$

This cannot yield the optimal result, which is $c'(x) + d'(x) = 0$. Over-compensation ($m > 1$) always leads to over-deterrence, and under-compensation ($m < 1$) always leads to under-deterrence. Again, negligence is the more robust system if one relaxes assumptions and allows for damage awards that are higher or lower than the damages.

1.3 Bilateral accidents

We now extend the analysis made above to cases where both parties in an accident may contribute to accident costs. Again, this section is based mainly on Schäfer and Ott (2005) and Shavell (1987), but also on Adams (1985) and Cooter and Ulen (2004). One of the first economists to study these issues was Brown (1973), who introduced the use of the assumption that the probability that an accident will occur is a function of the caretaking of both the tortfeasor and the victim. In fact, it is rare that an accident is due to one party (that is, the injurer) only. It is much more common that the victim can also exercise some precaution to prevent an accident. What makes bilateral accidents quite a complicated issue analytically is the interdependence of the parties' behaviour. We will see that in many cases the choice of one party in terms of levels of activity and care essentially depends on the other party's choice.

Since we now also have to take into account the victim's ability to reduce the probability or size of an accident, we need to modify the social objective function given above. If we denote the level of care taken by the injurer by x , as before, and if y measures the level of care taken by the victim, the social objective function now becomes

$$\min c(x) + c(y) + d(x,y) \tag{1.14}$$

where $d(x,y)$ denotes the total amount of expected damages which, of course, depends on the level of care exercised by both parties. Let x^* and y^* denote the socially optimal values of x and y .

There are now two conditions determining the optimal levels of care. First,

$$c'(x) = -d_x(x, y^*) \tag{1.15}$$

with d_x being the partial derivative of d with respect to x and with y assumed to be optimal. What it says is that the marginal cost to the injurer of taking an additional unit of care should equal the marginal benefit of the reduction in the expected cost of the accident, provided that the victim chooses the socially optimal level of care. Second,

$$c'(y) = -d_y(x^*, y) \tag{1.16}$$

which says that the marginal cost to the victim of increasing her level of care should equal the marginal benefit of the expected reduction in accident costs, provided that the injurer chooses the socially optimal level of care. The fact that the socially optimal solution requires that both parties exercise optimal care will be crucial in the analysis that follows.

1.3.1 *The 'cheapest cost avoider'*

Before discussing and comparing the various liability rules in the case of bilateral accidents, we want to examine cases which exhibit properties of both unilateral and bilateral accidents. This version can emerge when either the injurer or the victim (or a third person) is able to prevent the accident. Note the distinction: unlike in the case of unilateral accidents, it is now not only the injurer, but also the victim who can prevent the accident. And unlike in the case of bilateral accidents where typically both parties need to exercise care to achieve the socially optimal and efficient outcome, it is now either the injurer or the victim who has to take care to achieve the socially optimal result.

As Calabresi (1970) argues, in these cases, the person should be held liable who could have prevented the accident with the least cost of taking care (the cheapest cost avoider). The idea is quite simple: we know that as long as property rights are well-defined and there are no transaction costs, trade between agents would result in an efficient allocation of resources when there is an externality, a conclusion commonly known as the Coase Theorem (see Coase, 1960). Furthermore, note that what is known as causation in tort law can be reinterpreted as an externality in economics. An externality can be defined as a cost that the action of a person imposes on others without their consent. The prevention of an accident would therefore be undertaken by the cheapest cost avoider. However, this solution will not be achieved because of prohibitive *ex ante* costs of bargaining about who should be held liable for possible accident damages. In this case, the courts should place the burden of covering the costs of the accident on the individual who can avoid the accident at the lowest cost, no matter whether it is the injurer, the victim, or a third party.

This principle of cheapest cost avoider does, however, not lead to first-best results if one relaxes informational assumptions (Garoupa and Dari-Mattiacci, 2009). If both the victim and the tortfeasor can take care and if it is efficient for only one of them to take care, the cheapest cost avoider principle leads to the first-best outcome as long as the identity of the cheapest cost avoider is known *ex ante*, that is, when the actors take decisions to take care. This is often the case. For instance, house owners are not supposed to invest against damages from trucks hitting their houses and they as well as the truck owners know this. But often the cheapest cost avoider

is identified only *ex post* in the courtroom. In that case the parties know only a distribution function denoting the probability that the court will identify one of them as the cheapest cost avoider. If both parties fix their level of care simultaneously, the cheapest cost avoider might under-invest and the other party who should not take any care in the first-best solution might over-invest. The problem is even aggravated if care is allocated sequentially. In that case, the first mover will always invest regardless of whether she is the cheapest cost avoider and the second mover might invest nothing, even if she is the cheapest cost avoider.

1.3.2 *Rule of no liability*

As before, if the injurer cannot be held liable for the harm she causes, she will choose the lowest possible level of care, that is, zero, to minimise her cost. This may also lead the victim to exercise excessive care. As we have seen in the previous section, this is clearly not optimal because accident costs will be excessively high.

1.3.3 *Negligence*

Recall that the rule of negligence imposes the obligation to satisfy a legal standard of care usually defined as due care. The injurer is therefore liable unless he can prove that he has exercised due care. We now continue our analysis by introducing, discussing, and comparing several forms of the negligence rule (see for example Wittmann, 1986; Haddock and Curran, 1985). Let us begin with the simplest form of negligence.

Simple negligence The properties of this rule are basically the same as in the unilateral case, that is, the injurer is liable if and only if her level of precaution is below the legal standard regardless of the precaution level exercised by the victim. Assume now that the level of due care chosen by the courts equals the socially optimal level. Injurers will therefore have an incentive to exercise due care in order to escape liability. Hence, the victim faces the costs

$$c(y) + d(x^*, y) \tag{1.17}$$

and will choose the level of care that minimises this expression. Setting the first derivative with respect to y equal to zero we obtain equation (1.16), one of the two optimality conditions in the bilateral case.

If the injurer expects that the self-interested victim will exercise due care, the same arguments as in the unilateral case apply. The injurer faces the costs

$$c(x) + d(x, y^*) \tag{1.18}$$

and will choose the level of care that minimises this expression. Again, setting the first derivative with respect to x equal to zero we obtain equation (1.15), the other optimality condition in the bilateral case.

Therefore, we can conclude that the simple negligence rule leads to socially optimal levels of care. The outcome is a Nash equilibrium which can be expected to emerge instantaneously because a rationally self-interested person will assume that another equally self-interested person has decided to exercise efficient precaution and, that being so, it is reasonable for that person also to exercise efficient precaution. Generally, a pair of strategies is said to be a Nash equilibrium if player A 's choice is optimal given B 's choice, and player B 's choice is optimal given A 's choice. It is standard in the literature to assume the existence of a Nash equilibrium. However, there might be problems of existence, even in the case of well-behaved functions (see, for example, Endres and Querner, 1995). It is also standard to discuss bilateral accidents in the context of a Nash framework (for a reference that points to alternative approaches see Endres, 1992). Finally, note that under the rule of simple negligence there is no need to establish a legal standard of care for the victim. This conclusion changes under the following rules.

Negligence with the defence of contributory negligence Under this rule, the injurer will be held liable if she does not take due care while the victim does. The injurer will not be held liable if she either takes due care or if the victim does not take care. In other words, in comparison to simple negligence, the injurer now has, apart from exercising due care, an additional means of escaping liability by showing that the victim failed to take due care. To see whether this rule leads to a socially optimal outcome, we can use the same line of argument as before. If the injurer assumes that the victim takes due care to avoid liability, she will also have an incentive to do so for the same reason. This, in turn, leads the victim to take due care because she now has to bear the total amount of damages. She can minimise these costs by taking due care. Since the injurer is aware of this, it is reasonable for her to take due care herself and so on. Again, we have a stable and unique equilibrium, and a socially optimal result will be achieved.

Comparative negligence rule The difference between this rule and the two previous ones is that, when both parties are negligent, the accident costs are divided between them in proportion to the extent of their negligence. One way of doing this is to calculate the ratio of the differences between the due level of care and the actual level of care. If the courts choose optimal levels of due care, then both the injurer and the victim will exercise due care. The rationale is precisely the same as before. Again, we can conclude that the outcome under this rule is socially optimal.

When comparing the various versions of the negligence rule we come to the conclusion that none of these versions is more or less efficient than the others (efficiency equivalence theorem, see Orr, 1991; Rubinfeld, 1987). They all lead to socially optimal outcomes, provided that the courts set the legal standard of precaution at the efficient level, because self-interested agents have an incentive to choose the legal standard of care. The reason for this is, in essence, that whenever one party exercises due care, then it is entirely up to the other party to decide whether it alone will be held liable by failing to take due care. However, as White (1989) argues, there is empirical evidence that, in contrast to the equivalence theorem, contributory negligence provides better incentives to avoid accidents. If actors are risk averse and insurance markets are imperfect, relative negligence leads to a better risk allocation than contributory negligence, as it burdens the tortfeasor as well as the victim, if both are negligent.

An analysis of how these results change when relaxing and modifying some of the underlying assumptions will be given later. First, we will examine various forms of strict liability.

1.3.4 Strict liability

As in the previous section, there are several forms of the strict liability rule to consider. We begin with the simplest form of strict liability.

Simple strict liability In this case, the injurer has to bear the total amount of accident costs regardless of the extent of her precaution. Conversely, the victim will be compensated for all costs imposed on her, which implies that the victim's marginal benefit of taking an additional unit of care is zero for any level of care. Thus, it is optimal for the victim to choose a zero level of care because at a zero level the marginal cost of taking care equals zero, and her private optimality condition is satisfied. Of course, optimality condition (1.16) is not met and the outcome is not socially optimal because the marginal benefit of increasing the level of care exceeds the marginal cost to the victim.

Strict division of losses Under this liability rule, the injurer has to pay a fraction f of the accident costs. Hence, the injurer faces the costs

$$c(x) + f \cdot d(x, y) \tag{1.19}$$

and the victim faces the costs

$$c(y) + (1-f) \cdot d(x, y) \tag{1.20}$$

It is crucial to note that the size of the fraction is assumed to be independent of the parties' levels of care. Thus, the first-order conditions are

$$c'(x) = -f \cdot d_x(x, y) \quad (1.21)$$

and

$$c'(y) = -(1-f) \cdot d_y(x, y) \quad (1.22)$$

Comparing these optimality conditions with conditions (1.16) and (1.18) it is clear that, at any level of care, the marginal benefit of taking care is lower under strict division. Since parties save only a fraction of the true reduction in accident losses by taking care, they have too little incentive to exercise a socially optimal level of care.

Strict liability with the defence of contributory negligence Under this rule, the injurer is liable for the accident losses unless the victim's level of care was lower than her due level of care. It is straightforward to show that under this rule the outcome is socially optimal, provided that the courts set the level of care for victims equal to the socially optimal level of care. The rationale is the same as under the various versions of the negligence rule. Since injurers will be liable for accident damages if victims take due care and therefore will not bear the accident costs, injurers will exercise due care to minimise accident costs. On the other hand, victims will exercise due care because they do not want to be found contributorily negligent. Again, the result is a socially optimal Nash equilibrium.

Strict liability with the defence of relative negligence This rule is basically the same as the previous one with the following difference: if the victim is found negligent because she failed to take due care, she will have to bear only a fraction of her losses. If the fraction depends on the victim's actual level of care relative to due care, if it is sufficiently large, and if the courts choose the legal level of care equal to the socially optimal level of care, then the outcome is socially efficient. The rationale is the same as before.

1.3.5 *Relaxing assumptions*

Recall the first simplifying assumption that the court sets the level of due care equal to the socially optimal level. In the section on unilateral accidents, we conclude that under strict liability the courts need only determine the size of the damage, whereas under negligence the courts must in addition calculate the socially optimal level of due care, and they have to

determine the level of care actually taken in order to see whether the injurer was negligent or not.

In bilateral accidents, however, this result holds true only for the rule of simple strict liability which, as we saw in the previous section, does not achieve socially efficient results. Those forms of strict liability that lead to socially optimal outcomes have the same requirements with respect to their ease of application as the various rules of negligence. The only difference affecting the ease of application of the two rules is that under strict liability the courts do not need to determine the actual level of care of the injurer.

The second assumption concerns the equality between the legal sanction and the damage actually caused. In the case of unilateral accidents we see that, whenever damages are not perfectly compensatory, the potential injurer does not have an efficient incentive to exercise the socially optimal level of care. In the case of bilateral accidents, this result holds true only for, first, the potential injurer, and second, under the rule of simple strict liability.

For instance, it is important to note that, under simple strict liability, under-compensation would tend to create an incentive for the victim to exercise precaution by creating some residual liability. This is also how insurance companies deal with the problem of moral hazard. Since, however, the incentive problem of the potential injurer remains unsolved, under-compensation cannot lead to socially optimal results.

Also, we should note that under the rules of strict liability with the defence of contributory or relative negligence, equality between the legal sanction and the harm does not matter as long as the sanction is sufficiently large so that the private costs of the parties are minimised by conforming to the legal standard. These are, of course, the same results as under the rules of negligence.

Finally, the third assumption refers to the constant level of activity. Recall that in the case of unilateral accidents the rule of strict liability and the rule of negligence produced different results. Under negligence, the injurer has no reason to consider the effect that her activity has on others and would therefore choose too high a level of activity. Under strict liability, on the other hand, the injurer internalises the total amount of social costs and therefore reduces the activity level to the socially optimal level. The crucial condition in order for any liability rule to lead to a socially efficient level of activity is that the parties engaging in some activity must bear the total amount of accident losses. Otherwise only a fraction of the activity's costs are internalised, and the level of activity will be too high. As a matter of fact, though, it is impossible for both parties to bear the accident losses.

Therefore, results change quite drastically in the case of bilateral accidents as compared to unilateral accidents. As Shavell (1987, p. 29) puts it, the reason, in essence, is that for injurers to choose the correct level of activity they must bear accident losses, but for victims to choose the correct level of activity they, too, must bear accident losses. Yet, of course, injurers and victims cannot both bear accident losses under a liability regime, but the problem can be nicely solved by using Pigou taxes, which has led Baumol and Oates (1988) to prefer a system of Pigou taxes to liability as a matter of principle. Under a Pigou tax, the injurer minimises the sum total of damages and abatement costs. As the payment goes to the state rather than the victim, the victim has an incentive to do the same. Consequently, the pair of optimal abatement costs for the injurer and the victim is a Nash equilibrium.

As a result, in bilateral accidents no liability rule leads to socially optimal levels of activity. This implies that the net utility of an activity can be negative, as the following example illustrates. In bilateral accidents, an activity is socially useful if the utility to the injurer less the precaution costs to both the injurer and the victim less the costs of the accident is positive. Assume now that the utility is 100, the optimal precaution cost to the injurer is 40, the optimal precaution cost to the victim is 30, and the expected accident cost is 50. Obviously, the activity is not socially useful because its net utility is negative. Note, however, that under both the rule of negligence and the rule of strict liability the injurer will engage in the activity. Under negligence, his private utility is $100 - 40 = 60$, and under strict liability, his private utility is $100 - 40 - 50 = 10$. This is because, as noted above, the injurer does not take into consideration the precaution cost of the victim.

A theoretical means of achieving a socially optimal outcome would be to establish the legal obligation for the injurer to bear her own precaution cost, the accident cost, and also the precaution cost of the victim (see for example Rose-Ackerman, 1989).

A particular problem with consequences on the efficiency ranking of the negligence rule *vis-à-vis* the strict liability rule is interdependence between victims (Friehe, 2007). Here the damage for each particular victim decreases with the level of care of the tortfeasor and a particular victim's level of care but it increases with the level of care of other victims. This constellation is often observed in crime behaviour. If potential victims of crime invest in safety and if the criminals know this, the investment will reduce the crime rate but will also divert crime to other victims with lower investment levels. This effect might give incentives to increase private investment against crime above its socially optimal level. A similar effect can arise in tort law. Wild animals from a forest can destroy the crops of farmers. The forest owner as well as each farmer can reduce damages. But if the farmer invests, he also diverts animals to other farmers. In this

case, the negligence rule with the defence of contributory or comparative negligence cannot induce the first-best outcome, whereas the strict liability rule with the defence of contributory or comparative negligence leads to efficient levels of care.

To analyse this, assume one tortfeasor who invests x and two victims who invest y_1 and y_2 to reduce damages. Assume further that there exists a triple of strictly positive optimal levels of care $\{x^*, y_1^*, y_2^*\}$ which lead to optimal damages d_1^* and d_2^* for the two victims. Assume further the existence of a negligence rule with the defence of contributory or comparative negligence. And assume that courts define the optimal levels of care as due levels of care. This implies that victims bear all costs of accidents under the efficient combination of costs of care. We ask whether this combination $\{x^*, y_1^*, y_2^*\}$ is a Nash equilibrium. The tortfeasor has no incentives to deviate from the social optimum, as otherwise she must pay damages, which are by definition of optimality higher than her savings of care costs. (In the case of full liability as opposed to partial liability, they are even higher by the fixed amount of $d_1^* + d_2^*$ as the residual risk shifts from the victim to the tortfeasor as soon as the tortfeasor is negligent). In the social optimum $\{x^*, y_1^*, y_2^*\}$ both victims have to bear the damages because the tortfeasor is not negligent. If victim 1 increases her costs of care above y_1^* , this has two effects. It reduces the damages of victim 1 partly because fewer damages occur. But by the definition of optimality this decrease must be lower than the additional expenses. However it also decreases the damages of victim 1 by an additional amount and increases the damages of victim 2 by the same amount. Due to this diversion effect, it is privately profitable for victim 1 to invest more than y_1^* . The same reasoning applies to victim 2. Consequently the efficient combination of levels of care $\{x^*, y_1^*, y_2^*\}$ is not a Nash equilibrium under the negligence rule and victims have an incentive to over-invest.

This odd consequence cannot happen under a strict liability rule with the defence of contributory or comparative negligence. We again ask whether the triple $\{x^*, y_1^*, y_2^*\}$ is a Nash equilibrium. We again assume that the courts fix the due level of care of victims at y_1^* and y_2^* respectively. Victim 1 has no incentives to increase her costs of care above y_1 .

Otherwise her costs of care would increase, but the resulting damage reduction would only reduce the damage compensation of the tortfeasor, which leaves victim 1 with a pure increase in her costs. Victim 1 also has no incentives to reduce the costs of care below the optimal level, as this would lead to negligence and burden her with all the damages, thereby increasing her total costs in spite of the savings of costs of care. The same reasoning applies to victim 2. The tortfeasor has no incentive to deviate from x^* either because – by the definition of optimality – a reduction in the cost of

care below x^* would increase the damage compensation by more than the saved amount of costs of care. And for the same reason an increase in the costs of care above x^* would reduce damages and damage compensation by less than the additional costs of care. In the case described of the interdependence of victims therefore strict liability provides efficient deterrence whereas negligence results in over-investment on the part of victims.

1.4 Litigation costs

The cost of litigation might be higher or lower under strict liability as compared to negligence, depending on various factors. First, the number of cases which lead to damage compensation is strictly higher under strict liability than under negligence because under negligence some losses are borne by the victim whereas under strict liability any loss caused by the tortfeasor leads to compensation. Second, the degree of legal certainty is higher under strict liability as compared to negligence. Under strict liability the plaintiff has to give evidence on causation and on the level of damages. Under negligence, the plaintiff also has to show that the tortfeasor did not reach the due level of care. As the due level of care is often ill-defined *ex ante*, there are more cases under negligence in which plaintiff and defendant might have different views on the outcome of litigation and, therefore, go to court. Under strict liability, however, the quota of cases in which the outcome is clear must be higher. Therefore, the quota of cases in which damage compensation is paid in the shadow of the law, without litigation, is higher under strict liability. In these cases, the costs of transferring wealth from the tortfeasor to the victim are relatively low. Third, the cases which lead to litigation cause fewer litigation costs under strict liability as compared to negligence because less information (on causation and on the level of damages) is needed under strict liability as compared to negligence as an additional requirement for a damage award.

In cases of bilateral damages, however, the cost advantage of lower costs of litigation per case might disappear. In that case the court has to fix a due level of care for the victim (y^*). For this level to be efficient, the court must know the injurer's (x^*) as well as the victim's efficient care to be able to arrive at the socially efficient combination of care levels (x^* , y^*).

1.5 The decentralisation effect of strict liability and negligence

An important advantage of strict liability is seen in its decentralisation or self-selection effect (Cooter and Ulen, 2004, p. 388). If different tortfeasors have different costs of care, the optimal level of care, which minimises the sum of the costs of care and the expected damages, is different for each tortfeasor and it decreases with increasing per unit costs of care. Under strict liability, each tortfeasor has an incentive to minimise these costs as

they are the costs of the society as well as her private total costs. This leads to self-selection and tortfeasors with high per unit costs of care will exhibit a lower level of care than tortfeasors with low unit costs of care. Therefore strict liability leads every individual tortfeasor to reach the cost-minimising and socially optimal care level.

It has been argued that this efficiency result is not reached under a negligence regime in which courts fix a due level of care according to the 'reasonable man' standard or the *pater familias* standard. If this due level of care is somewhere in the middle between the optimal standard of a high and a low cost tortfeasor, both of them get the wrong incentives and the low cost tortfeasor allocates too little care and the high cost tortfeasor allocates too much care. Several authors have shown that this argument is not quite right for several reasons (Rubinfeld, 1987; Bar-Gill and Ben-Shahar, 2003; Miceli, 2006). They have also shown that somewhat different rules of negligence can also lead to an efficient self-selection of tortfeasors under a negligence standard.

Sometimes courts may observe that optimal standards are different for different groups of tortfeasors. They can then fix different levels of due care. For instance, courts often fix due levels of care which are higher for experts than for lay people. This leads experts to use a high level of care and lay people to use a comparatively low level of care, both of which are efficient. But self-selection of different groups of tortfeasors also occurs if courts cannot observe different costs of care of different groups of injurers and have no choice but to fix one due level of care for all potential injurers.

If courts use the reasonable man standard and if this standard is too low for some tortfeasors and too high for others, it is certain that those with low per unit costs of care will reach this standard to avoid liability. Therefore they reach a level of care at which one additional unit of care will reduce expected damages by more than one unit. This leads to inefficiency. The incentive effects of the reasonable man standard on tortfeasors with high per unit costs of care are however ambiguous. At the reasonable man standard, the costs of care for the tortfeasor with high unit costs of care are higher than his optimal costs of care. He will reach the due level of care as long as the sum total of his optimal costs of care plus the damage compensation at this level of care are higher than the costs of due care.

To illustrate, assume that the costs of due care are 30, the optimal costs of care for the high cost tortfeasor are 10 and the damages are 15 at this level of care. In this case, the tortfeasor will allocate efficient care and pay damages as his total costs are then lower than 30. If, however, at the efficient level of care the damages are 25, he will comply with the standard. In the first case, the negligence rule leads to efficient incentives for high cost tortfeasors whereas in the second case this result is not obtained. Those

groups of tortfeasors with an efficient level of care which is lower than the due level of care will sometimes have incentives to reach the due level of care and sometimes they will get incentives to reach the efficient level of care. The latter result usually occurs if the due level of care is very much higher than the efficient level of care.

The consequences of a reasonable man standard if injurers have different costs are again different if the liability rule is the so-called partial liability, also known as the 'difference principle' (Kahan, 1989). Under this rule, damage compensation of the careless injurer is always the difference between the harm done and the harm which would have occurred at the due level of care. It is interesting that this rule guarantees that a tortfeasor will reach the efficient level of care whenever the due level of care is higher than the efficient level of care. To understand this result, assume that the tortfeasor reaches the due level of care with a certain amount of costs. In that case he pays no damages. If – starting from the due level of care – he reduces his care level to a level which is still inefficiently high, he pays only the damages which he actually causes by deviating from the due level of care. By definition of efficiency, however, his cost of care savings must then exceed the additional damage he causes. This argument holds until the tortfeasor has reached her efficient level of care. Therefore under the difference principle the reasonable man standard leads to inefficiently low care for tortfeasors with low per unit costs whose efficient level of care is higher than the due level of care. It leads however to self-selection of tortfeasors whose unit costs of care are high and whose optimal level of care is lower than the due level of care. All of them have an incentive to allocate efficient care.

Miceli (2006) used this insight to criticise the reasonable man standard, which is lower than the efficient care level of some tortfeasors and higher than the efficient level of other tortfeasors. He proposed a standard of due care which is equal to the efficient care level of the tortfeasor with the lowest per unit costs of care. Such a standard would hold injurers to the 'highest degree of vigilance, care and precaution' (Miceli, 2006, p. 359). This would lead to a self-selection of all injurers with different costs of precaution. Each of them would have incentives to reach her efficient level of care just as under strict liability. This favourable result hinges however on the smooth working of the difference principle.

Summarising, we can say that strict liability leads to a perfect and efficient self-selection of all injurers with different per unit costs of care. It is not true that no self-selection exists under negligence. But the same desirable result as under strict liability is only obtained under a negligence standard of the 'highest degree of vigilance' as compared to the 'reasonable man standard'. This is not enough. This rule must be combined

with a comprehensive form of the difference principle. Full self-selection of injurers with different costs of care under negligence would therefore require far-reaching changes of the negligence rule and the strict use of the difference principle (partial liability).

1.6 The information-generating consequence of negligence

1.6.1 Negligence generates public information on safety technology

The negligence rule is usually the base line. In civil law countries, negligence is the general rule and strict liability is an exceptional rule codified in specific statutes. In common law countries, strict liability is imposed in case of abnormal dangerousness of an activity (Posner, 2005; Rosenberg, 2007). It is difficult to see what explains this. Strict liability with the defence of contributory or comparative negligence leads to efficient results in most cases. Negligence leads to efficient results only if courts fix a due level of care that is equal to the efficient level of care, or if they fix a due level of care that is too high (under partial liability) or much too high (under full liability), so that the tortfeasor prefers the efficient level of care even if this leads to compensation. The strict liability rule, therefore, seems to dominate the negligence rule in terms of giving the right incentives.

One can argue that negligence is superior to strict liability because it generates more public information about the due and efficient level of care (Ott and Schäfer, 1997; Feess and Wohlschlegel, 2006). Under strict liability each company fixes a level of care which maximises total profits. The level of care actually chosen remains the private knowledge of the firms, which have no incentive to disclose it to their competitors. Under the negligence rule courts use the private cost calculations of companies to fix due levels of care, and court decisions based on this information find their way into precedents and commentaries. The negligence regime therefore produces more generally accessible information about safety technology than the strict liability rule. If the efficient standard of care does not vary much across firms within an industry, the negligence rule therefore produces valuable spill-overs from firm to firm via the legal system, which the strict liability rule cannot provide. Under the negligence rule, courts aggregate and transmit private knowledge as to the optimal care level from informed companies to companies with inferior information by adjusting the due level of care over time as a response to the information obtained from observing the activity level of informed companies. In contrast, under strict liability, courts cannot transmit private information as to the optimal care level because they do not have an instrument to reveal and aggregate information from prior accidents caused by informed companies.

1.6.2 Information generated by the negligence rule alleviates principal-agent problems

A similar argument can be put forward for cases of vicarious liability. Vicarious liability is the liability of a principal for a damage caused by her agent. If the agent causes damage to a third party, the third party may have a damage claim against the principal if the agent is liable either under strict liability or because she was negligent. If the agent is liable, two possible consequences arise. The liability of the agent may trigger automatically the liability of the principal. This is the most important rule. Alternatively, the principal is liable for the agent only if she has not reached a due level of care in selecting or supervising the agent.

We consider here one of the four possible combinations of vicarious liability, the one which makes the principal strictly liable for the negligence of her agent. This rule can alleviate the principal-agent problem between employers and employees, as Demougin and Fluet (1999) have shown.

A worker might hide her type from the principal, which might lead to a higher probability of damages after hiring the agent (hidden information), or she might choose a low level of care for her own benefit and at the expense of the principal (hidden action). To illustrate: suppose that, in a chain store, a customer gets hurt because a sales person has dangerously stockpiled heavy goods. The chain store manager (the principal) can only imperfectly monitor the effort of the sales person (the agent). Suppose that the victim of an accident can show the negligent behaviour of the sales person in court. In other words, assume that the victim has better information about the effort of the agent than the principal. This is a likely situation in many instances in which the victim but not the employer can observe the care level of an employee.

Under the negligence rule, the manager obtains information in court about the negligent behaviour of his employee. This makes it possible for him to write a contingency contract under which the employee is sanctioned if she has negligently caused a damage which triggers vicarious liability. Put differently, the store manager may sanction the sales person if it is accurately established in court that he has negligently caused damage to the victim. This possibility alleviates the principal-agent problem within firms.

In contrast, consider the principal-agent problem under a strict liability rule, under which the causation of a damage by the agent triggers the liability of the principal. Under this rule, no information about the agent's negligence is generated in a judicial proceeding. Consequently, a contingency contract between the principal and the agent contingent on the negligent causation of an accident cannot be formed. By contrast, negligence generates information from the victim and thus allows for contracts which alleviate the principal-agent problems in firms. All in all, it can be said that the

negligence rule has the advantage of generating more valuable information for third parties than the strict liability rule. This is an advantage which has been overlooked in much of the literature.

1.7 Strict liability versus negligence if the injurer's wealth is lower than the damage

We have discussed the effect of under-compensation, which leads to under-deterrence under strict liability and to efficient deterrence or under-deterrence under the negligence regime. A particular case of under-compensation arises if the tortfeasor is judgment-proof, that is, if her total wealth is lower than the damage. In order to analyse this case sufficiently, one has to differentiate between two case groups of such injurers.

First group: the tortfeasor allocates costs of care which do not reduce her total wealth, for instance by allocating time and effort, but not money. Consider a car driver who takes optimal care when driving. Her level of care does not change her total wealth. In this case, the only possible inefficient result is under-deterrence. Second group: the tortfeasor expends monetary costs of care which reduce her wealth. Take for example a medical doctor who invests in costly equipment to reduce damages or an auditor who hires more staff to make a better audit. In this case, it is possible that the liability rule provides the judgment-proof injurer with incentives to reach a level of care which is too low or too high (Beard, 1990; Miceli and Segerson, 2003).

The intuition behind the result in the second group of cases is that every increase in investment in care must reduce the expected liability by more than the effect of the increased care on the expected damages. When the injurer takes the decision to invest in care, this decision must reduce her expected liability. If for instance the injurer invests one dollar more to increase her care level, the immediate consequence is that her liability is reduced by one dollar in case of damage. Thus, in the eyes of the injurer, the cost of one dollar of care is less than a dollar, but rather a dollar minus a dollar multiplied by the accident probability. The injurer is in a situation as if her investment in care were cross-subsidised by a reduction of wealth, which is lost anyway in the case of an accident. If at the efficient level of care this reduction in the injurer's perceived costs of care is higher than the effect that the injurer's remaining assets are less than the damages, the injurer will invest more than the optimal level of care. This result is, however, restricted to a rule of strict liability. It cannot occur under negligence, provided that the due level of care is equal to the efficient level of care. The intuition behind this is straightforward: under negligence, an injurer never has any incentive to invest more than the due level of care as this shifts all residual risks to the victim.

Another surprising result of inefficient deterrence for the judgment-proof injurer under negligence and strict liability becomes apparent if one

includes the rules of evidence for negligence (Demougin and Fluet, 2006). This rule can be either the preponderance of evidence, as in common law jurisdictions, or full proof, as in several civil law jurisdictions.

It is a well-established research result that under strict liability the judgment-proof tortfeasor usually prefers a lower level than the efficient level of care because his expected liability is lower than the expected harm he causes. This leads to under-compensation and thus – in the case of strict liability – to under-deterrence. We now turn to an analysis of the negligence rule. If under negligence the rule of evidence for negligence is full proof, a certain quota of all negligently caused damages may not be compensated. In anticipation of this consequence, the cost-minimizing level of care of the tortfeasor is likely to be below the social optimum. Under the preponderance of evidence for negligence, the careless tortfeasor faces a higher risk of being convicted and paying damages. This *per se* increases deterrence. A larger number of negligent tortfeasors have to pay compensation than under the full proof rule. However, under the preponderance of evidence rule, more non-negligent tortfeasors are convicted as negligent and must pay compensation. This *per se* reduces deterrence because the incurrence of costs for the due level of care may not be rewarded by evading liability. Demougin and Fluet (2006) show, however, that the overall effect of the rules of proof for negligence leads to the following social ranking of negligence versus strict liability for judgment-proof tortfeasors.

- (1) Negligence with preponderance of evidence for the proof of negligence
- (2) Strict liability
- (3) Negligence with full proof of negligence

This result should, however, only be taken as a first approach to the problem rather than as a clear ranking of evidence rules in common law countries over those in civil law countries. In civil law countries, full proof for negligence is only the baseline. It is often changed if the plaintiff has difficulty to showing evidence and if information is asymmetric between plaintiff and defendant. In such cases, courts may find other ways of alleviating the burden of proof for negligence or may even reverse the burden of proof. The overall effect of the multiplicity of such rules of evidence for negligence is still unknown.

1.8 Liability and contracts

In the previous sections of this chapter, we concentrated on situations where parties do not enter into contractual relationships because of high transaction costs such as the costs of bargaining. The notion of transaction costs, however, is crucial for the analysis of liability and deterrence.

Recall the basic insight of the Coase Theorem, which says that when parties can bargain with each other in order to settle their disagreements, their behaviour will be efficient regardless of the underlying rule of law. This implies that, whenever transaction costs are low, people enter into contractual relationships and the rules of contract law apply. Conversely, whenever transaction costs are high, people do not enter into contractual relationships and the rules of tort apply. There are a few areas, however, where tort law and contract law seem to merge, such as ‘products liability’ and ‘implicit contracts’.

We now examine the allocative effects of various forms of liability rules in those cases where parties have entered into contractual relationships. We assume profit-maximising behaviour of firms and perfect competition. That is, the price of a product equals total unit costs including liability costs. It is also assumed that rational consumers buy a product only if the utility of the product exceeds its perceived price, that is, the price actually charged plus expected accident costs not covered by liability payments.

If the customers’ knowledge of risk is perfect, firms will take optimal care under any liability rule, even under the rule of no liability. This is because customers would immediately discover whether or not firms took less than optimal care. Thus, the perceived price of the product including expected losses would be higher than the product price of firms exercising optimal care. The potential loss of customers forces firms to exercise optimal care regardless of the underlying rule of liability. Also, the level of consumption is optimal because the price of the product as compared by customers with their utility includes expected accident losses. These results change, however, once we assume that customers have imperfect knowledge of the risk associated with a product. If customers cannot determine product risks, they will not reward firms for making products safer. Therefore, firms do not have any incentive to take optimal care unless there is some rule of liability. Moreover, under the rule of no liability and under the negligence rule, the level of consumption will not be optimal. Only under strict liability does the misperception of risks not matter because customers are fully compensated for their losses anyway, and market prices reflect the true risk of accident losses. In all other cases, market prices, and thus consumption, are either too high or too low.

1.9 Negligence under the disguise of strict liability, liability for design defects

In product liability, the general rule is strict liability. In the European Union, the Council Directive 85/374/EEC provides ‘that the producer shall be liable for damage caused by a defect in his product’. Upon closer

inspection, however, it is unclear whether for design defects this is a rule of strict liability or of negligence. This depends on how courts conceptualise a design defect. They can use two alternative tests, the 'risk utility test' or the 'consumer awareness test'. Under the risk utility test, the court asks whether the product was designed to be reasonably safe. In that case the product is not defective even if it caused an accident to the victim. The risk utility test therefore asks whether those who prepared the blueprint for the product were negligent. The Learned Hand test must therefore be applied to the design of the product. If courts use this test, producer liability for design defects is negligence under the disguise of strict liability.

Under the consumer awareness test, courts ask whether consumers regard the product as safer than it actually is. In that case, the producer is liable regardless of the product's safety. This is an informational conceptualisation of the design defect. The risk utility test carries the disadvantage that civil courts often rely on biased expert opinion. They might face a 'cartel of silence' of engineers who depend on the industries that produce the goods. This might lead to a standard of safety which is lower than optimal. Even if the standard is optimal, consumers who are unaware of the risk face unexpected damages and consequently buy too many of the dangerous goods. By contrast, the information required for the consumer awareness test can be provided by disinterested experts, for instance by pollsters. Under the consumer awareness test, all unexpected damages are internalised in the price of the product. Therefore, the decision to buy reflects the product's dangerousness, even though consumers underestimate the damages. The disadvantage is that the consumer might overuse the product and thus cause a higher than efficient level of harm. Courts usually cannot observe the excessive use and therefore cannot reduce damage compensation under the defence of contributory negligence. However, this result might also occur – albeit to a lesser extent – under the risk utility test if the consumer believes that the product is safer than it actually is. This applies even if she correctly believes that in case of damage there is no claim. It is, therefore, a question still open to empirical research whether the conceptualisation of 'design defect' should be based on the producer's negligence or on information asymmetry between the producer and the consumer.

1.10 Multiple tortfeasors

We now turn to the case of multiple tortfeasors. Landes and Posner (1980) were the first authors to study the incentives to take care in the case of multiple tortfeasors, yet restricting their attention to negligence. For a more general discussion see Kornhauser (1989).

We will consider situations where there is more than one injurer affecting the probability of accident losses. Furthermore, we need to distinguish

between cases where injurers act independently with the victim's harm being indivisible, and cases where injurers act together (in concert) to cause the victim's harm.

Under strict liability, injurers who act independently will not always act optimally in equilibrium. Assuming that each injurer is liable for a fixed fraction of losses only, any increase in the injurer's exercise of care diminishes her liability by only a fraction of the reduction in expected losses, which induces the injurer to take a level of care that is clearly below the optimal level of care. When injurers act together, however, their minimisation problem obviously turns into a situation exactly equivalent to the one where there is only a single injurer. Thus, under strict liability and if injurers act in concert, injurers take optimal care. Note that this result is not obtained if injurers pay a fraction that is identical to their probability of causation.

Under the rule of negligence, we obtain different results. Injurers will now act optimally (they will take due care) in equilibrium both in cases where they act independently and in cases where they act together, provided that the due level of care is optimally determined, of course. Again, the analysis is straightforward and is precisely analogous to the previous analysis of situations of bilateral accidents. If one injurer alone fails to take due care, she will be held liable for the total amount of accident losses. A rationally self-interested injurer will now assume that another equally self-interested injurer has decided to exercise efficient precaution and, that being so, it is reasonable for that injurer also to exercise efficient precaution. Note that this outcome is unique and stable, and that it also holds true if injurers act in concert.

1.11 Risk aversion, liability law and insurance

So far we have constrained our analysis to the case of risk-neutral parties. We will now extend the analysis by allowing for risk-averse individuals, and we will discuss the interaction between risk aversion, liability law and insurance.

Risk aversion depends on the concavity of the utility function of wealth, that is, the rate at which utility losses grow with losses of wealth. The concavity of the utility function implies that a \$1,000 loss will cause greater harm to a person with assets of \$10,000 than to a person with assets of \$100,000. The shifting of risks from the more to the less risk-averse will raise social welfare given that social welfare is the sum of the individuals' expected utilities. Social welfare will also increase if risks are shared among risk-averse parties, thereby reducing the potential extent of the losses that each party might suffer.

One way of shifting and sharing risks is by insurance. Insurance can be described as a private system substitute for liability law, in which contracts

determine the allocation of risks. In the theory of insurance, a distinction has to be made between the cases in which the insured persons can influence risks and the cases in which they cannot. In the situations where the probability of damage cannot be affected by the actions taken by the insured persons, an insurance policy that offers complete coverage is socially optimal. If the insured, however, can influence risks, complete reimbursement creates the problem of moral hazard: the individual has no incentive to take any care at all.

We now turn to the discussion of the interaction between risk aversion, liability law and insurance. Under the assumption that injurers are subject to liability, but that there is no insurance, the comparison of liability rules shows that the rule of negligence is preferable when victims are less risk-averse than injurers, and the rule of strict liability is preferable when the reverse holds true. The rationale behind these results is that under the negligence rule injurers will not bear any risk when taking due care, whereas victims will bear their losses. Thus, social welfare will be lower if victims are more risk-averse than injurers. The outcome is quite different under the rule of strict liability. Injurers will bear risk regardless of the level of care they take. If injurers are more risk-averse than victims, social welfare will decrease. Under the assumption that insurance is available, both the rule of negligence and the rule of strict liability yield socially optimal outcomes because individuals, if risk-averse, can obtain liability insurance. The more efficient rule is the one that costs less. Assuming, for instance, that consumers can insure more cheaply than manufacturers, strict product liability should be limited.

The superiority of strict liability over negligence in cases of excessively dangerous activities and variable activity levels is not a general result, as Nell and Richter (2003) have shown. If courts cannot observe the optimal activity level and integrate this into the concept of negligence, strict liability outperforms negligence if injurers as well as victims are risk-neutral, or if insurance markets are perfect (see section 1.2.3 above). If, however, insurance markets are imperfect or if insurance coverage is not available, this result loses generality. This becomes most obvious for very dangerous and catastrophic accidents, in which one tortfeasor often causes harm to a large number of victims. In such a case, strict liability would allocate all risk to one person whereas in the absence of insurance coverage, an efficient risk allocation would spread the risk between victims and injurer. This inefficient risk allocation will cause the injurer to choose an activity level which may be too low from a social point of view. In such a case, a liability cap which redistributes some of the damages to the injurers would improve the risk allocation and would prevent the injurer from choosing an inefficiently low level of activity. Alternatively, in such cases, strict liability could be replaced by negligence. Then, if the harm to the injurer is a technical

external effect which is not internalised by the price system, the overall welfare effect is unclear. On the one hand, negligence would improve the risk allocation as the damages are distributed across more individuals. On the other hand, injurers would choose the efficient level of care, and would also choose an inefficiently high level of activity and thus increase the damages to an inefficiently high level. It depends on the parameters whether the overall benefit associated with a negligence rule would then be lower or higher than that associated with a strict liability rule.

If with imperfect insurance coverage liability works through a market and if victims must ultimately pay the price for the liability in a product price, the situation becomes different. In that case, negligence strictly outperforms strict liability because the tortfeasor will reach an efficient level of care. But as the residual risk is borne by the victims, they will keep the level of activity down by buying fewer dangerous products. As the risk allocation is better under negligence than under strict liability, consumers and buyers will choose an activity level that is higher and socially superior to the extremely low activity level which a non-insured producer would choose under strict liability.

1.12 Relaxing behavioural assumptions of rational choice

The large majority of tort law models assume a maximising tortfeasor who can map information into unbiased subjective probability values. This rules out optimistic and pessimistic attitudes of the injurer. It is, however, a well-known result of psychological research and behavioural economics that individuals tend to exhibit optimistic and pessimistic behaviour. For instance, individuals underestimate the likelihood that they will be involved in a car accident (Guppy, 1993). Furthermore, individuals tend to be unrealistically optimistic as to health or environmental risks (Sunstein, 1997; Weinstein, 1989). Furthermore, recent research suggests that individuals are pessimistic as to the risk of highly salient and catastrophic accidents such as earthquakes. They overestimate the probability of occurrence (Gigerenzer, 2005; Jolls, Sunstein and Thaler, 1998).

If ambiguity is introduced, that is, if the injurer can be either optimistic or pessimistic and consequently overestimates or underestimates the probability of an accident, the standard results of the efficiency of strict liability versus negligence change somewhat (Teitelbaum, 2007).

First, in the case of optimism, the expected value of damages corrected for the influence of optimism is lower than the expected value under full rationality. Consequently, under strict liability the tortfeasor will reach a level of care which is lower than the efficient level of care.

Second, in the case of pessimism, the perceived value of damages is higher than under full rationality. Accordingly, the level of care is higher

than optimal. To illustrate: an optimistic car driver might not care to use a safety belt. And the widely reported asbestos cases have led to pessimism, which pushed up the investment expenditure for asbestos decontamination to an unreasonably high level.

Third, under negligence, different outcomes are possible. Assume that the due level of care is equal to the efficient level of care and that the tortfeasor has to pay the full damages. In that case, the tortfeasor will reach the due and efficient level of care provided that the minimum of her perceived damage costs plus her costs of care are higher than the costs of due care. If these costs are, however, lower than the due costs of care, she will reach an inefficiently low level of care. The result changes if the difference principle (partial liability) is used. Under this principle, the tortfeasor can deduct those damages that would have occurred if she had reached the due level of care. Under that condition, it is certain that the perceived minimum of the costs of damage compensation and the costs of care are lower than the costs of due care. All in all, it can be said that in the case of optimism, negligence leads to better results than strict liability in some cases. In the case of pessimism, negligence leads to better results than strict liability in all cases. This proposition holds for the basic model of unilateral accidents with a fixed activity level.

This leads Teitelbaum (2007) to the suggestion that negligence is more robust to ambiguity than strict liability and that negligence is likely to outperform strict liability if the injurer is pessimistic. This might again add to the explanation why the negligence rule and not the strict liability rule is regarded as the baseline in tort law in both common law and civil law countries.

1.13 Comparing strict liability and negligence

Let us now summarise some of the main results of the previous sections. In the case of unilateral accidents, both the rule of strict liability and the rule of negligence achieve a socially optimal outcome, provided that courts set the level of due care equal to the socially optimal level of care, that the legal sanction equals the harm, and that the level of activity is constant. Relaxing these assumptions provides further insights favouring the rule of strict liability. Under strict liability, all the courts need to do is to determine causation and the size of the damage, whereas, under the negligence rule, the courts also need to determine the level of due care as a legal standard for the socially optimal level, and they have to determine the level of care actually taken in order to see whether the injurer was negligent or not. These information requirements are difficult and costly to satisfy. Moreover, the average costs of resolving claims tend to be higher under negligence.

Another important advantage of the rule of strict liability emerges when allowing for variable levels of activity. Under negligence, the injurer has no reason to consider the effect that her activity has on others because she can escape liability by taking due care. Thus, the injurer will choose too high a level of activity. Under strict liability, the injurer internalises the total amount of social costs and reduces the level of activity to the socially optimal level.

So far, the results suggest that the rule of strict liability achieves socially optimal results provided that damages are set at the perfectly compensatory level. What happens, though, when an accident is bilateral, requiring both parties to take precautions against accidents? Now the efficiency of the rule of strict liability becomes problematic because, even though strict liability may at first create the right incentives for potential injurers, it will create an incentive problem for potential victims and will in return lead injurers to exercise suboptimal care. Strict liability is the mirror image of no liability. One rule fails to create incentives for precaution by the victim, the other rule fails to create incentives for precaution by the injurer.

Therefore, our analysis suggests that in the case of bilateral accidents we should apply either a negligence rule or a rule of strict liability with the defence of contributory or relative negligence. All of them lead to socially optimal outcomes, provided that the courts set the legal standard of precaution at the efficient level, because self-interested agents have an incentive to choose the legal standard of care.

The efficiency of negligence disappears if negligence standards are ill-defined *ex ante* and if therefore the tortfeasor does not know at which level of care her probability of being held negligent becomes zero. Depending on the probability distribution function which maps a level of care onto a probability of being held negligent by the court, this might lead to under-deterrence or to over-deterrence or – by chance – to optimal deterrence. If a muddy standard of due care is combined with over-compensation, over-deterrence becomes inevitable, whenever the rate of over-compensation reaches a threshold level. The equivalent outcome shows up in cases of under-compensation.

Strict liability also trumps negligence in the case of interdependency of victims, that is, if increased care of one victim increases the damages of another victim.

The negligence rule is usually the base line around the world. In civil law countries, negligence is the general rule and strict liability is an exceptional rule or codified in specific statutes. In common law countries, negligence is the baseline and strict liability is imposed in case of abnormal dangerousness of an activity (Posner, 2005; Rosenberg, 2007). Given the basic analysis of negligence versus strict liability, it is difficult to see what explains this.

Strict liability with the defence of contributory or comparative negligence usually leads to efficient results. Negligence leads to efficient results only if courts fix a due level of care which is equal to the efficient level of care, or if they fix a very high due level of care, such that the tortfeasor prefers the efficient level of care even if this leads to compensation. The relative merits of the negligence rule as the baseline are not visible under the basic analysis.

A major drawback of the rule of strict liability in unilateral accidents, though, emerges when we relax the assumptions. Whenever damages are not perfectly compensatory, that is, compensation is below the level that would make the victim indifferent between the case of no accident and that of an accident with compensation, the potential injurer does not have an efficient incentive to exercise the socially optimal level of care under the strict liability rule. A symmetric result obtains in case of over-compensation under strict liability. The negligence rule is more robust with regard to deviations of damage compensation from damages, for instance if injurers are judgment-proof or remain undetected. This important advantage of the negligence rule disappears, however, if due levels of care are ill-defined *ex ante*.

An important advantage of the negligence rule is that it produces more publicly available information on safety technologies than the strict liability rule. The level of due care which is generated by the court system becomes a public good. Under strict liability, no such revelation mechanism for the technology to prevent damages exists. Moreover, under the negligence rule courts have to establish negligence and this information might be used within firms to improve the incentives for their workers and employees in cases of vicarious liability. Strict liability does not generate such information.

The negligence rule is socially superior to the strict liability rule in the case of multiple tortfeasors. This case requires a sharing rule that distributes the damage compensation payments among tortfeasors. Often the individual contribution of a tortfeasor is not known. The courts use an equal share rule for all tortfeasors. This rule leads to under-deterrence under strict liability but to efficient deterrence under the negligence rule.

Research which includes ambiguity of actors such as optimism and pessimism finds that the adverse effects of ambiguity are smaller under negligence than under strict liability.

A comparison of negligence and strict liability must also include the effects of procedural rules as evidence rules for proving negligence. These rules vary across legal orders and their effects can reverse the social ranking of negligence versus strict liability.

Bibliography

- Adams, Michael (1985), *Ökonomische Analyse der Gefährdungs- und Verschuldenshaftung* (Economic Analysis of Strict and Fault Liability), Heidelberg: R.v Decker's/C.F. Müller.
- Alpa, Guido (1976), 'Colpa e Responsabilità Oggettiva nella Prospettiva dell'Analisi Economica del Diritto (Negligence and Strict Liability in an Economic Analysis of Law Perspective)', *Politica del Diritto*, 431–48.
- Bakker, Bas B. and Cornelius G.M. Sterks (1988), 'Optimal Legal Standards in Negligence Based Liability Rules', *De Economist*, 136, 383–400.
- Bar-Gill, Oren and Omri Ben-Shahar (2003), 'The Uneasy Case for Comparative Negligence', *American Law and Economics Review*, 5, 433–69.
- Beard, T. Randolph (1990), 'Bankruptcy and Care Choice', *RAND Journal of Economics*, 21, 626–34.
- Brown, John Prather (1973), 'Toward an Economic Theory of Liability', *Journal of Legal Studies*, 2, 323–50.
- Burrows, Paul (1982), 'Idealised Negligence, Strict Liability and Deterrence', *International Review of Law and Economics*, 2, 165–72.
- Cabrillo, Francisco (1994), 'Industrialización y Derecho de daños en la España del siglo XIX (Industrialization and Tort Law in XIXth Century Spain)', *Revista de Historia Económica*, 12, 591–609.
- Cafaggi, Fabrizio (1995), 'La Nozione di Difetto ed il Ruolo dell'Informazione. Per l'Adozione di un Modello Dinamico-Relazionale di Difetto in una Prospettiva di Riforma (The Notion of Defect and the Role of Information. For the Adoption of a Dynamic-Relational Model of Defect in a Perspective of Reform)', *Rivista Critica del Diritto Privato*, 13, 447 ff.
- Cafaggi, Fabrizio (1996), *Profili della Colpa Relazionale* (Outlines of Relational Fault), Padova: CEDAM.
- Calabresi, Guido (1965), 'The Decision for Accidents: An Approach to Non-Fault Allocation of Costs', *Harvard Law Review*, 78, 713–45.
- Calabresi, Guido (1970), *The Costs of Accidents: A Legal and Economic Analysis*, New Haven: Yale University Press.
- Calabresi, Guido and Jon T. Hirschoff (1972), 'Toward a Test for Strict Liability in Tort', *Yale Law Journal*, 81, 1054–85. Reprinted in Robert L. Rabin (ed.) (1983), *Perspectives on Tort Law*, Boston: Little Brown, pp. 192–212.
- Centner, Terence J. (1989), 'Groundwater Quality Regulation: Implications for Agricultural Operations', *Hamline Law Review*, 15, 589–605.
- Centner, Terence J. (1990), 'Blameless Contamination: New State Legislation Regulating Liability for Agricultural Chemicals in Groundwater', *Journal of Soil and Water Conservation*, 45, 216–20.
- Centner, Terence J. and Michael E. Wetzstein (1992), 'Agricultural Pesticide Contamination of Groundwater: Developing a "Right-to-Spray Law" for Blameless Contamination', *Journal of Agricultural Taxation and Law*, 14, 38–52.
- Chapman, Bruce (1990), 'Punitive Damages as Aggravated Damages: The Case of Contract', *Canadian Business Law Journal*, 16, 269–80.
- Chelius, James R. (1976), 'Liability for Industrial Accidents: A Comparison of Negligence and Strict Liability Systems', *Journal of Legal Studies*, 5, 293–309.
- Cooter, Robert D. (1982), 'Economic Analysis of Punitive Damages', *Southern California Law Review*, 56, 79–101.
- Cooter, Robert D., Lewis A. Kornhauser and D. Lane (1979), 'Liability Rules and Accidents: Some Results Regarding Limited Information and Public Bads', *Bell Journal of Economics*, 366 ff.
- Cooter, Robert D. and Thomas Ulen (2004), *Law and Economics*, 4th edition, Boston: Pearson.
- Craswell, Richard and John E. Calfee (1984), 'Some Effects of Uncertainty on Compliance with Legal Standards', *Virginia Law Review*, 70, 965–1003.
- Craswell, Richard and John E. Calfee (1986), 'Deterrence and Uncertain Legal Standards', *Journal of Law, Economics, and Organization*, 2, 279–303.

- Dari-Mattiacci, Giuseppe and Gerrit De Geest (2006), 'When Will Judgment-proof Injurers Take too much Precaution?', *International Review of Law and Economics*, 26, 336–54.
- Demougin, Dominique and Claude Fluet (1999), 'A Further Justification for the Negligence Rule', *International Review of Law and Economics*, 19, 33–45.
- Demougin, Dominique and Claude Fluet (2006), 'Preponderance of Evidence', *European Economic Review*, 50, 963–76.
- Endres, Alfred (1991), *Ökonomische Grundlagen des Haftungsrechts* (Economic Fundamentals of Liability Law), Heidelberg: Physica.
- Endres, Alfred (1992), 'Strategic Behavior under Tort Law', *International Review of Law and Economics*, 12, 377–80.
- Endres, Alfred and Regina Bertram (2006), 'The Development of Care Technology under Liability Law', *International Review of Law and Economics*, 26, 503–18.
- Endres, Alfred and Andreas Lüdeke (1998), 'Incomplete Strict Liability: Effects on Product Differentiation and Information Provision', *International Review of Law and Economics*, 18, 511–28.
- Endres, Alfred and Immo Querner (1995), 'On the Existence of Care Equilibria under Tort Law', *Journal of Institutional and Theoretical Economics*, 151, 348–57.
- Epstein, Richard A. (1973), 'A Theory of Strict Liability', *Journal of Legal Studies*, 2, 151–204.
- Epstein, Richard A. (1974), 'Defenses and Subsequent Pleas in a System of Strict Liability', *Journal of Legal Studies*, 3, 165–215.
- Faure, Michael G. and Göran Skogh (1992), 'Compensation for Damages Caused by Nuclear Accidents: A Convention as Insurance', *Geneva Papers on Risk and Insurance*, 17, 499–513.
- Faure, Michael G. and Roger Van den Bergh (1987a), 'Efficiënties van het Foutcriterium in het Belgisch Aansprakelijkheidsrecht (Efficiencies of the Fault Criterion in Belgian Liability Law)', *Rechtskundig Weekblad*, 51, 11–19.
- Faure, Michael G. and Roger Van den Bergh (1987b), 'Negligence, Strict Liability and Regulation of Safety under Belgian Law: An Introductory Economic Analysis', *Geneva Papers on Risk and Insurance*, 12, 95–114.
- Feess, Eberhard and Ansgar Wohlschlegel (2006), 'Liability and Information Transmission: The Advantage of Negligence-based Rules', *Economics Letters*, 92, 63–7.
- Feldman, Allan M. and John M. Frost (1998), 'A Simple Model of Efficient Tort Liability Rules', *International Review of Law and Economics*, 18, 201–15.
- Finsinger, Jörg and Mark V. Pauly (1990), 'The Double Liability Rule', *Geneva Papers on Risk and Insurance*, 15, 159–70.
- Finsinger, Jörg and Philip von Randow (1991), 'Neue Aktivitäten und Haftungsregeln, zugleich ein Beitrag zur ökonomischen Analyse des Nachbarrechts (New Activities and Liability Rules)', in Claus Ott and Hans-Bernd Schäfer (eds), *Ökonomische Probleme des Zivilrechts*, Berlin: Springer, pp. 87–108.
- Frech, H. Edward III (1994), 'State-dependent Utility and the Tort System as Insurance: Strict Liability versus Negligence', *International Review of Law and Economics*, 14, 261–72.
- Friehe, Tim (2007), 'Victim Interdependence in the Accident Setting', Working Paper, University of Tübingen, 1–17.
- Gallo, Paolo (1993), 'Appunti in Tema di Colpevolezza, Colpa Soggettiva ed Efficienza Economica (in occasione di alcune recenti pubblicazioni) (Notes about Liability, Subjective Fault and Economic Efficiency on the Occasion of Some Recent Publications)', *Quadrimestre*, 712–32.
- Garoupa, Nuno and Giuseppe Dari-Mattiacci (2009), 'Least-Cost Avoidance: The Tragedy of Common Safety', *Journal of Law, Economics, and Organization*, 25, forthcoming.
- Geistfeld, Mark (1995), 'Manufacturer Moral Hazard and the Tort-Contract Issue in Products Liability', *International Review of Law and Economics*, 15, 241–57.
- Gilles, Stephen G. (1992), 'Rule Based Negligence and the Regulation of Activity Levels', *Journal of Legal Studies*, 21, 319–63.

- Goerke, Lazlo (2002), 'Accident Law: Efficiency May Require an Inefficient Standard', *German Economic Review*, 3, 43–51.
- Goldberg, Victor P. (1994), 'Litigation Costs under Strict Liability and Negligence', *Research in Law and Economics*, 16, 1–15.
- Grady, Mark F. (1983), 'A New Positive Theory of Negligence', *Yale Law Journal*, 92, 799–829.
- Grady, Mark F. (1988), 'Why Are People Negligent?: Technology, Nondurable Precautions, and the Medical Malpractice Explosion', *Northwestern University Law Review*, 82, 293 ff.
- Grady, Mark F. (1992), 'Better Medicine Causes More Lawsuits, and New Administrative Courts Will Not Solve the Problem: Review of Medical Malpractice on Trial by Paul C. Weiler', *Northwestern University Law Review*, 86, 1068 ff.
- Grady, Mark F. (1994), 'Res Ipsa Loquitur and Compliance Error', *University of Pennsylvania Law Review*, 142, 887 ff. Reprinted in Robert L. Rabin (1995), *Perspectives on Tort Law*, New York: Aspen.
- Haddock, David D. and Christopher Curran (1985), 'An Economic Theory of Comparative Negligence', *Journal of Legal Studies*, 14, 49–72.
- Hand, Learned (1947), *United States v. Carroll Towing Co.*, 159 F.2d 169 (2nd Cir. 1947).
- Hasen, Richard L. (1990), 'Comment, Efficiency under Informational Asymmetry: The Effect of Framing on Legal Rules', *UCLA Law Review*, 38, 391 ff.
- Hylton, Keith N. (1990a), 'The Influence of Litigation Costs on Deterrence under Strict Liability and under Negligence', *International Review of Law and Economics*, 10, 161–71.
- Hylton, Keith N. (1990b), 'Costly Litigation and Legal Error under Negligence', *Journal of Law, Economics, and Organization*, 6, 433–52.
- Hylton, Keith N. (1993), 'Litigation Cost Allocation Rules and Compliance with the Negligence Standard', *Journal of Legal Studies*, 22, 457–76.
- Jain, Satish K. and Rajendra P. Kundu (2006), 'Characterization of Efficient Simple Liability Rules with Multiple Tortfeasors', *International Review of Law and Economics*, 26, 410–27.
- Jain, Satish K. and Ram Singh (2002), 'Efficient Liability Rules: Complete Characterization', *Journal of Economics*, 75, 105–24.
- Jansen, Nils (2004), 'Duties and Rights in Negligence: A Comparative and Historical Perspective on the European Law of Extracontractual Liability', *Oxford Journal of Legal Studies*, 24, 443.
- Johnston, Jason Scott (1987), 'Bayesian Fact-Binding and Efficiency: Toward an Economic Theory of Liability under Uncertainty', *Southern California Law Review*, 61, 137 ff.
- Kahan, Marcel (1989), 'Causation and Incentives to Take Care under the Negligence Rule', *Journal of Legal Studies*, 18, 427–47.
- Kim, Jeong-Yoo (2006), 'Strict Liability versus Negligence when the Injurer's Activity Involves Positive Externalities', *European Journal of Law and Economics*, 22, 95–104.
- Kobayashi, Bruce H. (1996), 'Strict Liability, Gun Control, and Sin Taxes', in William F. Shughart II (ed.), *Taxing Choice: The Political Economy of Fiscal Discrimination*, New Brunswick, NJ: Transaction Publishers.
- Kolstad, Charles D., Thomas S. Ulen and Gary V. Johnson (1990), 'Ex Post Liability for Harm vs. Ex Ante Safety Regulation: Substitutes or Complements', *American Economic Review*, 80.
- Kornhauser, Lewis A. (1989), 'Sharing Damages among Multiple Tortfeasors', *Yale Law Journal*, 98, 831–84.
- Landes, William M. and Richard A. Posner (1980), 'Multiple Tortfeasors: An Economic Analysis', *Journal of Legal Studies*, 9, 517–55.
- Landes, William M. and Richard A. Posner (1987), *The Economic Structure of Tort Law*, Cambridge, MA: Harvard University Press.
- Lando, Henrik (1996), 'Hvornår bør Objektivt Ansvar Gælde? Det Retsekonomiske bud på et sæt af Kriterier for Objektivt Ansvar' (When Should Strict Liability Apply? The Law-and-Economics Answer), Working Paper, Institute of Finance, University of Oslo.
- Lee, Gary L. (1981), 'Strict Liability versus Negligence: An Economic Analysis of the Law of Libel', *Brigham Young University Law Review*, 398–406.

- Levmore, Saul (1986), 'Rethinking Comparative Law: Variety and Uniformity in Ancient and Modern Tort Law', *Tulane Law Review*, 31, 235–87.
- Low, Stuart and Janet Kiholm Smith (1992), 'The Relationship of Alternative Negligence Defense Rules to Litigation Behavior and Tort Claim Disposition', *Law and Social Inquiry*, 17, 63–87.
- Low, Stuart and Janet Kiholm Smith (1995), 'Decisions to Retain Attorneys and File Lawsuits: An Examination of the Comparative Negligence Rule in Accident Law', *Journal of Legal Studies*, 24, 535–57.
- Markovits, Richard S. (1998), 'The Allocative Efficiency of Shifting from a "Negligence" System to a "Strict-Liability" Regime in our Highly-Pareto-Imperfect Economy: A Partial and Preliminary Third-Best-Allocative-Efficiency Analysis', *Chicago-Kent Law Review*, 73, 11, 30–33.
- Miceli, Thomas J. (2000), 'Deterrence, Litigation Costs, and the Statute of Limitations for Tort Suits', *International Review of Law and Economics*, 20, 383–94.
- Miceli, Thomas J. (2006), 'On Negligence Rules and Self-Selection', *Review of Law and Economics*, 2, 349–61.
- Miceli, Thomas J. and Kathleen Segerson (2003), 'A Note on Optimal Care by Wealth-constrained Injurers', *International Review of Law and Economics*, 23, 273–84.
- Nell, Martin and Andreas Richter (2003), 'The Design of Liability Rules for Highly Risky Activities – Is Strict Liability Superior When Risk Allocation Matters?', *International Review of Law and Economics*, 23, 31–47.
- Newman, Harry A. and David W. Wright (1990), 'Strict Liability in a Principal-Agent Model', *International Review of Law and Economics*, 10, 219–31.
- Orr, Daniel (1991), 'The Superiority of Comparative Negligence: Another Vote', *Journal of Legal Studies*, 20, 119–29.
- Ott, Claus and Hans-Bernd Schäfer (1997), 'Negligence as Untaken Precaution, Limited Information, and Efficient Standard Formation in the Civil Liability System', *International Review of Law and Economics*, 17, 15–29.
- Page, Talbot (1987), 'On Strict Liability: Reply to Hausman and to Schwartz', *Ethics*, 97, 817–20.
- Parisi, Francesco (1993), 'Learned Hand Formula of Negligence', *Digesto Civile*, 10, 436–43.
- Parisi, Francesco and Vincy Fon (2004), 'Comparative Causation', *American Law and Economics Review*, 6, 345–68.
- Perry, Stephen R. (1988), 'The Impossibility of General Strict Liability', *Canadian Journal of Law and Jurisprudence*, 1, 147–71.
- Polinsky, A. Mitchell (1980), 'Strict Liability vs. Negligence in a Market Setting', *American Economic Review. Papers and Proceedings*, 70(2), 363–7.
- Polinsky, A. Mitchell and Steven Shavell (2007), 'The Theory of Public Enforcement of Law', in A. Mitchell Polinsky and Steven Shavell (eds), *Handbook of Law and Economics*, Amsterdam: Elsevier, pp. 403–54.
- Posner, Richard A. (1972), 'A Theory of Negligence', *Journal of Legal Studies*, 1, 29–96.
- Posner, Richard A. (1973), 'Strict Liability: A Comment', *Journal of Legal Studies*, 2, 205–21.
- Posner, Richard A. (1979), 'Epstein's Tort Theory: A Critique', *Journal of Legal Studies*, 8, 457–75.
- Posner, Richard A. (2005), 'The Supreme Court, 2004 Term – Foreword: A Political Court', *Harvard Law Review*, 119, 31–102.
- Posner, Richard A. (2007), *Economic Analysis of Law*, 7th edition, New York: Aspen.
- Priest, George L. (1991), 'The Modern Expansion of Tort Liability: Its Sources, its Effects, and its Reform', *Journal of Economic Perspectives*, 5(3), 31–50.
- Rabin, Robert L. (1981), 'The Historical Development of the Fault Principle: A Reinterpretation', *Georgia Law Review*, 15, 925 ff. Reprinted in Robert L. Rabin (ed.) (1983), *Perspectives on Tort Law*, Boston: Little Brown, pp. 44–70.
- Ramseyer, J. Mark and Nakazato Minoru (1989), 'The Rational Litigant: Settlement Amounts and Verdict Rates in Japan', *Journal of Legal Studies*, 18, 263 ff.

- Rizzo, Mario J. (1980), 'Law amid Flux: The Economics of Negligence and Strict Liability in Tort', *Journal of Legal Studies*, 9, 291–318.
- Rose-Ackerman, Susan (1989), 'Dikes, Dams, and Vicious Hogs: Entitlement and Efficiency in Tort Law', *Journal of Legal Studies*, 18, 25–50.
- Rosenberg, David (2007), 'The Judicial Posner on Negligence versus Strict Liability: Indiana Harbor Belt Railroad Co. v. American Cyanamid Co', *Harvard Law Review*, 120, 1210–22.
- Rubinfeld, Daniel L. (1987), 'The Efficiency of Comparative Negligence', *Journal of Legal Studies*, 16, 375–94.
- Sappington, David (1983), 'Limited Liability Contracts between Principal and Agent', *Journal of Economic Theory*, 29, 1–21.
- Schäfer, Hans-Bernd (2004), 'Efficient Third Party Liability of Auditors in Tort Law and Contract Law', *Supreme Court Economic Review*, 12, 181–209.
- Schäfer, Hans-Bernd and Claus Ott (1986), 'Begründung und Bemessung des Schadensersatzes wegen entgangener Sachnutzung (Foundation and Rating of the Compensation for Damage Because of Lost Utility of Property)', *Zeitschrift für Wirtschaftsrecht*, 7, 613–24.
- Schäfer, Hans-Bernd and Claus Ott (2004), *The Economic Analysis of Civil Law*, Cheltenham, UK and Northampton, MA: Edward Elgar.
- Schäfer, Hans-Bernd and Claus Ott (2005), *Lehrbuch der ökonomischen Analyse des Zivilrechts* (Textbook on Economic Analysis of Civil Law), 4th edition, Heidelberg: Springer.
- Schwartz, Gary T. (1981), 'Tort Law and the Economy in Nineteenth-Century America: A Reinterpretation', *Yale Law Journal*, 90, 1717–75.
- Schwartz, Gary T. (1989), 'Objective and Subjective Standards of Negligence: Defining the Reasonable Person to Induce Optimal Care and Optimal Populations of Injurers and Victims', *Georgetown Law Journal*, 78, 241–79.
- Schwartz, Gary T. (1992), 'The Beginning and the Possible End of the Rise of Modern American Tort Law', *Georgia Law Review*, 26, 601–702.
- Schwartz, Gary T. (1993), 'Waste, Fraud, and Abuse in Workers' Compensation: the Recent California Experience', *Maryland Law Review*, 52, 983–1015.
- Schwartz, Gary T. (1996), 'Weaver v. Ward', *Texas Law Review*, 74, 1271–5.
- Schwartz, Warren F. (1988), 'Objective and Subjective Standards of Negligence: Defining the Reasonable Person to Induce Optimal Care and Optimal Populations of Injurers and Victims', *Georgetown Law Journal*, 76, 241 ff.
- Shavell, Steven (1980), 'Strict Liability versus Negligence', *Journal of Legal Studies*, 9, 1–25.
- Shavell, Steven (1987), *Economic Analysis of Accident Law*, Cambridge, MA: Harvard University Press.
- Shavell, Steven (2004), *Foundations of Economic Analysis of Law*, Cambridge, MA and London: Harvard University Press, Belknap Press.
- Shavell, Steven (2007), 'Liability for Accidents', in A. Mitchell Polinsky and Steven Shavell (eds), *Handbook of Law and Economics*, Amsterdam: Elsevier, pp. 139–82.
- Simon, Marilyn J., Robert G. Wolf and Jeffrey M. Perloff (1985), 'Product Safety, Liability Rules and Retailer Bankruptcy', *Southern Economic Journal*, 51, 1130–41.
- Singh, Ram (2007), '"Causation-consistent" Liability, Economic Efficiency and the Law of Torts', *International Review of Law and Economics*, 27, 179–203.
- Sloan, Frank A., Bridget A. Reilly and Christoph M. Schenzler (1995), 'Effects of Tort Liability and Insurance on Heavy Drinking and Drinking and Driving', *Journal of Law and Economics*, 38, 49–77.
- Smith, Steven D. (1984), 'Rhetoric and Rationality in the Law of Negligence', *Minnesota Law Review*, 69, 277–323.
- Stout, Lynn A. and David D. Barnes (1992), *Economic Analysis of Tort Law*, St Paul, MN: West Publishing.
- Teitelbaum, Joshua C. (2007), 'A Unilateral Accident Model under Ambiguity', *Journal of Legal Studies*, 36, 431–77.
- Trimarchi, Pietro (1961), *Rischio e Responsabilità Oggettiva* (Risk and Strict Liability), Milano: Giuffrè.

- Tullock, Gordon (1981), 'Negligence Again', *International Review of Law and Economics*, 1, 51 ff.
- Vandall, Frank J. (1983), 'Applying Strict Liability to Professionals: Economic and Legal Analysis', *Indiana Law Journal*, 59, 25–64.
- Vandall, Frank J. (1986), 'Judge Posner's Negligence-Efficiency Theory: A Critique', *Emory Law Journal*, 35, 383–418.
- van Egteren, Henry and R. Todd Smith (2002), 'Environmental Regulations under Simple Negligence or Strict Liability', *Environmental and Resource Economics*, 21, 369–96.
- Versteeg, John C. (1974), 'Strict Liability and Judicial Resources', *Journal of Legal Studies*, 3, 217–48.
- Von Hippel, Eike (1978), 'Prevention of Accidents and Compensation of Accident Victims', in Göran Skogh (ed.), *Law and Economics. Report from a Symposium in Lund*, Lund: Juridiska Föreningen, pp. 211–21.
- Von Randow, Philipp and Klaus Wehrt (1989), 'Comment: New Technologies, Liability Rules and Adaptive Behaviour', in Michael Faure and Roger Van den Bergh (eds), *Essays in Law and Economics. Corporations, Accident Prevention and Compensation for Losses*, Antwerpen: Maklu, pp. 107–16.
- Wetzstein, Michael E. and Terence J. Centner (1992), 'Regulating Agricultural Contamination of Groundwater through Strict Liability and Negligence Legislation', *Journal of Environmental Economics and Management*, 22, 1–11.
- White, Michelle J. (1989), 'An Empirical Test of the Comparative and Contributory Negligence Rules in Accident Law', *Rand Journal of Economics*, 20, 308–30.
- Witt, Robert C. and Jorge Urrutia (1983), 'A Comparative Economic Analysis of Tort Liability and No-Fault Compensation Systems in Automobile Insurance', *Journal of Risk and Insurance*, 50, 631–69.
- Wittman, Donald A. (1986), 'The Price of Negligence under Differing Liability Rules', *Journal of Law and Economics*, 29, 151–63.
- Zwier, Paul J. (1985), 'The Consequentialist/Nonconsequentialist Ethical Distinction: A Tool for the Formal Appraisal of Traditional Negligence and Economic Tort Analysis', *Boston College Law Review*, 26, 905–44.

Other references

- Baumol, William J. and Wallace E. Oates (1988), *The Theory of Environmental Policy*, Cambridge: Cambridge University Press.
- Chateauneuf, Alain, Jürgen Eichberger and Simon Grant (2007), 'Choice under Uncertainty with the Best and Worst in Mind: Neo-additive Capacities', *Journal of Economic Theory*, 137, 538–67.
- Coase, Ronald H. (1960), 'The Problem of Social Cost', *Journal of Law and Economics*, 3, 1–44.
- Dari-Mattiacci, Giuseppe and Hans-Bernd Schäfer (2007), 'The Core of Pure Economic Loss', *International Review of Law and Economics*, 27, 8–28.
- Gigerenzer, Gerd (2005), 'Is the Mind Irrational or Ecologically Rational?', in Francesco Parisi and Vernon L. Smith (eds), *The Law and Economics of Irrational Behavior*, Stanford, CA: Stanford University Press, pp. 37–67.
- Glaeser, Edward L. and Andrei Shleifer (2003), 'The Rise of the Regulatory State', *Journal of Economic Literature*, 41, 401–25.
- Guppy, Andrew (1993), 'Subjective Probability of Accident and Apprehension in Relation to Self – Other Bias, Age, and Reported Behaviour', *Accident Analysis and Prevention*, 25, 375–82.
- Jolls, Christine, Cass R. Sunstein and Richard Thaler (1998), 'A Behavioural Approach to Law and Economics', *Stanford Law Review*, 50, 1471–550.
- Keeton, W.P. et al. (1984), *Prosser and Keeton on Torts*, St Paul: West Publishing Company.
- Sunstein, Cass R. (1997), 'Behavioral Analysis of Law', *University of Chicago Law Review*, 64, 1175–95.

Weinstein, Neil D. (1989), 'Optimistic Biases about Personal Risks', *Science*, 246, 1232–3.
Zweigert, Konrad and Hein Kötz (1996), *Einführung in die Rechtsvergleichung*, Amsterdam:
North-Holland.

Cases

United States v. Carroll Towing Co., 159 F.2d 169 (2nd Cir. 1947).

2 Contributory and comparative negligence in the law and economics literature

*Mireia Artigot i Golobardes and
Fernando Gómez Pomar**

2.1 Introduction

This chapter reviews the literature on two different and important rules within the universe of negligence law, namely contributory and comparative negligence, and discusses their efficiency properties in inducing care and minimizing the costs of accidents.

The chapter is structured as follows. The first part of the chapter introduces the differences between contributory and comparative negligence, and the judicial evolution of the application of those rules in the United States and Europe.

The second part reviews the law and economics literature on contributory and comparative negligence. This literature has gone through four major phases. In the first phase, contributory negligence was considered the efficient rule because it was believed to create efficient incentives for parties to adopt efficient care, mainly in a setting in which a least cost avoider was assumed to exist. In the second phase, it was shown that under perfect information both rules were equivalent from an efficiency perspective. However, once some of the assumptions were relaxed, the equivalence between both rules did not hold. Hence, in this third phase, the discussion has focused on the assumptions and the performance of both rules that seem to favor comparative negligence.

Today, though, discussion on the relative efficiency properties is more parsimonious in terms of a global advantage, and skepticism prevails about deciding which rule is preferred.

This chapter navigates the different phases of this literature and presents the most important articles that have contributed to the discussion, and their major criticisms. Still, there is a lot to be said on comparative and contributory negligence from an economic viewpoint.

* Universitat Pompeu Fabra.

2.2 The world of negligence

Negligence law assigns liability for harm caused by conduct that breaches a given standard of care. The standard of care is set by the law, and it serves to guide the legal consequences of accidents. In so doing, it also guides the conduct of anyone considering the precautions necessary to avoid future liability for their actions. If an actor unintentionally causes harm but has complied with the applicable standard of care, negligence law ensures that this actor will not be liable and that the injured party (or someone else) will instead bear the costs of the injury. If, on the other hand, the actor has breached the applicable standard of care, then the actor will bear the costs of the injury and the injured party will be compensated¹ (Grady, 1983; Kahan, 1989).

In setting the standard of care, negligence law recognizes that not all injuries are worth preventing. In many instances, the standard of care is relatively low because a more demanding standard may be viewed as impossible to achieve or economically impractical. The first formal legal definition of how the standard of care should be optimally set came from Judge Learned Hand in *United States v. Carroll Towing Co.*² In that case, Judge Hand set the standard of care based on the interaction of three parameters: the probability of an accident, the cost of the accident, and the cost of adopting the care necessary to avoid the accident. He concluded that a party should be required to take care up to the point where the cost of such care becomes equal to or greater than the expected cost of the accident.³

The level of care (so calculated) may vary depending on the circumstances. Judge Hand's approach recognizes this variation, and requires an individual to take the level of care that a reasonable person would take under the circumstances, with the above parameters as a guide.⁴ While the meaning of 'reasonable person' may be open to debate, the combination of reasonableness considerations with Judge Hand's parameters fosters the emergence of an efficient standard of care – that is, a standard that minimizes the sum of the costs of care for both potential injurers and the expected costs of the accidents for potential victims.

¹ Under conventional approaches to causation in negligence law, the injurer's expected total cost function shows a discontinuous jump at the level of due care. An alternative approach, proposed by Grady, would make liability for negligence a continuous function based on the incremental difference between the harm that takes place with the injurer's actual level of care and the harm that would have taken place had the level of care taken by the injurer been the due care set by the rule.

² 159 F.2d 169 (2d Cir. 1947).

³ *Ibid.* at 173.

⁴ *Ibid.* at 174.

Judge Hand's formula has been enormously influential. It has been adopted by the Restatement (Second) of Torts,⁵ and by numerous courts in the United States. It has been applied to hold negligent countless defendants, and it has guided countless potential defendants to invest in the care necessary to prevent any harm that has an expected cost that is greater than the cost of eliminating it.

Our discussion, so far, has been framed in a unilateral context. When only one party can take measures influencing expected accident costs, this party knows that by adopting the standard of care set by the law, she can avoid liability. Conversely, by falling short of the standard of care, this party may bear the costs of any harm she causes to others. Optimal negligence rules should result in compliance with the standard of care and in an efficient minimization of the costs of both care and accidents.

Those who are injured by accidents, however, also play a role in this scheme. The conduct of potential victims can influence both the probability and the severity of an accident.⁶ To create efficient negligence rules, we must therefore consider the incentives necessary to ensure that victims exercise an appropriate level of care as well. In other words, we must consider bilateral care models.

The two most important concepts in the bilateral care setting are contributory and comparative negligence. The rules surrounding these concepts are far from uniform, in either theory or application, and they have evolved over time in important ways.

2.3 Contributory and comparative negligence: concepts and evolution

2.3.1 Contributory negligence: origin, development and later trend towards comparative negligence

In the legal systems that apply it, contributory negligence is generally a defense that may be asserted in a negligence action to bar an injured plaintiff from obtaining compensation for harm proximately caused by his own negligence,⁷ regardless of whether and to what extent this harm was also caused by the defendant's negligence. In other words, if the plaintiff's

⁵ § 291 (1968).

⁶ Indeed, Judge Hand's famous rule in *Carroll v. Towing* was actually laid out in the context of the injured party's role in causing the harm for which it sought compensation. See 159 F.2d at 173–4.

⁷ The Restatement (Second) of Torts – s 463 (1965) – defines such negligence on the part of the plaintiff as a 'conduct on the part of the plaintiff which falls below the standard to which he should conform for his own protection, and which is a legally

negligence played any role in causing the harm for which he seeks compensation, no matter how slight this role was in comparison to the role of the defendant's negligence, the contributory negligence defense entirely absolves the defendant from liability. Contributory negligence is thus an all-or-nothing approach.

The seminal case establishing a contributory negligence rule is *Butterfield v. Forrester*, decided by the English Court of King's Bench in 1809.⁸ In this case, the plaintiff had ridden a horse very quickly down a public road and collided with a pole placed in the road by the defendant, who was making repairs on his house. When the plaintiff sought compensation for his resulting injuries, the court denied the claim on the ground that he had been riding too fast to see and avoid the obstruction. In other words, he was barred redress because his own negligence had contributed to his harm.⁹

Almost five decades later, the US Supreme Court introduced the concept of contributory negligence to the American legal system in *Brown v. Kendall*.¹⁰ The concept quickly spread to other courts in the United States as a judge-made rule and became, for a time, the generally accepted approach to bilateral negligence law in that country. Some early economic literature even claimed that contributory negligence played a critical role in furthering efficiency, by encouraging potential victims to take precautions against harm to themselves (Landes and Posner, 1987).

Contributory negligence, however, came to be criticized on several grounds. It was deemed unfair for making one party bear an entire loss even when that loss was caused in part by others.¹¹ Worse, the rule treated negligent defendants significantly better than negligent plaintiffs. While a negligent plaintiff would always be required to bear the full cost of an injury partially caused by him, a negligent defendant would never be required to bear any of the cost of any injury partially caused by him.

contributing cause co-operating with the negligence of the defendant in bringing about the plaintiff's harm'.

⁸ 103 Eng. Rep. 926 (Court of King's Bench 1809).

⁹ Lord Ellenborough, the presiding judge, explained: 'One person being in fault will not dispense with another's using ordinary care for himself. Two things must concur to support this action, an obstruction in the road by the fault of the defendant, and no want of ordinary care to avoid it on the part of the plaintiff'.

Likewise, Judge Bayley stated: 'The plaintiff was proved to be riding as fast as his horse could go, and this was through the streets of Derby. If he had used ordinary care he must have seen the obstruction; so that the accident appeared to happen entirely from his own fault'.

¹⁰ 60 Mass. (6 Cush.) 292, 296 (1850).

¹¹ See Keeton et al. (5th ed. 1984 and Supp. 1988), 468–9 (describing contributory negligence as unfair, inherently unjust and inequitable in its operation).

Another criticism was that, given its harshness, it could backfire and result in too few findings of defendants' negligence, and thus become ineffective. The fear was that jurors would be uncomfortable with the rule, regardless of whether it was the law, and would try to avoid applying it: juries would end up finding plaintiffs at fault less often, resulting in defendants being held liable more often or would award the plaintiff damages even when there was evidence of his negligence (Best, 2007; there is evidence of compensation in the context of automobile accidents even where both parties were negligent. See Sloan, Reilly and Schenzler, 1995).

In light of the perceived unfairness and harshness of contributory negligence, courts developed mechanisms that aimed to make the rule more equitable (one of the first steps in abandoning contributory negligence was in intentional tort cases. See Sudman, 1999).¹² These mechanisms, however, were, complex, and often very difficult and confusing for juries to apply (Gardner, 1996). Over time, courts in the United States created three major exceptions to the contributory negligence rule (Abraham, 2002): the safety statute exception, the greater degree of blame exception, and the last clear chance doctrine.¹³

The safety statute exception provided that a negligent plaintiff could recover, despite her negligence playing a role in the harm, if the defendant breached a statute designed to protect a class of persons unable to protect themselves against the type of negligence displayed by the defendant (Abraham, 2002). The greater degree of blame exception provided that a plaintiff's contributory negligence would not bar recovery when the defendant's conduct was intentional or reckless. Finally, the last clear chance doctrine provided that a plaintiff's contributory negligence would not bar recovery when the negligent defendant was in the position of having the last chance to avoid harming the plaintiff and failed to do so (Abraham, 2002).

These loopholes in the application of contributory negligence, together with a widely shared view that it was an unfair rule, ultimately led to a shift in the law. Legal systems began abandoning the contributory negligence rule, and replacing it with the doctrine that came to be known as comparative negligence, which shares the loss between the injurer and the victim in cases where both have been negligent (Best, 2007). (Under both

¹² For example, *Poole v. City of Rolling Meadows*, 1995 WL 480511(III), where the Illinois Supreme Court held that, when the claim was based on a willful and wanton misconduct the jury could not reduce the plaintiff's damages because of the plaintiff's contributory negligence if the defendant's willful and wanton misconduct had been intentional. Cited by Pham, 1995.

¹³ This doctrine was established by *Davies v. Mann*, 152 Eng. Rep. 588 (1842).

contributory and comparative negligence, of course, the victim will not receive compensation when only she is to blame for the injury.)

In Europe, the shift from contributory to comparative negligence predated that in the United States. Before, and in many places long before, the US shift, comparative negligence was the general rule in European tort law. It remains so today (Van Dam, 2006).

Just to give some illustrations, in France, comparative fault is based on the concept of the *faute de la victime* – the victim's fault – a doctrine developed by the courts without an explicit statutory basis. Under French law, consideration of the victim's fault can result in the victim receiving a lower amount of compensation, or can even leave her with no compensation at all, but only if the defendant can prove that the victim's conduct was the only cause of the damages (Van Dam, 2006).

In England, the shift was brought about by the Law Reform (Contributory Negligence) Act of 1945. England applies the traditional negligence standard of general negligence liability: the standard of the 'reasonable person' to the injurer's and to the victim's conduct (Van Dam, 2006; Von Bar, 2000).¹⁴

In Germany, under § 254 of the BGB (*Mitverschulden*), comparative negligence can be established whenever the claimant has acted negligently. The negligence test, which compares the victim's conduct with the conduct of a careful person of average circumspection and ability, is decisive – the test is included in § 276 (*Fahrlässigkeit*).

This shift occurred in the United States relatively quickly at the end of the 1960s and beginning of the 1970s. In 1968, all but seven states recognized the contributory negligence defense. By around 1974, comparative negligence, rather than contributory negligence, had become the majority rule, and it remains so today (Robinette and Sherland, 2003). Some states shifted to comparative negligence by statute, while others did so through the decisions of their highest courts. Since October 1989, only six US jurisdictions have continued to apply the traditional contributory negligence rule. These are Alabama, the District of Columbia, Maryland, North Carolina,¹⁵ South Carolina and Virginia (Little, 1989). Thus, in the vast majority of US states, the contributory negligence rule has been abandoned. In its place, states have adopted some version of the comparative

¹⁴ Section 4 of the Law Reform (Contributory Negligence) Act 1945 defines the claimant's fault as 'negligence, breach of statutory duty or other act or omission that gives rise to liability in tort or would, apart from this Act, give rise to the defence of contributory negligence'.

¹⁵ Contributory negligence is still the common-law doctrine in force in North Carolina. But some defend the adoption of comparative negligence instead. See Gardner (1996).

negligence rule, either pure or modified (as explained below) (Best, 2007), and none of these states has switched back. Under both rules, though, when only the victim is to blame, she will not be entitled to receive any compensation.

In the US, perhaps due to the speed of legal change in this matter, soon after the spread of the comparative negligence rule, the rule received a significant amount of criticism and questioning, both from a theoretical and from a more practical perspective.

2.3.2 *Comparative negligence: pure and modified forms*

Comparative negligence aims to apportion damages according to each party's negligence. It allows a negligent plaintiff to recover from a negligent defendant whose negligence is a proximate cause of the plaintiff's injuries, even if the plaintiff's negligence is also a proximate cause of his own injuries.

Based on the principle that when parties are at fault they should be responsible for the cost of any injuries suffered that were caused by their own fault, comparative negligence compares the fault attributable to the plaintiff to the fault attributable to the defendant and provides for a division or sharing of damages. Hence, a defendant is liable for the share of the damages caused by her fault even when the plaintiff is also negligent. The complexity of apportioning liability when there is multiple causation makes the application of this rule quite difficult (Singh, 2007).

There are two different forms of the comparative negligence rule: pure comparative negligence and modified comparative negligence.

The pure comparative negligence rule does not bar a plaintiff's recovery (so long as the defendant's negligence is at least partly to blame for the harm), and only reduces the amount of the claim in proportion to the plaintiff's own fault.¹⁶ Such allocation of damages between the injurer and the victim can be made by looking at each party's deviation from the standard of care and the marginal value that the trier of fact (whether this be judge or jury) places on these deviations (Rubinfeld, 1987). Under this pure version of the rule, the plaintiff may recover from a negligent defendant even when her own negligence is greater than that of the defendant.¹⁷

¹⁶ Restatement (Third) of Torts: Apportionment of Liability § 7 cmt. a (2000). Pure comparative negligence is the law in 11 US jurisdictions. See Robinette and Sherland (2003).

¹⁷ Since 1989 13 US states have applied this rule, six of which passed statutes regulating their comparative negligence rule and seven of which operate under a judicially established pure comparative negligence rule. See Little (1989).

The modified comparative negligence rule bars a negligent plaintiff's recovery when the plaintiff's fault exceeds a certain level in comparison to the defendant's fault; otherwise the rule functions as the pure form does in allocating damages between plaintiff and defendant based on the relative negligence exhibited by each. In other words, the plaintiff's compensation is reduced in proportion to her negligence as in the pure form, but she receives no recovery at all once her negligence reaches a certain proportion of the defendant's. Depending on the jurisdiction, the cut-off at which the plaintiff receives no compensation is generally based on either the '50 percent rule', the '49 percent rule', or the 'slight gross rule'.

The '50 percent rule' allows a negligent plaintiff to recover only if her fault is less than or equal to the defendant's.¹⁸ The '49 percent rule' allows a negligent plaintiff to recover only if her fault is less than the defendant's fault.¹⁹ Finally, the 'slight gross rule' allows a negligent plaintiff to recover only if her fault is considered 'slight' in comparison to the defendant's.²⁰ In all of these cases, if the plaintiff's fault is below the cut-off, then she will be able to recover damages that are reduced in proportion to the fault attributable to her.

As can be seen, the modified comparative negligence rule is, to some extent, a combination of pure comparative negligence and contributory negligence. Below a given threshold, modified comparative negligence functions like pure comparative negligence; above this threshold, it functions like contributory negligence. Consequently, once the threshold is exceeded, modified comparative negligence shares the properties of contributory negligence, including the placement of a higher burden on plaintiffs than on defendants (Best, 2007).

2.4 Incentives to take care

2.4.1 Initial literature: contributory negligence and the least-cost avoider

As noted above, the early law and economics literature on liability for accidents tended to paint contributory negligence as a more efficient rule than comparative negligence. The premise of this literature was that comparative negligence would result in excessive and wasted investments in care by both potential victims and potential injurers (Posner, 1997). That may be so in certain circumstances.

¹⁸ Twenty-one states follow the 'not greater than' system. See Gardner (1996). See also Cooter and Ulen (1986).

¹⁹ Eleven states follow the 'less than' system. See Gardner (1996).

²⁰ This system was adopted by Nebraska, South Dakota and Tennessee, see Little (1989), but as of 2003 only South Dakota still applied it. See Robinette and Sherland (2003) stating the same.

This premise, however, is flawed if the costs or availability of care are different for each party. Under a unilateral care model, the injury can be avoided only by one party to begin with. Where that is the case, and where the legal system can determine who this party is,²¹ it should not matter whether a contributory or comparative negligence rule is employed.

Under bilateral care models, however, the difference between these two negligence rules becomes relevant (Faure, 2004). In one model, known as alternative care, either party can take the care necessary to avoid the injury regardless of the other party's care. Where one of these parties is the least-cost avoider – meaning that the costs of the care necessary to avoid the harm are lowest for this party – it is socially optimal to require only this party to adopt the care in question, and to set the other party's standard of care at zero (Haddock and Curran, 1985; Chung, 1993; Bar-Gill and Ben-Shahar, 2003). By structuring the standards of care in this way, double expenditure is avoided and the total cost of care is minimized (Shavell, 1987 discussing the simplifications of the least-cost avoider model of unilateral care). In a joint care model, both parties' actions simultaneously contribute to the accident and parties may avoid the accident by simultaneously adopting various levels of care. Here, an optimal liability regime would create incentives for each party to adopt a level of care that minimizes their total combined care expenditure.

The first scholar who formally discussed the differences in the economic performance of contributory and comparative negligence rules was John P. Brown in 1973. Brown concluded that, in the general joint care setting, all liability rules except comparative negligence lead to economically efficient incentives that result in efficient outcomes (Brown, 1973).

Brown presented a simple model in which injurers, victims and courts are all assumed to know the legal standard of care and everyone's precautions. The efficient level of care cannot be achieved by common law tort rules unless courts have enough information to set the legal standard at an efficient level.

The due care standard in Brown's model is a variable dependent on two parameters: the level of care taken by plaintiffs and by defendants. Therefore, the finding of one party's negligence depends on the level of care adopted by the other party. The social optimal outcome aims to minimize the aggregate cost of care of plaintiffs and defendants. Mathematically,

$$\text{Min } C_s(X, Y) = W_x X + W_y Y + A[1 - P(X, Y)]$$

x, y

²¹ See, below, on the circumstances under which this assumption is relaxed, text and accompanying note.

where X and Y are the levels of care taken by the injurer and the victim, W_x and W_y are the unit cost of care, $Cs(X, Y)$ is the total social cost of care, A is the accident cost and $P(X, Y)$ ²² is the probability of an accident given the parties' level of care (Brown, 1973).

In the model, the parties decide to take the level of care that makes the marginal cost of caretaking (W_x and W_y) equal to its marginal benefit.²³ Given that courts know the level of care adopted by the parties to the accident, they would set the standard of care at the optimal level. Courts in the model consider a party negligent when the expected reduction in accident costs is higher than the cost of the increase in care necessary to achieve that reduction. Consequently, parties have incentives to take the optimal level of care given the other parties' level of care and given that the due care standard is set at the optimal level as well.

$$W_x = AP_x(X^*, Y_\Omega)$$

and

$$W_y = AP_y(X_\Omega, Y^*)$$

Applying this incremental standard, the negligence standard that minimizes the social cost is the same for the injurer and for the victim.

Hence, $X^* = X_\Omega$ and $Y^* = Y_\Omega$.

Given these assumptions, Brown showed that negligence rules are efficient and lead to a unique equilibrium since the injurer initially faces the full costs of his actions, and will therefore choose to comply with the standard of care.²⁴ Under those assumptions, Brown claimed, contributory negligence is efficient but comparative negligence is not (Brown, 1973). Under the latter rule, the costs of accidents are shared between injurer and victim, and thus

²² Regarding the characterization of the correlation of the level of care and the probability of an accident $P_x, P_y > 0$, Brown defined it as

$$P_{xx}, P_{yy} < 0$$

$$P_{xx}P_{yy} - P_{xy}^2 > 0$$

²³ The equality between the marginal cost of care and expected benefit from it can be represented by

$$W_x = AP_x(X, Y)$$

$$W_y = AP_y(X, Y)$$

²⁴ (X_Ω, Y_Ω) would be a unique solution.

neither of them bears the full costs of failing to take optimal care. Hence, since the accident cost falling on either party is reduced by the effect of the sharing rule, both parties may be induced to be less careful than is optimal.

Brown concluded that contributory negligence induces socially optimal levels of care by the population, so long as courts set the legal standard of care at the socially optimal level, because the negligent party faces full accident costs.

Shortly after Brown's analysis, Peter A. Diamond (1974) used a similar model to argue that comparative negligence is not inefficient *per se*, but that its efficiency depends on how the rule is structured. Diamond argued that a comparative negligence rule in the 50 percent version of the modified form cannot lead to economically efficient results in an error-free context (Diamond, 1974; Rubinfeld, 1987). He then introduced court errors and uncertainty in court behavior into a model where parties expect to bear some fraction of the costs of others to match the fraction of their costs borne by others and believe that by increasing the amount of care they adopt, the fraction of total costs borne will decrease. Diamond concluded that when care affects the probability of an accident but not its costs, the equilibrium will not tend to comparative negligence, but will instead tend to no-liability, as care differences decrease the importance of cost allocation (Diamond, 1974). Hence, he illustrated the inefficiency of comparative negligence while at the same time showing that contributory negligence induces parties to take levels of care that minimize total accident costs.

Richard Posner also argued in favor of contributory negligence, though based on somewhat different theoretical perspectives and reasons. In an alternative care setting with perfect information by parties and courts, Posner argued that the least-cost avoider should be the one adopting care. Otherwise, the result would not be optimal.

Posner's analysis concludes that contributory negligence is the optimal negligence rule because it encourages only the least-cost avoider to adopt care instead of creating incentives for both parties to take care (Posner, 1977). This line of argument has two flaws, however. First, it only holds when the victim is the least-cost avoider; where the injurer is the least-cost avoider, the contributory negligence rule inefficiently encourages the victim to adopt care anyway in order to avoid being barred from recovery. Second, and more importantly, where courts have perfect information and can determine that one party is the least-cost avoider, courts can preserve incentives for optimal efficiency by simply setting the standard of care for the other party to zero, regardless of whether they are operating under a contributory or comparative negligence rule.

In fact, it has since been shown that when courts – or other relevant decision-makers – do not have perfect information on the costs of care for

each party, comparative negligence may be the most efficient rule under both bilateral and unilateral care models. Giuseppe Dari-Mattiacci and Gerrit De Geest, for instance, show how in a scenario of unilateral care, in which courts cannot verify who is the most efficient caretaker, sharing rules such as comparative negligence filter the most undesirable instances of harm. Avoidable accidents will happen under comparative negligence as well as contributory negligence rules, but those that happen under comparative negligence rules will be less costly in net social terms. In an alternative care scenario with imperfect court verifiability, the advantage of sharing rules like comparative negligence, though less general, may still hold when avoidance costs significantly exceed the harmful consequences of the accident (Dari-Mattiacci and De Geest, 2005).

Posner argued in favor of contributory negligence on other grounds as well, namely administrative and litigation costs. Comparative negligence involves a transfer payment that entails administrative costs, and also involves additional litigation, given that this is necessary to determine the relative negligence of each party involved in the accident. Therefore, additional resources are spent in determining and predicting the extent of liability of each party (Posner, 1997). At the same time, however, he acknowledged comparative negligence may be justified, despite being more expensive, if the social objective of the tort system is to provide insurance to accident victims: careless victims of careless injurers receive some compensation under comparative negligence, while under contributory negligence those same victims receive nothing (Posner, 1997).

Not too long after Brown, Professor Gary Schwartz discussed the contributory and comparative negligence rules, and challenged the safety incentive argument provided up to that moment in support of the contributory negligence rule (Schwartz, 1978). Schwartz raised four different arguments in support of his claim: the difficulty of designing an optimal contributory negligence rule;²⁵ the relatively limited effects of such a rule;²⁶ the psychological characteristics of the conduct that the law considered

²⁵ Schwartz argued that the contributory negligence rule should only bar the plaintiff's recovery when the plaintiff's prevention costs were lower than the defendant's and suggested that when the cheapest means of prevention were independent instead of complementary, comparative negligence could sometimes perform better than a contributory negligence rule. But such performance of comparative negligence was only fortuitous. See Schwartz (1978).

²⁶ Ibid. Schwartz considered that given the personal costs of litigation, the limits of tort law's damage rules on individuals' behavior and the inability of individuals to predict a liable defendant, any potential victim would have incentives to behave carefully and behave non-negligently. Schwartz (1978).

unreasonably risky;²⁷ and finally, the opportunities that such a rule created for defendants who had to prevent the contributory negligent conduct of potential plaintiffs.²⁸

In addition to these arguments, Schwartz emphasized another issue that has since been raised as an argument against contributory negligence and in favor of comparative negligence: barring the plaintiff's recovery despite both parties' negligence means that the negligence of both defendant and plaintiff are treated as if they were equivalent. So, if the injurer is negligent and the victim is also negligent, both deviations from the due care standard are being treated in a symmetric way despite the victim's being the one injured. It is especially this last argument that makes Schwartz consider comparative negligence as the proper rule (Schwartz, 1978).

In general, the early literature failed to notice that, under perfect information, negligence, contributory negligence, and comparative negligence create efficient incentives for care and an efficient equilibrium outcome as long as the legal standard of care set by the negligence rule is set at the socially efficient level, and parties rationally respond to it (Kim, 2004).

2.4.2 *Haddock and Curran and Shavell: the equivalence between contributory and comparative negligence*

The initial preference in the literature for contributory negligence was challenged in the mid-1980s by David Haddock and Christopher Curran (1985) and by Steven Shavell (1987). These scholars demonstrated that under conditions of perfect information both rules give injurers and victims incentives to take efficient care.

Under both negligence rules, the injurer can avoid liability by adopting the due level of care, and he therefore has an incentive to do so. Given that the injurer will expect to bear the residual loss – either all the harm suffered by the victim or a share of it, depending on the negligence rule – he will internalize all the benefit of adopting the standard of care set by the negligence rule because he will save the liability costs arising from the accident (Shavell, 1987).

The result is that contributory and comparative negligence rules produce the same incentives for both parties to adopt the due care level and therefore, as long as this care level is set at the optimal level, injurers and victims are expected to behave efficiently under either rule.

²⁷ Schwartz in this paper claimed that prevention sometimes might be less a matter of tort law and economics theory and more one of applied psychology and knowledge of individuals' conducts. Schwartz (1978).

²⁸ In some circumstances, the plaintiff's unreasonable conduct could effectively be prevented by the defendant who may even be better able than the plaintiff to prevent such negligent conduct. Schwartz (1978).

Haddock and Curran, using the same model as Brown, showed the same result as Brown. They pointed out that under both rules, if the two parties are exercising due care, neither has an incentive to deviate from that level of care, and if neither party is exercising due care, both are induced to converge on the due care level. Thus, in terms of the pure incentives for care, there is no reason to choose one rule over the other.

Shavell introduced a new element into the analysis: activity levels. But this new element did not modify the main conclusion of his model, that is, that neither of the negligence rules seemed to be generally preferable to the other. This equivalence, even when considering activity levels, can be explained by the parties' behavior under each negligence rule. The injurer will not have the incentive to adopt the optimal level of activity because he will avoid being held liable by adopting the due care level regardless of his level of activity but the victim, as the residual bearer, will have an incentive to adopt the optimal activity level. Thus, a consideration of activity levels does not establish a preference for either of the negligence rules.

Shavell did distinguish between the two rules, but not based on deterrence. Instead, Shavell looked at other considerations such as the administrative cost and risk-spreading properties of the rules. Administrative cost considerations favor contributory negligence, because it is cheaper to implement. Risk-spreading properties, on the other hand, favor comparative negligence.

2.4.3 Relaxing some of the initial assumptions and moving away from first-best analysis

2.4.3.1 Evidentiary uncertainty and court error The equivalence of contributory and comparative negligence above is based on the assumption of a perfectly functioning liability system. During the 1980s, in parallel with the increased modeling of imperfections in the operation of tort liability in general, more realistic models began to be used to assess the relative desirability of contributory and comparative negligence. The results favoring comparative negligence as an efficient rule quickly spread.

Haddock and Curran (1985) and Cooter and Ulen (1986) challenged the first wave of law and economics literature on the issue, arguing that when uncertainty is introduced, comparative negligence may be the more efficient rule. They showed that comparative negligence leads to economically efficient incentives for both parties to take care.²⁹

²⁹ However, White showed that if the due care level is assumed to be stochastic, any level of care that would be high enough so that it would allow injurers to be

In the new literature, court errors were initially modeled as the inability of a court to assess the level of care actually taken by a party. The introduction of such a complicating feature is of crucial importance for the analysis: if parties know that courts may not be able to adequately verify their levels of care, they may have incentives to behave suboptimally.

Haddock and Curran started with the equivalence result in the perfect information setting, and its corollary, that rationally self-interested parties would not choose to be negligent, and would exactly comply with the legal standard of care, assumed to be set optimally (Haddock and Curran, 1985). They then explained how things become different once error is introduced into this analysis. They considered the possibility that either one of the parties involved in the accident or the factfinder (jury or judge) makes a mistake – either because the injurer or the victim miscalculate the amount of precaution required or because the victim or the injurer does not know the true relationship between their precaution and the probability of an accident.³⁰ Formally, however, Haddock and Curran only fully analyzed evidentiary uncertainty – the possibility of the factfinder making *ex post* errors in assessing the true level of care adopted by a party.

With the introduction of this type of error, the efficiency of an all-or-nothing rule like contributory negligence is seriously weakened (Haddock and Curran, 1985). Admittedly, none of the other negligence rules induces efficient caretaking under these conditions either, which makes the choice among them unclear (Haddock and Curran, 1985). Haddock and Curran argued that to play with the level of due care to counteract the effects of evidentiary error would not be feasible, given that the errors would be different across courts and juries. For that reason, different standards of care would have to be applied to injurers by different juries or courts, and the deviations would have to be correlated with the underlying propensity of a jury or court to err, which seems highly unrealistic for legal standards of care (Haddock and Curran, 1985).

Haddock and Curran, however, assumed that contributory or comparative negligence rules take as given what the optimal standards of care should be, and that these standards are the same under both rules (Haddock and Curran, 1985). This is not the way to design optimal legal standards. Given

reasonably certain that they would avoid liability would be unattractive for them. Under this condition, victims will not be able to guarantee that injurers will bear the full amount of their damages. Consequently, the domination of the economically efficient level of care over other care levels is not straightforward. See White (1989).

³⁰ Parties would not know the relationship between X (care taken by the injurer), Y (care taken by the victim) and $P(X, Y)$ (the probability of an accident). See Haddock and Curran (1985).

that the differences between contributory and comparative negligence arise only when the defendant has been negligent (otherwise, both rules establish that the plaintiff bears the entire loss), the legal standards for the plaintiff should be optimally set assuming the defendant's negligence. When this is considered, it becomes clear that the standards should be set at different levels depending on whether contributory or comparative negligence rules are being employed. The comparative negligence rule, with its cost-sharing property, provides only a partial incentive because of the sharing property of the rule and so requires a higher level of care for the plaintiff. This result holds under evidentiary uncertainty – which is one of the main reasons why we can expect the defendant to be negligent (Edlin, 1994).

Cooter and Ulen argued for comparative negligence along similar lines. In a well-known paper (Cooter and Ulen, 1986), they compared the efficiency of contributory and comparative negligence rules when courts cannot observe or assess each party's care level. They concluded that comparative negligence is superior to other negligence rules because parties internalize *ex ante* the possibility of court error and deviate from the legal standard by adopting a level of care higher than the level set by the legal rule (Cooter and Ulen, 1986). They demonstrate this with a graph (see Figure 2.1) where x^* is the optimal level of care, L is the cost of precaution and H is the expected total cost of accidents.

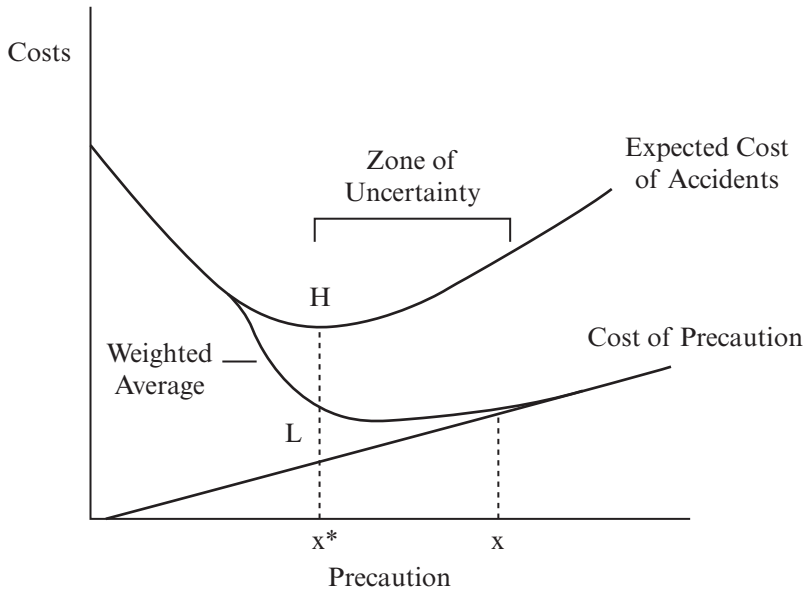


Figure 2.1 Accident costs under evidentiary uncertainty

Table 2.1 Injurer's incentives for precaution

Strong			Weak	
Simple Negligence	Pure Comparative Negligence	Modified Comparative Negligence	Slight/Gross Comparative Negligence	Contributory Negligence

Table 2.2 Victim's incentives for precaution

Strong			Weak	
Contributory Negligence	Slight/Gross Comparative Negligence	Modified Comparative Negligence	Pure Comparative Negligence	Simple Negligence

When there is evidentiary uncertainty, instead of a radical drop at x^* (the optimal level of care) between H and L , as occurs under full information, Cooter and Ulen argue that one would expect a continuous change of the function between H and L at x^* represented by the weighted average costs. Given this expected cost function, individuals will not choose the legal standard of due care x^* but a higher level of care (Cooter and Ulen, 1986).

The potential injurer's incentive to take a higher level of care will depend on the negligence rule in place, and his forecast of the victim's level of care, which in turn will depend on the level of care the victim anticipates the injurer will take. The injurer, thus, will have less incentive to take care under contributory negligence than under comparative negligence. The incentives of care of the different parties are summarized by Cooter and Ulen as follows (Cooter and Ulen, 1986).

As can be seen, the victim's incentives of care mirror the injurer's, but in reverse: the victim's incentives are strong when the injurer's incentives are weak and vice-versa. Comparative negligence then gives moderate incentives to deviate from the standard of care to both injurers and victims while contributory negligence gives the strongest incentives to one party and the weakest incentives to the other.

Thus, Cooter and Ulen argue that the distortion would be minimized when parties share liability because they know they would eventually be burdened with a share of the liability the court would determine (Cooter and Ulen, 1986). The implicit assumption by Cooter and Ulen is that small symmetric intermediate deviations by both the injurer and the victim are more socially desirable than the sum of potentially large deviations by

one party and small deviations by the other that could take place under contributory negligence.³¹ This makes comparative negligence the most efficient rule under conditions of evidentiary uncertainty because it minimizes the total amount of deviation from the standard of care when parties are symmetrically situated.

The symmetry assumption, however, does not necessarily hold, and it may depend on the type of accident. Symmetry may be a reasonable assumption in a collision between automobile drivers, where it is relatively simple to determine the relative negligence of the parties. But this is not so in other tort contexts, such as products liability. As the ability to determine relative negligence breaks down, so too does the reasonableness of the symmetry assumption (Wittman, Friedman, Crevier and Braskin, 1997).

In 1991, Daniel Orr followed this logic in searching for second-best outcomes in this area (Orr, 1991). With a game-theoretic model, he showed that the shift from contributory to comparative negligence has two positive effects. On one side, it improves the incentives for precaution and, on the other, it diminishes excess expenditure (Orr, 1991).

In Orr's model, A is the expected accident cost in the absence of effective precaution by either party, p is the precaution, which reduces the cost of accidents from A to pA and c is the cost of precautions. Orr developed a model where care was both unilateral (alternative) and binary. Unilateral care is a form of care equally effective whether provided by the injurer, the victim or both simultaneously. So if both parties take due care, there is excessive expenditure on care.³² He also assumed that care was binary. This means that it either exists or not. That is, it is a discrete variable with only two possible values: caution or negligence.³³

When care is assumed to be just unilateral, it is of course efficient to put the burden to take care on the least-cost avoider; whenever the least-cost avoider is identified in advance, the other party should never take care. This result is well known in the literature as an efficient outcome. In his model, Orr assumed that care is both unilateral and binary whereby neither party can predict the level of care taken by the other and therefore cannot predict whether the court would decide this party was negligent.

³¹ This conclusion was endorsed by other authors who reached the same conclusion in different negligence contexts and with parties deciding their level of care sequentially or simultaneously. See Rea (1987).

³² This definition of unilateral care is equivalent to the traditional definition of alternative care. However, in the second part of Orr's paper, care is assumed to be interactive, meaning that parties are taking joint care.

³³ This is the terminology that Orr uses to define the adoption of care or no care by the parties. See Orr (1991).

		Injurer (R)	
		Caution	Negligence
Victim (E)	Caution	$pA + c$ c	c pA
	Negligence	pA c	γA $(1 - \gamma) A$

Figure 2.2 *Alternative and binary care with parties sharing accident costs*

By introducing this uncertainty, Orr predicted that parties will take a positive amount of care because they will not know whether they will be considered the least-cost avoider by the court and therefore whether they will be held to have had the duty to take care. Even though parties do not have pure strategies and therefore the game has no Nash equilibrium, there is excessive expenditure on care.

Consequently, when care is unilateral (alternative) and binary, contributory negligence does not result in the equilibrium that minimizes costs because the injurer and the victim cannot contract and share the precaution costs in advance. This results in both parties adopting care, with an inefficiently high level of expenditure on precaution.

When the accident costs are shared among parties and γ is the share of the accident costs borne by the victim and $(1 - \gamma)$ is the remainder borne by the injurer, the result is quite different. γ is $0 < \gamma < 1$ and determined by the legal decision-maker.

In this case, the injurer has a pure strategy which is to take care no matter what the victim does, when $(1 - \gamma)A > c$ and also $pA > c$. But taking care will not be the optimal strategy for the victim because she will gain from being negligent given that $pA + c > pA$. Consequently, the Nash equilibrium that is efficient is the bottom left cell in Figure 2.2, where the injurer takes care and the victim is negligent.

Comparative negligence, with its *ex ante* known split of damages, may induce precaution by the potential injurer only, eliminating wasteful double or excess precaution, as results from contributory negligence (Orr, 1991).

Further, Orr argued that when the split of damages is stipulated appropriately in advance, it induces efficient precaution in any instance.

Hence, comparative negligence is more efficient than the other negligence rules.³⁴

Orr's analysis was later criticized by Tai-Yeong Chung on a number of grounds (Chung, 1993). First, Chung holds that Orr's terminology of 'caution' versus 'negligence' is misleading because it is the courts that decide whether a party is negligent. Instead, Chung suggested that the binary choices should be defined more simply as taking a precaution versus taking no precaution. Orr had defined negligence as the failure to take care when there is a duty to do so, but Chung pointed out that when no such duty is required, taking no care does not result in being negligent and understood that Orr implicitly assumed that the legal standard of care was set at an inefficient level contrary to Orr's statement of having assumed exactly the opposite (Chung, 1993).

Chung argued that Orr's results were dependent on assuming that the standard of care is set at an inefficient level because if the standard is efficient, under unilateral care, both contributory and comparative negligence would result in the same efficient outcome.

Finally, Chung challenged Orr's argument in favor of comparative negligence in the case of interactive precaution by showing that the stronger incentives of comparative negligence over contributory negligence are not relevant given that both negligence rules reach the same efficient outcome. The only difference between them is which party has the dominant strategy to take care. While contributory negligence makes care the dominant strategy for the victim, comparative negligence makes it the dominant strategy for the injurer (Chung, 1993).

Recently, the advantage of comparative negligence in settings with evidentiary uncertainty has been seriously challenged by Oren Bar-Gill and Omri Ben-Shahar in a joint paper (Bar-Gill and Ben-Shahar, 2003). Their challenge focuses, first, on the assumption that parties are 'symmetrically situated' when adopting care. In fact, Bar-Gill and Ben-Shahar argue, this need not be so, given that one party could be better situated to adopt care.³⁵

³⁴ However, Orr also argued that when the technology of care was interactive – in the case of joint care – the argument in favor of comparative negligence was weakened because the Nash equilibrium was the choice of precaution by both players. Orr (1991).

³⁵ The constant sum hypothesis assumed by Cooter and Ulen asserted that the sum of the biases – in the injurer's care level and the victim's care level – was constant across the three liability rules: negligence, negligence with a contributory negligence defense and comparative negligence.

$$|x^{SN} - x^*| + |y^{SN} - y^*| = |x^{CnN} - x^*| + |y^{CnN} - y^*| = |x^{CmN} - x^*| + |y^{CmN} - y^*|$$

When that happens, the sum of the biases induced by the rules under judicial error in determining levels of care need not be constant. In other words, the constant sum hypothesis underlying the Cooter and Ulen ordering of rules does not hold. Bar-Gill and Ben-Shahar also challenge the assumption that both the injurer and the victim, in a setting of evidentiary uncertainty, exercise excessive care under the negligence rules considered.³⁶

Bar-Gill, in a previous paper (2001), had identified two types of judicial error: (1) the so-called evidentiary uncertainty that represents court errors in assessing a party's true level of care, and (2) courts' inaccuracy when applying negligence liability rules. These errors, Bar-Gill had argued, modified the conclusion regarding the preference for comparative negligence.

The introduction of evidentiary uncertainty, Bar-Gill and Ben-Shahar showed, does not make comparative negligence inefficient in all cases. For a standard deviation of the court's error of 30 percent of the optimal care level, the contributory negligence rule becomes optimal, but for a court error between 30 percent and 65 percent from the optimal care level, comparative negligence is inefficient and is efficient again for high levels of error exceeding 65 percent of the optimal level.³⁷

Moreover, these authors also insisted on a different avenue along which to question the preference for comparative negligence, one that had already been explored in earlier literature: contributory negligence might be cheaper to administer than comparative negligence (Bar-Gill, 2001).

In their joint paper, Bar-Gill and Ben-Shahar show, through computer simulations and numerical examples, that it is not necessarily true that small intermediate deviations should necessarily be preferred to large deviations potentially resulting from other liability rules. The superiority of intermediate biases strongly depends on the constant sum hypothesis, on the assumption that all deviations from the optimum are towards adopting excessive care. When one questions these assumptions, the superiority of comparative negligence ceases to be generally true. Consequently, Bar-Gill and Ben-Shahar conclude that comparative negligence is not generally a superior negligence rule.

2.4.3.2 *Stochastic due care and the losses of injurers and victims* Most analyses of liability rules and of the efficiency properties of contributory

Bar-Gill argued that this hypothesis was quite unrealistic, and under more realistic assumptions, symmetric biases were not generally true. See Bar-Gill (2001).

³⁶ Cooter and Ulen compared the negligence rule, negligence with a contributory negligence defense and comparative negligence. See Cooter and Ulen (1986).

³⁷ Bar-Gill (2001). This result was later reaffirmed in Bar-Gill and Ben-Shahar (2003).

and comparative negligence typically assume that the roles of injurer and victim are well-defined and separate, and that parties know in advance, before engaging in an activity and taking decisions concerning care, which role they would assume. There are, however, some analyses of the setting in which this assumption does not hold, and in which both injurers and victims may suffer losses.³⁸

This setting seems particularly appropriate for modeling certain accident environments in which both parties to the interaction can take care to reduce expected harm, but they do not know in advance who will suffer losses and who eventually will be deemed injurer and victim. Collisions between automobiles provide a paramount example of such an environment. White has examined both theoretically and empirically the performance of contributory and comparative negligence in a setting characterized by the role of uncertainty (White, 1989). In her theoretical model, White assumes that the level of due care is perceived by the parties as stochastic within a given range of care levels, since judges and juries may vary widely in their reasons for picking a given care level, as the legal standard and parties cannot easily anticipate these reasons.

Not surprisingly, in such a setting comparative negligence generally does not allow one to obtain first-best behavior by parties, who may be led to take too little care or too much care, depending on the parameters. Efficient care incentives only appear in a narrow set of circumstances. And even if due care is not perceived as stochastic by parties, and parties can predict the legal standard with certainty, the comparative negligence rule remains generally inefficient so long as due care is not set at the socially optimal level.

Contributory negligence, however, does not perform much differently, as this rule can generally lead also to suboptimal or excessive care, depending on the specific values of the parameters. The efficiency question, then, for White, becomes essentially an empirical one.

2.4.3.3 Heterogeneous agents Implementation and other errors by decision-makers have not been the only complications in defining the setting in which to assess the relative efficiency of contributory and comparative negligence. Rea used a game-theoretic model to study the possibility of unresponsive individuals who do not behave according to the incentives created by negligence rules (Rea, 1987). For example, it could be the case that some individuals do not respond to economic incentives because the cost of

³⁸ This approach started with Leong (1989). The equivalence result of negligence rules was shown by Arlen (1990). See also Arlen (1992).

learning the incentive mechanism in the rules is too high, or because they misperceive accident risks. Similarly, individuals might not respond because they are judgment proof, or because they make mistakes in executing their intended optimal care, or because they have an unusually high cost of care.

As mentioned above, the optimal levels of care are determined by minimizing the expected social costs as long as individuals respond to those incentives. Rea considered the changes in the level of care adopted when parties move both sequentially or simultaneously. In his model, X is the cost of care taken by the injurer, Y is the cost of care taken by the victim, $\beta(X, Y)$ is the share of accident losses borne by the injurer, $[1 - \beta(X, Y)]$ is the share of losses borne by the victim, and $A(X, Y)$ ³⁹ is the total expected accident costs for both parties.

Rea defined the comparative negligence rule as a function $\beta(X, Y)$:

$$0 \leq \beta(X, Y) \leq 1, (X < X^* \text{ and } Y < Y^*)$$

$$\beta(X, Y) = 0, X^* \leq X, Y < Y^*$$

$$\beta(X, Y) = 1, X < X^*, Y^* \leq Y$$

Under these assumptions, Rea concludes that the method of apportionment of losses has no bearing on the decision to take care. This is because there is no solution where both parties are negligent so long as each party can escape liability by taking the optimal amount of care when the other is negligent.⁴⁰ This is so regardless of whether the parties choose their levels of care sequentially or simultaneously.

Of course, this cannot explain the rise in comparative negligence and its adoption as the prevalent rule. For this, he introduces unresponsive parties into his model. With the previous assumptions and assuming that α_x is the fraction of potential injurers and α_y is the fraction of potential victims that would choose negligent levels of care, X^- and Y^- , the optimal levels of care for those who respond to the incentives are represented by the following minimization function:

$$\begin{aligned} & (1 - \alpha_x)(1 - \alpha_y)[X + Y + A(X, Y)] \\ & + \alpha_x \alpha_y [X^- + Y^- + A(X^-, Y^-)] + (1 - \alpha_x) \alpha_y [X + Y + A(X, Y^-)] \\ & + \alpha_x (1 - \alpha_y) [X^- + Y + A(X^-, Y)] \end{aligned}$$

³⁹ Being $A_x < 0, A_y < 0, A_{xx} > 0, A_{yy} > 0$. See Rea (1987).

⁴⁰ Given that the apportionment rule is indifferent in terms of efficiency, it follows that all kinds of negligence rules will be equally efficient. See Rea (1987).

The optimal X and Y when unresponsive parties are introduced is such that:

$$(1 - \alpha_y)A_x(X^{**}, Y^{**}) + \alpha_y A_x(X^{**}, Y^-) = -1$$

$$(1 - \alpha_x)A_y(X^{**}, Y^{**}) + \alpha_x A_y(X^-, Y^{**}) = -1$$

Assuming that the party who decides first is the unresponsive party, the standard of care for the other party must be such that:

$$A_x(X^{**}, Y^-) = -1$$

or

$$A_y(X^-, Y^{**}) = -1$$

The optimal level of care of the second party increases when parties move sequentially.

If parties move simultaneously and the responsive or unresponsive type of the other side is not observable, comparative negligence is preferred to contributory negligence with respect to the creation of incentives to take care.

Contributory negligence leads to deficient care (Rea, 1987) because injurers will take into account the proportion of unresponsive injurers. So contributory negligence may induce injurers to reduce the amount of care they take if they expect the proportion of unresponsive victims (α_y) to be high:

$$X^* + (1 - \alpha_y)\beta(X^*, Y^*)A(X^*, Y^*) > X^n + (1 - \alpha_y)A(X^n, Y^*)$$

Equally, a potential victim will not take care if the expected proportion of unresponsive injurers (α_x) is sufficiently high:

$$Y^* + (1 - \alpha_x)[1 - \beta(X^*, Y^*)]A(X^*, Y^*) > Y^n + (1 - \alpha_x)A(X^*, Y^n)$$

Comparative negligence may result in non-negligent behavior on the part of the responsive actors. Since both parties are faced with some share of damages,

Injurers will take care if:

$$X^* + (1 - \alpha_y)\beta(X^*, Y^*)A(X^*, Y^*) < X^n + (1 - \alpha_y)A(X^n, Y^*) \\ + \alpha_y\beta(X^n, Y^-)A(X^n, Y^-)$$

Victims will take care if:

$$Y^* + (1 - \alpha_x)[1 - \beta(X^*, Y^*)A(X^*, Y^*)] < Y^n + (1 - \alpha_x)A(X^*, Y^n) \\ + \alpha_x[1 - \beta(X^-, Y^n)]A(X^-, Y^n)$$

Therefore, when parties move simultaneously, comparative negligence performs better because both parties face some damage and therefore it becomes inefficient for them to take into consideration whether the other party will respond or not to the standard of care set by the rule.⁴¹

When parties move sequentially, under contributory negligence, the party who moves second should be required to take more care than would be optimal if the first party had responded according to the incentives for care created by the rule. Thus, if a defendant follows an unresponsive negligent plaintiff, he will not have incentives to take care under contributory negligence and will have diminished incentives under comparative negligence.

In order to avoid this inefficient behavior, Rea suggests that the care required of this second person should be much larger than the optimum and a larger share of the damages should also be assigned to that person in order to induce efficient care (Rea, 1987).

2.4.3.4 Asymmetric information and liability rules as mechanisms to reveal information The absence of evidentiary uncertainty or court errors hides another implicit assumption in earlier analyses of liability rules, namely, the impossibility that information is transferred from informed parties to uninformed courts. Rubinfeld relaxed this assumption and introduced into the analysis heterogeneous parties⁴² and the possibility that liability rules could be used as mechanisms to reveal information (Rubinfeld, 1987).

In this context, optimal negligence rules should set due care standards

⁴¹ This is true as long as the standard does not increase and become too high in order to compensate for the unresponsive group. If responsive parties found the standard too high, they would also become unresponsive. See Rea (1987).

⁴² Note, however, that if we consider unresponsiveness of parties as an inherent feature, the model by Rea is also about heterogeneity. See Ganuza and Gómez (2005). See also Edlin (1998).

in different ways so that they reflect the parties' different skills and characteristics. But such an approach is typically not feasible, because the best a law-maker can do is setting a uniform standard of care that is efficient for the majority (or plurality) of individuals. This uniform standard, however, will be too high for some parties and too low for others.

Rubinfeld argued that when victims and injurers are identical, both simple negligence and comparative negligence rules lead to efficient outcomes (Rubinfeld, 1987). However, victims need not be identical even though courts cannot establish specific standards of care for individual cases (Rubinfeld, 1987).

Rubinfeld developed a model of heterogeneous types in which parties vary according to their individual skills to prevent accidents, but where courts cannot verify such characteristics. In the model of uncertainty used by Cooter and Ulen, individuals were considered to be homogeneous. When individuals are heterogeneous, in contrast, comparative negligence can be more efficient than contributory negligence.

Liability rules could be designed to provide parties with differentiated incentives depending on the private information parties possess regarding, for example, the level of harm they suffer, or their costs of care. Rubinfeld considers several scenarios in which heterogeneous parties would have different care possibilities available, and would adjust their final choice to their costs of care.⁴³ The decision of care by the parties could not be verified by the court without obtaining private information from the parties.

Rubinfeld's analysis suggests that negligence rules may induce parties to reveal their private information to the court through their choice of care. Under this scheme, liability rules would allow agents to self-select and take precautions according to characteristics that only they knew, even when courts cannot subsequently verify these characteristics.⁴⁴ As a result, an efficiently designed comparative negligence rule could optimally induce parties with different private characteristics to reveal information through the level of care they adopt. When such information is available to the court, the court can then infer respective costs of care.⁴⁵

⁴³ This is the argument that Rubinfeld used to explain the shift from negligence to comparative negligence in some US states. See Rubinfeld (1987).

⁴⁴ The self-selection role of liability rules has been recently suggested by Bar-Gill and Ben-Shahar (2003). They conclude that all negligence rules can lead victims to efficiently self-select.

⁴⁵ Rubinfeld (1987) stated: '[I]n a model with nonidentical injurers and victims, the ability of the comparative negligence rule to more closely approximate the entire range of the expected marginal damage function can make it more efficient than a negligence rule with the sharp cutoff at . . . ' a single, objective standard of care.

If courts are unable to ascertain the actual level of care adopted by parties, Rubinfeld suggested they should set an excessively high standard of care, one that is too costly for most parties to satisfy. Most parties would then be negligent (because of their inability to meet the standards), and under comparative negligence, for example, this would lead to sharing liability among parties in proportion to their negligence (Rubinfeld, 1987).

Rubinfeld further argued that parties with sufficiently low costs of care would meet the courts' excessively high standard because the cost of doing so would not be unreasonably high for them. In contrast, parties with high costs of care would prefer to be negligent because it would not be attractive for them to meet the standard. This system would lead parties to take differentiated levels of care according to their relative costs of precaution. This would thus lead to an efficient outcome because the legal regime would provide differentiated incentives to take care (Rubinfeld, 1987).⁴⁶

Bar-Gill and Ben-Shahar argue, however, that this self-selection property of comparative negligence is not an exclusive feature of sharing rules such as comparative negligence. It may take place also under other negligence rules and in other liability contexts because the optimal rule will set an 'average' standard of care for potential injurers that will not be subject to unobservable case-specific parameters, allowing the injurer to anticipate and comply with this standard. The victim, who will bear the total amount of the harm, will take the care that is optimal and therefore self-selection will occur.⁴⁷

Thus, when heterogeneous parties and self-selection mechanisms are introduced, there is not a clear superiority of comparative negligence because other negligence rules could also lead parties to reveal the information regarding the level of care they adopt (Bar-Gill and Ben-Shahar, 2003).

2.4.3.5 Convergence to equilibrium Assuming perfect information and symmetric damages among parties (Wittman et al., 1997), some experiments have showed that comparative negligence is superior to contributory negligence because it converges to an efficient equilibrium in a faster

⁴⁶ As Rubinfeld (1987) states: 'The continuous marginal expected damage function under the comparative negligence rule leads to a continuous distribution of care levels, while the discontinuous marginal expected damage function under the negligence rule leads to a discontinuous distribution of care. This discontinuous distribution marks the inability of the negligence rule to allow individuals to make small adjustments to differences in their own circumstances.'

⁴⁷ They then argue that Rubinfeld's self-selection argument in support of the efficiency of comparative negligence becomes a general argument for efficiency of self-selection in general and not for the choice between different negligence rules. See Bar-Gill and Ben-Shahar (2003).

and more reliable way (Wittman et al., 1997). Even though contributory and comparative negligence lead to the same efficient equilibrium, they differ from a practical perspective because they do not equally promote learning by parties and courts, and they do not equally facilitate convergence upon the efficient equilibrium by the parties potentially involved in an accident.⁴⁸ In other words, how easy it is for parties to reach the equilibrium under each of the liability rules is of crucial importance (Wittman et al., 1997).

When this parameter is introduced into the analysis, empirical tests have shown that comparative negligence allows for faster convergence to equilibrium compared with contributory negligence. This is especially important given that the social costs of reaching equilibrium may be significant (Wittman et al., 1997).

2.5 Other grounds for criticism of comparative negligence

One of the most popular criticisms raised against comparative negligence by efficiency-minded scholars is that it puts too much emphasis on fairness in compensation, and overlooks the incentive or deterrent function of the rule, by assuming that courts and juries will be able to correctly apply it (Robinette and Sherland, 2003). The literature has presented several factors that explain the difficulties in implementing the comparative negligence rule:

ABILITY TO APPORTION NEGLIGENCE The first difficulty is comparative negligence rule's assumption that negligence can be measured, assessed and apportioned in percentages. It is often argued that negligence is a subjective measurement and therefore cannot be correctly apportioned as the theoretical formulation of the rule would suggest (Little, 1989).

RISK COVERAGE In addition, the allocation of damages and, therefore, of risk between injurer and victim, which is one of the alleged virtues of comparative negligence, is of questionable value in providing risk coverage for accident damage. With the widespread use of third-party insurance, we have better and more tailored alternatives readily available to spread risk of accidental harm (White, 1989).

⁴⁸ Why then did comparative negligence not spread much earlier, replacing contributory negligence? Wittman et al. suggested that despite the better convergence upon the equilibrium of comparative negligence, the apportionment of losses it entails makes it a difficult rule to apply in some negligence cases such as products liability where the parties' negligence is not symmetric and difficult to measure. Wittman et al. (1997).

THE ROLE OF JURORS⁴⁹ The fact that in the United States the task of determining fault and damages falls on the civil jury also weighs negatively against comparative negligence. The effort to apportion fault under any comparative negligence doctrine will involve more jury time than a simple negligence rule or contributory negligence. Worse, substantial errors may be expected from the jury decision-making process in light of the increased complexity that the application of comparative negligence entails (Rubinfeld, 1987). The nature of fault among parties may be very different and the possibility of making a correct assessment may be very different as well. What and how are jurors apportioning when having to assign percentages of negligence in a negligence case? Juries are given little guidance as to what to do when determining negligence percentages among parties.⁵⁰

THE COSTLY MECHANISM OF ADJUSTING THE DEFENDANT'S LIABILITY SHARE BOTH WITH RESPECT TO THE PLAINTIFF AND WITH RESPECT TO THE OTHER DEFENDANTS⁵¹ A common criticism of comparative negligence is the litigation costs it entails.⁵² Comparative negligence may encourage excessive litigation by increasing the proportion of cases which the plaintiff is likely to win. It may also increase court costs by raising the complexity of the level of an average case (White, 1989).

2.6 Empirical studies on the performance of contributory and comparative negligence rules, and on pure comparative versus modified comparative negligence

There is very little empirical analysis of the performance of these rules with respect to real-world behavior. White tried to cover this gap in 1989, using data collected by Donald Wittman on 582 rear-end automobile accident cases decided by juries in California during the period 1974–76.⁵³ This data set included information regarding the level of care of injurers and victims.

⁴⁹ There is evidence that shows that juries tend to share damages even under the contributory negligence rule. See White (1989).

⁵⁰ Edelman (2007) argues that jury instructions should reflect the specific nature of care at issue – whether care is commensurable or incommensurable – and whether it is similar, or so different that the comparison is not feasible.

⁵¹ Little (1989).

⁵² Rubinfeld (1987). However, when litigation costs are not considered in the analysis, comparative negligence presents clear advantages compared to other negligence rules because by sharing damages among parties, it induces precautions but at the same time it eliminates the waste of double or excess of precaution that both parties incur under contributory negligence. See Orr (1991).

⁵³ California shifted from a contributory negligence rule to a comparative negligence rule in 1975. See White (1989).

The drivers in this study typically would not know *ex ante* with whom they would be involved in an accident, and whether they would be the injurer or the victim when the accident occurred (White, 1989).

The care levels of the injurers and victims in White's sample fell into three broad categories: (i) very bad driving; (ii) mediocre driving; and (iii) good driving (White, 1989). In the sample, there were very few observations of injurers who had displayed 'good driving', and no observations of victims who had displayed the level of care of category (i), very bad driving. To avoid colinearity in these circumstances, White modeled care as a dummy variable for both injurers and victims. For injurers, the variable would equal one if the injurer's driving was 'mediocre' and zero if the injurer's driving was 'very bad', and for victims the dummy would take the value of one if the victim's driving was 'good', and zero if the victim's driving was 'mediocre'.

Given the different observed probabilities of being held liable under comparative versus contributory negligence, and the different amount of damages imposed under each rule, the data showed that for bad drivers expected liability was considerably higher under contributory negligence than under comparative negligence, whereas for mediocre drivers the advantage in terms of higher incentives was associated with comparative negligence, albeit with much lower levels and also a much lower relative difference.

Furthermore, White used the observed percentages of each category under both rules to estimate the *ex ante* probabilities of being an injurer and a victim, and of being found liable, in her theoretical model.⁵⁴ Given these estimates, the data showed that under both liability rules the incentive to avoid accidents increased as drivers' care level dropped from good to mediocre or to bad driving. But for mediocre or bad drivers, the incentive to drive carefully was much stronger under the contributory negligence rule than under the comparative negligence rule.⁵⁵ This was because, given their low level of care, these drivers face higher expected liability under contributory than under comparative negligence. In this sense, the shift from contributory to comparative negligence in automobile accident law can be seen to have reduced drivers' incentives to increase care. Also, the incentives to avoid accidents, even when the level of care is insufficient, are stronger under contributory than under comparative negligence.

⁵⁴ See above, section 2.4.3.2. In the automobile accident context, other authors claimed that driving under the influence of alcohol is a setting in which the driver is more likely to be the injurer than the victim. See Sloan, Reilly and Schenzler (1995).

⁵⁵ Even though White acknowledged that it was not clear whether these incentives were efficient. See White (1989).

Other empirical studies (Sloan, Reilly and Schenzler, 1995) of the effects of tort liability on the use of alcohol among individuals from 1989–90 showed that the US states that switched from contributory to pure or modified comparative negligence experienced an increase in binge drinking (Sloan, Reilly and Schenzler, 1995). The number of accidents per month was 0.28 higher in states with a pure or modified comparative negligence rule than in those with a contributory negligence rule.⁵⁶ Even though the shift in negligence rules had an effect on accident rates, it did not have a significant effect on the payments injurers made to victims because even under contributory negligence, some injurers were making payments even in cases where victims had also been negligent (Sloan, Reilly and Schenzler, 1995).

The study also showed that for significant deviations from due care, such as driving under the influence of alcohol, drivers will more likely be injurers than victims under comparative negligence given their low incentive to take care.⁵⁷ This conclusion was confirmed by Flanigan et al. (Flanigan, Johnson, Winkler and Ferguson, 1989) who showed that states with a comparative negligence rule had higher automobile insurance costs and therefore higher accident costs than states with a contributory negligence rule (Flanigan, Johnson, Winkler and Ferguson, 1989).

Regarding the differences between pure and modified comparative negligence, it has often been claimed that both forms are equally efficient for care.⁵⁸ There is some literature, however, discussing whether pure or modified comparative negligence rules are equally desirable in other respects.

Differences between the two forms in terms of deterrence effects, for instance, were recently examined empirically by Robinette and Sherland (Robinette and Sherland, 2003). They did this by examining data on injury claims in automobile accidents collected by the Insurance Research Council (IRC) between 1980 and 1998. Based on his analysis of these data, Robinette and Sherland concluded that there was no evidence of the rules having different deterrent effects (Robinette and Sherland, 2003).

From a corrective justice perspective, pure comparative negligence

⁵⁶ This article also mentioned that the effect of the change of negligence rule on the amount of accidents was even more important when the negligence rule considered was the pure comparative negligence rule rather than the modified comparative negligence rule. However, this result was not justified in the paper. Sloan, Reilly and Schenzler (1995).

⁵⁷ This test showed that drivers, as potential accident victims, have fewer incentives to take care. See Sloan, Reilly and Schenzler (1995).

⁵⁸ Rea claimed that all variations of comparative negligence were equally efficient in terms of care. See Rea (1987).

seems to be a superior rule because by always finding liable negligent parties, these parties are forced, to some degree, to bear the cost of the wrongs they negligently committed (Robinette and Sherland, 2003; Flanigan et al., 1989). Since this helps to further the general goals of tort law, pure comparative negligence may well be the preferable choice rather than the modified form (Robinette and Sherland, 2003).

2.7 Conclusions

The literature on contributory and comparative negligence has evolved in the last three decades along two lines. It has made models more realistic by relaxing some of the standard assumptions initially employed in looking at accidents and liability. It has also reassessed, through different approaches, the conclusions reached concerning the relative efficiency and advantages of each negligence rule with respect to the other.

The early literature showed an unabashed and mistaken clear preference for contributory negligence. This vision was soon corrected by the equivalence result in the standard model of liability with perfect information and error-free decision-makers. Given that comparative negligence spread in many states and jurisdictions, especially in the United States, the literature then focused on finding theoretical explanations for this legal change. In doing so, the literature's overall expressed preferences shifted from contributory to comparative negligence.

This third stage of the literature concluded that comparative negligence seemed to be preferred under evidentiary uncertainty – when judges do not have perfect information regarding the parties' level of care (Cooter and Ulen, 1986; Haddock and Curran, 1985), when parties have private information about their differentiated costs of care (Rubinfeld, 1987), and when some individuals are unresponsive to the incentives to take care created by the negligence rules (Rea, 1987).

The most recent literature (Bar-Gill and Ben-Shahar, 2003), though, is overtly skeptical concerning any general superior performance of comparative negligence over contributory negligence. In this sense, it resembles the neutral attitude of the equivalence literature, though emphasizing the indeterminacy of general assessments, and the significance of specific assumptions on the size of care functions and accident technologies for more precise conclusions on relative efficiency. This suggests that new and more sophisticated models may provide an opportunity to further economic research on accidents and liability.

Bibliography

Abraham, Kenneth S. (2002), *The Form and Functions of tort law*, 2nd edition, New York: Foundation Press.

- Arlen, Jennifer H. (1990), 'Re-examining liability rules when injurers as well as victims suffer losses', *International Review of Law & Economics*, 10, 233.
- Arlen, Jennifer H. (1992), 'Liability for physical injury when injurers as well as victims suffer losses', *Journal of Law, Economics and Organization*, 8, 411.
- Bar-Gill, Oren (2001), 'Does uncertainty call for comparative negligence?', Discussion Paper 346, 12/2001 Harvard Law School.
- Bar-Gill, Oren and Omri Ben-Shahar (2003), 'The uneasy case for comparative negligence', *American Law & Economic Review*, 5, 433.
- Best, Arthur (2007), 'Impediments to reasonable tort reform: lessons from the adoption of comparative negligence', *Industrial Law Review*, 40, 1.
- Brown, John P. (1973), 'Toward an economic theory of liability', *Journal of Legal Studies*, 2, 323.
- Calabresi, Guido (1970), *The Cost of Accidents: A Legal and Economic Analysis*, New Haven and London: Yale University Press.
- Chung, Tai-Yeong (1993), 'Efficiency of comparative negligence: a game theoretic analysis', *Journal of Legal Studies*, 22, 395.
- Cooter, Robert, Lewis Kornhauser and David Lane (1979), 'Liability rules, limited information, and the role of precedent', *Bell Journal of Economics*, 10, 366.
- Cooter, Robert D. and Thomas S. Ulen (1986), 'An economic case for comparative negligence', *New York University Law Review*, 61, 1067.
- Curran, Christopher (1992), 'The spread of the comparative negligence rule in the United States', *International Review of Law & Economics*, 12, 317.
- Dari-Mattiacci, Giuseppe and Gerrit De Geest (2005), 'The filtering effect of sharing rules', *Journal of Legal Studies*, 34.
- Diamond, Peter A. (1974), 'Single activity accidents', *Journal of Legal Studies*, 3, 107.
- Edelman, Paul H. (2007), 'What are we comparing in comparative negligence?', *Washington University Law Review*, 85, 73.
- Edlin, Aaron S. (1994), 'Efficient standards of due care. Should courts find more parties negligent under comparative negligence?', *International Review of Law & Economics*, 14, 21.
- Edlin, Aaron S. (1998), 'Due care', in Peter Newman (ed.), *The New Palgrave Dictionary of Economics and the Law*, London: Macmillan Press.
- Faure, Michael G. (2004), 'Economic analysis of contributory negligence', in U. Magnus and M. Martín-Casals (eds), *Unification of Tort Law: Contributory Negligence*, Vienna: Springer, V–IX.
- Flanigan, George B., Joseph E. Johnson, Daniel Y. Winkler and William Ferguson (1989), 'Experience from early tort reforms: comparative negligence since 1974', *Journal of Risk & Insurance*, 56, 525.
- Ganuzza, J. and F. Gómez (2005), 'Caution, children crossing: heterogeneity of victim's cost of care and negligence rule', *Review of Law & Economics*, 1, 365.
- Gardner, Steven (1996), 'Contributory negligence, comparative negligence, and stare decisis in North Carolina', *Campbell Law Review*, 18, 1.
- Grady, Mark F. (1983), 'A new positive theory of negligence', *Yale Law Journal*, 92, 799.
- Haddock, David and Christopher Curran (1985), 'An economic theory of comparative negligence', *Journal of Legal Studies*, 14, 49.
- Kahan, Marcel (1989), 'Causation and incentives to take care under the negligence rule', *Journal of Legal Studies*, 18, 427.
- Kim, Jeonghyun (2004), 'A complete characterization of efficient liability rules: comment', *Journal of Economics*, 81.
- Landes, William M. and Richard A. Posner (1987), *The Economic Structure of Tort Law*, Cambridge, MA and London: Harvard University Press.
- Leong, Avon K. (1989), 'Liability rules when injurers as well as victims suffer losses', *International Review of Law & Economics*, 9, 105.
- Little, Joseph W. (1989), 'Eliminating the fallacies of comparative negligence and proportional liability', *Alabama Law Review*, 41, 13.

- Orr, Daniel (1991), 'The superiority of comparative negligence: another vote', *Journal of Legal Studies*, 20, 119.
- Pham, Tu Minh (1995), 'A new approach to modified contributory negligence', *Illinois Bar Journal*, 83, 655.
- Posner, Richard (1972), 'A theory of negligence', *Journal of Legal Studies*, 1, 29.
- Posner, Richard (1977), *Economic Analysis of Law*, 2nd edition, Boston and Toronto: Little Brown.
- Posner, Richard (1997), *Economic Analysis of Law*, 5th edition, New York: Aspen Publishers.
- Priest, George L. (1987), 'Modern Tort Law and its Reform', *Valparaiso University Law Review*, 2(1), 11.
- Prosser, William Llyod, W. Page Keeton, Dan B. Dobbs, Robert E. Keeton and David G. Owen (1984), *Prosser and Keeton on Torts*, 5th edition and Supplement (1988), St. Paul, Minneapolis: West Publishing Co.
- Rea, Samuel A. Jr. (1987), 'The economics of comparative negligence', *International Review of Law & Economics*, 7, 149.
- Robinette, Christopher J. and Paul G. Sherland (2003), 'Contributory or comparative: which is the optimal negligence rule?', *Northern Illinois University Law Review*, 24, 41.
- Rubinfeld, Daniel L. (1987), 'The efficiency of comparative negligence', *Journal of Legal Studies*, 16, 375.
- Schwartz, Gary T. (1978), 'Contributory and comparative negligence: a reappraisal', *Yale Law Journal*, 87, 697.
- Shavell, Steven (1987), *Economic Analysis of Accident Law*, Cambridge, MA and London: Harvard University Press.
- Singh, Ram (2007), 'Comparative causation and economic efficiency: when activity levels are constant', *Review of Law & Economics*, 3.
- Sloan, Frank A., Bridget A. Reilly and Christoph Schenzler (1995), 'Effects of tort liability and insurance on heavy drinking and drinking and driving', *Journal of Law & Economics*, 38, 49.
- Sudman, Michael (1999), 'Definition of fault in contributory and comparative negligence statutes', *Journal of Legal Advocacy & Practice*, 1, 206.
- Van Dam, Cees (2006), *European Tort Law*, Oxford and New York: Oxford University Press.
- Von Bar, Christian (2000), *The Common European Law of Torts*, vol. 2, Oxford: Clarendon Press.
- White, Michelle J. (1989), 'An empirical test of the comparative and contributory negligence rules in accident law', *Rand Journal of Economics*, 20, 309.
- Wittman, Donald, Daniel Friedman, Stephanie Crevier and Aaron Braskin (1997), 'Learning liability rules', *Journal of Legal Studies*, 26, 145.

Cases cited

- Butterfield v. Forrester*, 103 Eng. Rep. 926 (Court of King's Bench 1809).
- Davies v. Mann*, 152 Eng. Rep. 588 (1842).
- Brown v. Kendall*, 60 Mass. (6 Cush.) 292, 296 (1850).
- United States v. Carroll Towing Co.* 159 F.2d 169 (2d Cir. 1947).
- Poole v. City of Rolling Meadows*, 1995 WL 480511(III)

Restatements and Regulation cited

- Restatement (Second) of Torts s 463 (1965).
- § 291 of the Restatement (Second) of Torts (1968).
- Restatement (Third) of Torts: Apportionment of Liability § 7 cmt. a (2000).
- Section 4 of the Law Reform (contributory negligence) Act 1945 (England).

PART II

CAUSATION AND MULTIPLE TORTFEASORS

3 Causation and foreseeability

*Omri Ben-Shahar**

3.1 Introduction

The contribution of economic analysis is particularly evident in the law of causation. The vast juristic literature on causation has not managed to clarify the essence of the requirement. In fact, prominent tort scholars have conceded that ‘there is perhaps nothing in the entire field of law which has called for more disagreement, or upon which the opinions are in such a welter of confusion’ (Keeton et al., 1984, p. 263), and that ‘both courts and textbook writers still fall back when deciding issues in causal terminology’ (Hart and Honoré, 1985, p. 1). Economic analysis provides much needed order in this field. The contribution is twofold. First, conceptually, economic analysis provides a framework that unifies the analysis of seemingly unrelated problems. Second, normatively, economic analysis can help determine which acts constitute the cause of an injury, for the purpose of holding the actor liable.

The attempts of traditional tort scholarship to make sense of the law of causation have led to the classification of the debates into two separate doctrines, *cause-in-fact* and *proximate cause*. The *cause-in-fact* doctrine defines when an act is part of a causal chain that ends with the injury. Here, the *but-for* test is the most common intuitive criterion for inferring such a factual causality relation. But not all acts that are *cause-in-fact* are also deemed liable. The law narrows down the responsibility to those satisfying additional ‘legal’ tests, which are mostly embodied in the proximate cause doctrine. Liability is imposed only upon a sub-set of the acts that are causally linked to the injury, those that survive the scrutiny of a variety of normative judgments regarding their proximity to the harmful event. As Cooter (1987) nicely labeled it, the proximity doctrine portrays causation as a ‘decaying transitive relation’: as the chain of causal inference extends (‘a caused b, b caused c, . . .’), the relationship between removed links weakens.

The economic analysis of the law of causation illuminates both the *cause-in-fact* and the proximate cause doctrines. Economic analysis applies positive tools from decision theory and statistics to clarify the

* University of Chicago. © Copyright 2007 Omri Ben-Shahar.

definition of a cause-in-fact, and to resolve some of the confusion regarding the relative contribution of a given factor to the harmful consequence. Under the normative economic analysis, the proximate cause doctrine's designated role is to expand or shrink the scope of liability, in order to achieve efficient deterrence.

This chapter is structured as follows: it begins with a survey of the implicit role of causation in the writings of the early, pathbreaking economic analysts of tort law. It then clarifies the basic distinction between retrospective (*ex post*) causation and prospective (*ex ante*) causation, a distinction that forms the core of many subsequent economic discussions of causation. Next, the explicit role of causation doctrines in inducing optimal care and activity levels is examined under the strict liability and the negligence regimes. The analysis is then extended to cover several complications: uncertainty over causation, joint actions among tortfeasors and unforeseeability of harm. Finally, the chapter discusses causation notions in contract law.

3.2 Causation in early economic analysis of law

The original economic theory of tort law deliberately rejected an explicit role for a causation doctrine in determining liability. Coase's (1960) view was particularly resolute in its exclusion of a formal causation element. Coase describes an injury as a result of mutual and symmetric interaction among parties. Like particles that randomly collide with each other in space, actions of individuals may conflict and cause one-sided or mutual harm. Thus, the phrase 'the injurer acted and, when coming across the victim, caused an injury' is interchangeable with the phrase 'the victim acted and, when coming across the injurer, caused an injury'. Both passive and active factors are equally necessary in making the harm occur.

Since liability cannot be placed solely on the basis of causation, as both the injurer and the victim are necessary causes, it ought to be decided according to a cost-benefit analysis, which will determine the identity of the party that can alter its actions more cheaply and avoid the injury. As Calabresi (1970) explained, for instrumental reasons the least-cost avoider should be singled out as the cause of an injury. The forward-looking social objective – minimization of accidents' costs – will be furthered if a party that can prevent an accident with a lower cost than the harm arising from the accident is regarded as the sole legal cause of the accident and held liable. Hence, under this view, causation is not a preliminary condition for evaluating liability, but it is the *conclusion* of the evaluation (see Cooter, 1987).

Landes and Posner (1983, 1987, pp. 228–55) reinforced this view and argued explicitly that causation has no role in determining liability.

Inasmuch as the purpose of tort law is to promote economic efficiency, the injurer should be regarded as the cause of an injury when he is the lower-cost avoider of it, and not otherwise. Therefore, they claimed, ‘the idea of causation can largely be dispensed with in an economic analysis of torts’. When efficiency analysis is conducted to determine liability, it can be fully pursued without reference to causation. Inefficient behavior is synonymous with causing an expected harm.

The symmetry among the roles of the injurer and the victim, as well as the absence of any independent requirement of causation, became well evident when Brown (1973) formulated his rigorous model of accidents. This model – the benchmark for subsequent economic analysis of tort law – assigned symmetric roles to the injurer and the victim, by making the expected harm a function of care levels taken by both. A party’s action can raise the probability of harm and, thus, *ex ante*, can only be a cause of an *expected harm*.

Thus, in early economic analysis of tort law, cause is reduced to efficient prevention: the assignment of legal cause is dependent solely upon the judgment about the economic efficiency of preventive measures. The inquiry into causation carries no additional message once a cost-benefit analysis of the care choices has been completed. This characterization of causation, which prominent scholars have labeled ‘causal minimalism’ (see Hart and Honoré, 1985, pp. lxvii–lxxvii), has led authors to argue that causation serves goals other than efficiency (Epstein, 1973, 1979, 1987; Borgo, 1979; Cooter, 1987) or that it merely represents an older method of conducting efficiency analysis (Grady, 1989; Miceli, 1996).

3.3 Prospective causation

Building on the analytical framework of Calabresi (1970) and Brown (1973), subsequent treatments of causation distinguished between two concepts of factual linkage between acts and harms. Calabresi (1975) classified the empirical tests of causality into two types, which he labeled *causal link* and *but-for cause*. Both describe effects of actions on outcomes. An act is a but-for cause if, without it, the injury would not have taken place. In contrast, an act has a causal link to an injury if it increases the probability of its occurrence. As Shavell (1980) later rephrased the distinction, causation can be either retrospective or prospective. Retrospective causation exists if, all else held fixed, but for the action the harmful consequence would not have occurred. Prospective causation exists when an action raises the probability of the harmful consequence. Thus, the distinguishing factor between the two types of causation is the *time* perspective of the evaluation. Retrospective causation is backward-looking, answering the counterfactual inquiry of whether the action was a necessary condition for the

outcome. Prospective causation, in contrast, is forward-looking, answering the *ex ante* inquiry of whether the action increased the likelihood of injury (see also Rizzo, 1981; Miceli, 1996).

This distinction, and in particular the development of analytical tools to focus on prospective-probabilistic causation, has helped the economic literature advance both in its normative and in its positive study of the law. In the normative dimension, probabilistic causation became a building block of economic models of tort law. As Shavell (1980, p. 475) explicitly phrased it, ‘the first-best level of care is determined by the cost of taking care and the degree to which lack of care is a *cause of expected losses*’. For an action (‘low care’) to raise the probability of a consequence (‘harm’) relative to another action (‘high care’), there must be states of the world in which harm occurs only if that action is taken, and not if the other action is taken.

The prospective causation concept has also advanced the positive analysis of tort law. Perhaps the sharpest example of the contrast between retrospective and prospective causation theories, and the clearest application of prospective causation analysis, arises within the family of ‘coincidental’ accidents cases. In the famous case of *Berry v. Borough of Sugar Notch*, 43 A 240 (1899), an excessively speeding streetcar happened to arrive at a point along its route just when a tree fell above that point, and struck it. A strict retrospective causation inquiry would have identified the action of speeding as a but-for cause, since the accident would not have occurred had the streetcar traveled more slowly. Applying the traditional retrospective approach, the court sensed the illogic of assigning liability for such an arbitrary episode, thus had to resort to elusive concepts such as ‘coincidental harm’ or ‘abnormal risk’ in order to screen such results and derive a general principle that would restrict the scope of liability. In contrast, under prospective causation inquiry, the action of speeding is recognized to have not affected the likelihood of harm of the type that occurred. *Ex ante*, a tree can fall at any point along the route, and the speed at which the vehicle is moving does not increase its probability of being hit. The result that the court reached can be easily aligned with the logic of prospective causation. (See Honoré, 1983, pp. 50–55, for early applications of the prospective causation concept.)

3.4 Causation and socially optimal care

The causation requirement, although not an explicit element in the ordinary economic model of tort law, can be isolated and characterized in economic terms. The idea is that the desirability of any precautionary action should be determined only with reference to states of the world in which failure to take the action would lead to greater expected losses. In

determining the level of care that is optimal, the benefits of care should be balanced against its costs. But whereas the costs of care accrue before the ensuing state of the world materializes and regardless of the actual state of the world that will materialize, the benefits of care arise only in those states in which taking care reduces harm. Thus, the socially optimal level of care depends only on states of the world in which the injurer's care would have reduced the harmful consequences (Shavell, 1980, 1987, pp. 105–26; Rizzo, 1981; Landes and Posner, 1983, 1987; and Cooter, 1987). For example, in the case of *City of Piqua v. Morris*, 120 NE 300 (1918) the defendant failed to take sufficient measures against floods. However, a particularly severe flood occurred, one that even appropriate precautions would not have withstood. Thus, in evaluating the desirability of anti-flood measures, only the chance for moderate floods should be counted.

In order to examine the extent to which liability rules can implement optimal care, a causation restriction can be formally introduced to the structure of liability rules. Shavell's (1980) concept of the *scope of liability* incorporates the causation restriction. The scope of liability is defined as the set of states of the world under which liability can be applied. The scope of liability is said to be restricted if, given a harmful consequence, there are some states of the world in which the injurer is not held liable. The scope of liability will be unrestricted if, anytime there is a harmful consequence, and no matter what state of the world surrounded it, the injurer is held liable. The design of a liability regime includes, in addition to the determination of due care (in negligence) and the magnitude of liability (both in strict liability and in negligence), the determination of the scope of liability. If an act is not a necessary cause of the injury, the injury may be left outside the actor's scope of liability.

3.5 Causation under strict liability

Under strict liability, courts have to determine the magnitude of liability and its scope. Assuming the magnitude of liability equals the victim's actual harm, what remains to be determined is whether the accident is to be included within the scope of liability. Two principal propositions can be made regarding the incentive effects of the determination of the scope of liability and these are examined below.

3.5.1 The effect of the scope of liability on the level of care

The injurer will have optimal incentives to take care as long as the scope of liability includes *at least* all the states of the world in which the injurer's care is a necessary cause of the harm. If the scope of liability is too restricted, and does not include all the states in which the injurer could alter the harmful consequence with its care, then the injurer will have insufficient

incentives to take care. In this case, the injurer will ignore some of the social benefits of its care – the reduction in expected harm occurring in states of the world outside the scope of liability – and will underinvest in care. If, in contrast, the scope of liability is optimally restricted, and includes only states of the world in which the injurer's care is a necessary cause, the injurer will bear only the increment in expected losses due to its actions, and will have optimal incentives to take care. Similarly, if the scope of liability is unrestricted, so that whenever harm occurs, and regardless of the state of the world, the injurer is held liable, the injurer will engage in optimal care. Notice that an unrestricted scope of liability does not, in itself, distort the injurer's incentives to take care. Even if the injurer is liable for harms which its care could not have prevented, it will *not* exercise excessive care. Taking more care will not prevent the harm in the states of the world in which care is not a necessary cause, and thus will not reduce its expected liability. Hence, the injurer's incentives to take care can be distorted only by an overly restricted scope of liability, not by an unrestricted one (see Shavell, 1980, 1987, pp. 105–10; Landes and Posner, 1987, p. 236).

3.5.2 *The effect of the scope of liability on the level of activity*

If the scope of liability is too restricted, and does not include all the states in which the injurer's care is a necessary cause, it was already established above that underinvestment in care will arise. This underinvestment can also lead to excessive incentives to engage in the activity, as the injurer will not bear the full 'externality' of its activity. The cost of engaging in the activity is reduced by the incremental reduction in the investment in care and by the incremental reduction in the expected liability and, thus, an injurer may engage in an activity even when it is undesirable from a social point of view. Similarly, if the scope of liability is too broad or unrestricted, it may discourage an injurer from engaging in a socially desirable activity. Although the injurer who faces an unrestricted scope of liability will not take excessive care, the injurer will face an inflated expected liability. As Shavell (1980, 1987, p. 108) has termed it, the injurer may find the unrestricted scope of liability to be 'crushing'. An activity that is worthwhile may be deterred by imposing upon the actor costs of losses that would have been occasioned regardless of this activity. For example, if a car manufacturer is held liable for accidents arising from bad conditions of roads, such that they cannot be avoided by extra prevention devices in the car's design, it may be led to reduce the volume of production. Or, if a drug manufacturer is held liable for harms that are due to environmental or genetic conditions and would have occurred even if the drug were safer, he may refrain from marketing the drug in the first place. Hence, for injurers to engage in optimal levels of activity, courts have to restrict the scope

of liability appropriately, which may demand too much information and sophistication from the legal system (Burrows, 1984; Wright, 1985).

3.6 Causation under the negligence rule

Under the negligence rule, courts have to determine the level of due care, the magnitude of liability and the scope of liability. Assuming that the magnitude of liability equals the victim's actual harm, what remains to be determined is which harms should be factored into the determination of the standard of due care, and under what states of the world the accident is to be included within the scope of liability. Shavell (1980, 1987, pp. 105–21) has made the following propositions concerning the incentive effects of causal determinations:

3.6.1 The determination of the optimal standard of care

The due level of care should equal the optimal level of care, as determined by considering the effect of care only in circumstances in which care is a necessary cause – that is, only in states of the world in which taking care would reduce harm. Care that has no bearing on the occurrence of harm should be excluded from the negligence standard.

3.6.2 The effect of the scope of liability on the actual level of care

Once a standard of due care is set, the scope of liability has only limited incentive effects. Whether the scope of liability is optimally restricted (to include only states of the world in which the injurer is the necessary cause), or whether the scope of liability is too broad or unrestricted, the injurer will take the due level of care (assumed to be set optimally). Further, unlike the activity-crushing effect of strict liability, under the negligence rule an unrestricted scope of liability does not necessarily deter the injurer from engaging in the activity. The injurer is induced to take due care and thereby avoid liability, and thus becomes indifferent as to the actual scope of liability (Landes and Posner, 1983, 1987, p. 236). As long as the exaggerated scope of liability does not boost the level of due care, it has no adverse incentive effects *per se*. In contrast, if the scope of liability is too restricted, and does not include all the states in which the injurer's care could have reduced harm, the injurer may (but not necessarily) be led to take too little care. The injurer will compare the cost of due care to the cost of liability in its inefficiently restricted scope. If the cost of liability is smaller, the injurer's incentives to take due care will be distorted.

3.6.3 The scope of liability in an imperfectly operating negligence system

Inasmuch as the application of the negligence rule is plagued with error and uncertainties, it contains an element of strict liability (the injurer may

bear liability even if he were not negligent). In this case, the unrestricted scope of liability can have the crushing effect that is associated with the operation of a strict liability rule (Shavell, 1980, 1987, p. 108), Landes and Posner, 1983, 1987, p. 236).

Many economic writers implicitly assume that under the negligence regime the scope of liability is unrestricted, and that liability turns solely upon the injurer's negligence. That is, if the injurer were negligent, no matter how slight its deviation from due care, it is liable for any accident that arises, including accidents that additional care would not have prevented. This assumption, however, fails to correctly characterize the law. Grady (1983, 1984, 1989), Kahan (1989) and Marks (1994) argued that the assumption of unrestricted scope of liability is not in line with either tort doctrine or optimal incentive design. An injurer who takes less than due care is not liable for every harm that arises, but only for those harms which would not have arisen had the injurer taken due care. Thus, if the injurer takes slightly less than due care, the proper scope of its liability would include only the (slight) incremental harm that occurred due to this deviation, and will not include all harms that would have occurred anyway. If an accident occurs, the negligent injurer will have to pay damages with a probability less than one.

Using Kahan's (1989) illustration, suppose the proper height of a fence surrounding a stadium is 10 feet, and the field owner negligently erects a fence of 9 feet. If a ball flies over the fence and causes harm, the scope of liability should be (and, as a matter of common law, is) restricted to those accidents caused by balls flying over the fence at heights between 9 and 10 feet. Only those accidents are caused by the field owner's negligence. Making the field owner liable for all harms caused by flying balls, including those that fly at heights exceeding 10 feet, would mean imposing an unrestricted scope of liability.

Until Kahan (1989) exposed it, most economic models managed to conceal their incorrect characterization of the scope of liability. The reason these models successfully overlooked this restriction relates to the discussion above, which suggested that in the case of a perfectly operating negligence system an exaggerated scope of liability does not have a distorting effect. Since the perfect-information models of negligence find that the injurer will have the proper incentives to take optimal care even under the exaggerated scope of liability regimes, and since there is no crushing of activity effect, they suppress the significance of the exaggerated scope of liability. But, as Kahan demonstrated, an unrestricted scope of liability will have different incentive effects from an optimally restricted scope of liability in cases in which the application of the negligence rule is plagued with information imperfections.

Grady and Kahan's analyses also suggest that the proper characterization of causation should eliminate what is otherwise considered a prominent feature of the negligence rule: the discontinuity of the injurer's cost function at the point of due care. This feature of discontinuity plays an important role in models analyzing injurers' behavior under uncertainty (see, for example, Craswell and Calfee, 1986; Shavell, 1992; Ben-Shahar, 1995, 1999). If the injurers' cost function is continuous, as Grady (1989), Kahan (1989) and Cooter (1989b) have demonstrated it to be, the incentive to deliberately engage in excessive care, to ensure compliance with the uncertain legal standard, is significantly diminished.

3.7 Uncertainty over causation

When an injury occurs, its origin may be ambiguous. Several reasons may account for the uncertainty. First, it may be that separate factors created similar risks simultaneously, and the actual injury cannot be clearly traced to any one of them. Second, it may be that the injury manifested itself a long period after the risk was created or the accident occurred, in which case the cause is difficult to identify. The principal question that needs to be addressed in the face of causal uncertainty is *under what conditions should a party be liable for injuries that are uncertain to have been caused by its actions?*

Two basic approaches to liability in the face of uncertainty over causation can be proposed. The first approach applies an all-or-nothing criterion to determining liability: liability is either equal to the full losses of the victim, or there is no liability at all. The most common all-or-nothing criterion is the threshold probability rule, under which full liability is imposed upon the defendant if the probability that it caused the accident exceeds a threshold level. Potentially, any threshold can be set, including one that would require proof of causation exceeding any reasonable doubt. However, the prevalent doctrine applying the threshold probability rule is the 'preponderance of the evidence' standard of civil law, which incorporates a threshold probability of 50 percent. (In some cases, the law reverses the burden of proof and presumes that the defendant is the cause of the injury. Then, the defendant needs to satisfy the 50 percent threshold in proving that he is not the cause of the injury.)

The second approach to resolving uncertainty over causation is the proportional liability criterion. Under this approach, whenever there is a positive probability that the defendant caused the injury, liability will be imposed, but its magnitude will be reduced proportionally to account for the uncertainty. The most common proportional rule, known as the 'market share' approach, sets the defendant's liability equal to the actual harm multiplied by the probability that the defendant caused the injury.

Traditionally, the law of torts has been governed by the first approach of all-or-nothing. Full liability is assigned to a party whose acts are assessed to be a substantial factor in bringing about the harm. A preponderance of probabilities is required for imposition of liability, and without it no liability is inflicted. However, beginning in the 1980s, and coming as a response to the onslaught of mass exposure or catastrophic injury torts, American courts have been more willing to apply the second approach. In the case of *Sindell v. Abbott Laboratories* 607 P.2d 924 (1980), which involved the mass disaster of the DES drug, the court determined each manufacturer to be liable for a fraction of every victim's harm, with liability determined in proportion to the likelihood that the manufacturer caused the harm, that is, in proportion to the manufacturer's market share. The debate over the market share doctrine has since occupied many branches of tort scholarship, including law and economics. The next two sections examine the economic justifications for the two approaches.

3.8 The case for threshold probability rules

The first systematic analysis applying economic methods to compare the two liability approaches was presented by Kaye (1982), who proposed to show the superiority of the 50 percent threshold probability rule over any other threshold probability rule as well as over the proportional approach. Kaye's argument is based on the assumption that in situations of uncertainty over causation the social objective of tort adjudication is to minimize the *ex post* costs of erroneous liability decisions. Ignoring any *ex ante* incentive effects that the rules may have, and assuming that the two types of potential errors courts could make – false positives and false negatives – are just as costly, Kaye shows that the 50 percent threshold rule is the error-minimizing one. To illustrate the essence of Kaye's argument, consider a case in which the harm is \$100 and the probability that the defendant caused it is 40 percent. Under the 'preponderance of the evidence' rule, the defendant will not be liable, and the expected error costs will equal \$40 (there is a 40 percent chance that the defendant is truly the tortfeasor, in which case it underpays by \$100, for an expected error cost of $0.4 \times \$100 = \40). In contrast, if the court applies the proportional liability rule and sets the defendant's liability at \$40, the expected error costs will be \$48 (there is a 40 percent chance that the defendant is truly the tortfeasor, in which case it underpays by \$60, for an expected error cost of $0.4 \times \$60 = \24 ; and there is a 60 percent chance that the defendant is not the tortfeasor, in which case it overpays by \$40, for an expected error cost of $0.6 \times \$40 = \24 ; the sum of the expected costs of the two possible errors is $\$24 + \$24 = \$48$).

The all-or-nothing feature embodied in the threshold liability rule has an additional potential advantage, suggested by Levmore (1990), of reducing

the degree of uncertainty. If uncertainty is assumed to be endogenous, and to vary according to the incentives of the parties to bring evidence to court, then the liability approaches can be compared with respect to the degree of uncertainty they generate. Here, Levmore claims, a high threshold probability will produce the most evidence and lead to the least uncertainty. When uncertainty is great and tortfeasors are difficult to identify, plaintiffs face a complete denial of recovery under a threshold rule that sets a sufficiently high threshold probability. This will induce plaintiffs to invest more in developing evidence and identifying the true injurers. In contrast, under a market share regime, plaintiffs need not invest in identifying the true injurers, since they are fully compensated regardless of the degree of uncertainty. (Of course, if the defendant, rather than the plaintiff, were assumed to be the party that can develop superior evidence, then a market share rule will give the defendant the greatest incentives to bring evidence.) Again, ignoring the *ex ante* incentive effects of the rules and focusing on the *ex post* characteristics of the adjudicatory regime, a case is made for the threshold probability rule.

Apart from minimizing uncertainty and the *ex post* costs of uncertainty, the threshold probability approach may offer the additional advantage of reducing administrative costs. As Shavell (1987, p. 117) suggests, there are three distinct reasons that the administrative costs will likely be higher under the proportional liability approach. First, the volume of cases is likely to be higher under the proportional liability approach, because actions in which the probability of causation is less than the threshold could be brought. Second, more defendants could be sued in a typical case under the proportional approach, raising the costs of litigating the case. And third, litigation under the proportional approach requires the added judicial determination of the precise probability of the defendant being the cause of the injury, whereas under the threshold probability approach the only thing that matters is whether the probability of causation exceeds the threshold. Some of these excess costs may be diminished under the enforcement regime that Rosenberg (1984) has proposed, which borrows features from 'public law', such as class actions, damage scheduling, and insurance fund judgments.

3.9 The case for the proportional liability rule

The analysis so far has compared the two approaches to uncertainty over causation in terms of *ex post* measures of utility. But the main thrust of the economic approach to tort law is in assessing the *ex ante* effects of rules on primary behavior, that is, the *ex ante* effects. From this perspective, accuracy of adjudicatory outcomes and legal errors do not involve a welfare cost *per se*, and their minimization could perhaps be taken as a measure of

fairness but not as a proxy for optimal deterrence (Kaplow, 1994). So how do the two approaches fare in terms of the optimal deterrence criterion?

Shavell (1985, 1987, pp. 115–18, 123–6) argues that the threshold probability criterion distorts the incentives of parties to take care. If the probability of causation is systematically below the threshold probability, the party will face too little liability and will take less than optimal care. This problem of underdeterrence under the conventional threshold probability rule was labeled by Levmore (1990) and Farber (1990) as the problem of *recurring misses*. For example, if the probability of a party being the cause of a typical injury is systematically 40 percent (as in the case of a manufacturer holding a 40 percent share of the market for a harm-causing product), the party will always escape liability under the 50 percent threshold rule. The net of liability will miss this party repeatedly. Thus, the party will have no incentives to take care. The underinvestment result arises both under the negligence rule and under strict liability (see also Landes and Posner, 1987, pp. 263–9; Robinson, 1985).

Similarly, if the probability of causation is systematically assessed above the threshold, the injurer may have excessive incentives to take care. This distortion will arise under a strict liability regime, since the injurer will pay for all losses, more than it actually causes. The injurer may take excessive care for a subtle reason. Since the injurer pays for all losses only if he is determined to be the likely cause, the injurer will have an incentive to reduce the chance that this determination would be made. By taking excessive care, the injurer may be able to reduce the posterior probability that he will be designated as the likely cause of the injury. That is, extra care may shift the preponderance of probabilities, and clear the injurer from liability altogether. Notice that this overinvestment result will not arise under a negligence regime, since the injurer will take due care and will avoid the excessive liability (unless, of course, the level of due care is ill-defined). This is another illustration of the general proposition discussed in Section 3.6 above, that an unrestricted scope of liability – that is, liability for consequences that a party did not cause – does not in itself lead to distorted incentives, and only enhances the motive to take due care under a negligence regime.

In contrast to the distorted outcome under the threshold probability rule, the proportional liability approach leads to socially optimal levels of care (see Delgado, 1982; Rosenberg, 1984; Shavell, 1985, 1987, pp. 115–18; Levmore, 1990). The injurer faces expected liability equal to the expected loss associated with its behavior, and will behave as it would in the absence of uncertainty over causation. For example, a manufacturer who causes 40 percent of the harms of a particular type will pay for losses in every case, including the 60 percent of the cases which it did not cause. But in every

case its liability will equal 40 percent of the individual harm, thus it ends up bearing liability of 40 percent of the total harm, equal to the fraction it caused.

Another effect has to do with the incentives of parties to engage in the activity that produces the harm. Again, the threshold probability rule distorts *ex ante* incentives. When the probability of causation is systematically above the threshold, the injurer will be overdeterred from engaging in activity under the strict liability regime. (Under the negligence rule the injurer takes due care and escapes liability, thus engages in the same level of excessive activity as it does in the absence of uncertainty over causation; see Shavell, 1987, pp. 21–32.) Likewise, when the probability of causation is systematically below the threshold, the injurer escapes liability and, as a result, engages in excessive levels of activity, both under negligence and under strict liability. In contrast, under the proportional liability rule, the injurer's incentives to engage in the activity are the same as they would be in the absence of any uncertainty over causation. Further, the incentive to engage in activity depends on insurability of this activity, and it is plausible to suggest that proportional liability would be easier to insure because the insurer will only have to cover harm caused by the insured, not by others (Faure, 2003).

Several authors have argued that the market share approach may lead to a free-rider problem which will cause underinvestment in care. Marino (1991) demonstrated that care practiced by one firm produces benefits to other firms. By reducing the probability of harm associated with its products, a firm produces a positive externality captured by the other firms in the form of reduced expected liability. That is, each firm will underinvest in care because it bears the cost of care in full but can appropriate only a share of its benefits. The magnitude of this underinvestment will diminish as the firm's market share increases, and the underinvestment problem will disappear if the firm is a monopoly. This is an illustration of a general problem of the 'tragedy of common safety', in which care is viewed as a public good: it is produced by one party, but reduces liability on others as well (Dari-Mattiacci and Garoupa, 2008). In a similar spirit, other authors have argued that proportional liability will not generate optimal incentives for safety research. Delgado (1982) and Rose-Ackerman (1990) have pointed out the public good characteristics of safety improvements, and speculated that the infliction of full liability on an injurer who has the greatest opportunity to conduct safety research may be superior to the division of liability according to proportional causation. Moreover, it is suggested that proportional liability would be more costly to adjudicate since it implicates more parties and would require courts to verify factors affecting the probability of causation (Faure, 2003).

The dichotomy between the proportional liability approach and the all-or-nothing threshold probability approach reflects the tension between *ex ante* and *ex post* goals of the tort system. A framework that seeks to unite the two approaches has been offered recently by Porat and Stein (1997). Under this framework, a liability rule should be designed to give incentives to parties who are the *cheapest evidence providers*, to reduce the *ex post* uncertainty in assessing liability. The ingenious mechanism these authors examine is titled ‘liability for uncertainty’ – imposing liability for an injury whose cause is uncertain on the party that created or had the best opportunity to prevent that uncertainty. This will lead the parties to invest optimally in removing uncertainties, and when *ex post* uncertainty is eliminated, the ordinary liability mechanisms can operate to generate optimal incentives to reduce the primary damage. Thus, for example, DES manufacturers can either eliminate the uncertainty over causation (thus avoid liability for uncertainty), in which case the all-or-nothing approach will apply and will generate optimal care incentives, or the manufacturers can choose not to eliminate the uncertainty over causation, in which case they will be liable for the injuries based on their proportional contribution to the creation of uncertainty.

3.10 Risk-based liability and safety regulation

The market share approach is a doctrinal step away from the strict fundamentals of causation. But it is not the most radical step. With the growth of mass exposure torts, and due to the large degree of uncertainty over causation in these torts, authors have advocated an even more unorthodox legal mechanism which will practically abandon any causality requirement between the injurer’s action and actual harm. The idea is to structure a liability regime based solely on ‘probabilistic causation’. Under this regime, liability is proportional not to the harm itself, but rather to the *risk* of harm which the actor produces; it is applied regardless of whether this risk actually materializes. For example, an individual who uses a product and later discovers that she is under a particular risk, which may or may not develop into actual harm, may recover damages equal to her expected harm. Thus, liability is assigned strictly on the basis of the creation of unreasonable risk, independent of any injury. Contrary to the dominant role that the causation requirement was given in other influential theories (as in Epstein, 1973), here the causation element is essentially eliminated.

Robinson (1985) and Landes and Posner (1984, 1987, pp. 263–9) have argued that awarding the expected harm to each potential victim exposed to the risk of harm will create the proper incentives for injurers to take care and to select the correct activity levels. In the context of mass exposure accidents, and in light of the severity of risk-spreading and bankruptcy

concerns, this view has triggered serious attention (see, for example, Roe, 1984; Celli, 1990).

Viewed *ex post*, this approach gives many potential victims a windfall, as they are going to be compensated without actually suffering harm, as it is already known who suffered the harm. At the same time, actual victims will be undercompensated. Of course, the potential victims can use the recovery to pay for insurance, in which case they will be made whole. But viewed *ex ante*, this approach can provide superior incentives for care relative to other approaches that have to await the actual, oftentimes lagged, harm and, thus, dilute the deterrent force of liability. Obviously, a troubling aspect of a risk-based liability regime is its administrative costs. Litigation need not be conditional on occurrence of harm and thus could be more frequent, let alone more complicated (see Celli, 1990). At the same time, each victim is awarded only a fraction of the actual harm, which may reduce the incentives to take legal action and, consequently, will lead to underdeterrence.

A different approach to monitoring incentives in cases that pose inherent difficulties in ascertaining causation is a centralized approach, relying on administrative regulation to enforce optimal risk reduction. Several authors (Shavell, 1984, 1993; Cooter and Ulen, 1989, p. 420) have examined the advantages of relying on regulatory authorities to monitor and deter risk creation in the period before harm manifests itself. These authors have suggested that regulation of safety may perform better than a risk-based liability system in preventing mass torts. The main justifications for the superiority of a regulatory regime are: (1) the government may be a better information-gatherer than the injurer; (2) injurers may be judgment-proof in catastrophic harms, thus liability will not generate sufficient deterrence; (3) suits may not be brought in all cases, due to their costs and to victims' lack of information, thereby diluting the deterrent effect of liability; (4) administrative costs of decentralized liability regimes may be higher.

3.11 Causal apportionment among joint tortfeasors

Uncertainty over causation may involve another dimension. Apart from the difficulty of identifying the party whose act caused the particular accident, courts may face the difficulty of determining the relative causal *share* of each of several tortfeasors. There may be information as to the probabilistic contribution of each act – what *ex ante* risk each act imposes – and how the risks change when acts occur simultaneously. However, when two acts operate simultaneously to cause harm, the contribution of each act to the combined risk has to be determined before courts can apply either the threshold probability approach or the proportional liability approach. This determination involves a ‘disentanglement’ of the harm-production process, a logical exercise which has proven to be problematic.

To illustrate the problem, imagine two fires that are set simultaneously and independently and combine to destroy a field. It is estimated that, *ex ante*, the first fire alone had a 10 percent chance of destroying the field, the second fire alone had a 20 percent chance, and together they had a 50 percent chance of destruction. That is, their joint operation creates a synergistic effect. If both fires were set and the destruction occurred, how should liability be divided across the two 'causes'? Or, suppose a particular illness can be contracted either by use of a product (1 percent) or, independently, by smoking (4 percent). However, if an individual both uses the product and smokes, the risk increases to 15 percent. Again, a significant synergistic effect exists. What fraction of the harm can a smoker that has used the product recover from the manufacturer? In both examples, how should the synergistic effect arising from the multiple causes joined together be divided across the causal contributors?

The problem of allocating the shares of liability in accidents that have multiple causes is said to have 'generated a bewildering variety of legal rules and nomenclature' (Kaye and Aickin, 1984). Scholars expressed 'doubts that there exists a single factotum satisfactory formula for dividing damages' (Kruskal, 1986). For a valuable comparative law treatment of this problem, see Spier (2000). The first systematic treatment of the causal apportionment problem was offered by Rizzo and Arnold (1980) (see also Rizzo and Arnold, 1986), an apportionment scheme that assigns to each act a share of liability that consists of two elements. The first element is proportional to the act's 'marginal product', defined to be the probability of harm given this act operating alone. The second element is a fraction of the synergistic effect, which Rizzo and Arnold arbitrarily selected to be one half. In the two-fires example above, the first fire would be apportioned 40 percent, derived as follows: $10 + \frac{1}{2}(50 - 10 - 20)$, divided by 50. Similarly, the second fire is apportioned 60 percent of the harm.

Kaye and Aickin (1984) challenged the justifications for this apportionment scheme, arguing that Rizzo and Arnold's definition of an act's marginal product – the increase in the probability of harm, given this act operating alone – is no more appropriate than many other possible definitions, such as the incremental increase in the probability of harm, given that the other act is also operating. Since there is no one logical way to divide the synergistic effect across the acts, a causal apportionment scheme needs to be justified, not on the basis of intrinsic logic, but rather according to the incentive effects it generates (for a critique along similar lines, see Kruskal, 1986; Kelman, 1987; and Rose-Ackerman, 1990). An alternative to the Rizzo and Arnold method of defining an act's marginal product can be derived from the cooperative game-theory concept of the Shapley value. This method offers a more structured way to define an act's marginal

product, based on its expected marginal contribution to the probability of harm, *averaged* over all possible combinations of acts (see Ben-Shahar, 1996, for an unpublished working paper developing this scheme). While this approach enjoys some intuitive appeal that the previous method did not have, it has a similar shortcoming in its reluctance to consider the *ex ante* effects of the apportionment rule on the incentives for care among multiple tortfeasors.

When multiparties are responsible for an injury, there may not exist an apportionment rule that leads to efficient incentives *and* keeps total liability equal to harm. To provide the right incentives to all parties, damages exceeding full harm may need to be assigned (but see Young et al., 2007 for a formal analysis when damages need, and when they need not, exceed full harm). For example, Landes and Posner (1980, 1987, pp. 193–201) have focused on the effects of liability apportionment on incentives for care under the negligence regime. They have argued that joint tortfeasors can be led to take due care under a no-contribution rule – that is, a rule that makes each party liable for the entire damage and allows the victim to determine each tortfeasor’s liability share. If the total cost of care is less than the expected harm, at least one of the injurers will have the incentives to take due care (his cost of care is less than half the expected harm), thereby placing the entire liability on the other and leading the other to take due care as well (see also Wittman, 1981, for a related argument in a joint but sequential care setting). Thus, in the celebrated case of *Summers v. Tice*, 199 P.2d 1 (1948), where two hunters independently and simultaneously fired in the direction of a victim but only one (unidentified) hit, joint liability with no contribution will lead both to take optimal care. Notice that a doctrinal justification for making each hunter fully liable can be obtained through Porat and Stein’s (1997) idea of liability for uncertainty. Each hunter is liable since, but for his action, the apportionment difficulty would not have existed: either the fatal bullet was shot by him, in which case but for his action there would have been no injury, or the fatal bullet was shot by the other, in which case but for his action there would have been no uncertainty.

The problem with the negligence-based no contribution rule is that it may lead injurers to engage in excessive levels of activity. Miceli and Segerson (1991) study a different apportionment rule, one that would potentially lead joint tortfeasors to take efficient care and make efficient activity decisions. They propose a ‘decoupled’ strict liability regime, under which each tortfeasor pays a sum equal to the difference between actual damages and the damages that would have resulted were he inactive. That is, all tortfeasors are held strictly liable *simultaneously*, but each receives a ‘credit’ for the expected damages that would have occurred in his absence.

Since this rule may lead to payment exceeding actual harm, the excess can be paid as a fine to the state.

The problem of apportionment among joint tortfeasors is analytically identical to the problem of assigning liability to a single tortfeasor that increased an already existing risk. A doctor who administered a negligent treatment may have caused harm of \$1000. But if some other risk, say as high as \$250, would have been associated with the optimally cautious treatment, then this alternative risk ought to be offset and the doctor's liability should amount to \$750. This idea of offsetting the 'alternative' risk – of reducing liability by the harm that would have arisen otherwise – is developed in the most general tort context by Porat (2007). An injurer, he argues, should be liable only for the fraction of the harm that exceeds the lesser that would otherwise occur.

3.12 Foreseeability in tort law

Whether the objective probability of an accident is low or high should not in itself affect its inclusion or exclusion from the scope of liability. Even if the probability of the harmful consequence is very small, the act that is the cause of the increase in probability should carry liability. The effect on incentives to take care and on the level of activity will be correspondingly small, as it ought to be. In addition, the added expected administrative costs of adjudicating a low-probability event are small, since these costs will be incurred only with a small probability.

It can be argued, however, that in determining the incentive effects that any scope of liability generates, it is not the objective probability of harm that matters, but the subjective probability – the *ex ante* assessment of the possible consequences as it is made by the injurer. Calabresi (1975) was the first to state explicitly that there is no sense in trying to deter an act which is a necessary cause of the injury by threatening to impose liability on an injurer who assigns a subjective probability of zero to the injury. An injurer who does not foresee a harmful consequence cannot be meaningfully labeled the least-cost avoider. Whenever the subjective probability is very low in absolute terms, and lower than the objective probability in relative terms, liability will not produce sufficient *ex ante* behavioral effects to justify the increase in the costs of dispute resolutions (Shavell, 1980). Thus, under the doctrine of unforeseeability, accidents whose probabilities are likely to be underestimated by injurers should be excluded from the scope of liability. (But see Rizzo, 1981, for an alternative view, advocating the use of objective probabilities in determining the abnormality of events.)

It may be that an injurer does not foresee some specific low-probability consequences that subsequently materialize. However, the same injurer may still be in a position to associate an activity with unforeseen risks.

The injurer may recognize a large variance of outcomes even if it does not recognize the nature of each outcome in the distribution. In this case, assigning liability for unforeseen harms will have the desirable effect of reducing the level of an activity that is known, *ex ante*, to cluster many unforeseen risks (see Shavell, 1980; Landes and Posner, 1987, p. 250). For example, handing a loaded gun to a child leads to many unforeseeable risks (apart from the obvious ones), and can be deterred by imposing liability on this action. Of course, when injurers systematically fail to recognize the unforeseeable consequences of their actions, other forms of deterrence may be required, such as criminalizing the actions (see Calabresi, 1975).

The scope of liability for low-probability events has another important effect, in determining the incentives for potential injurers to investigate and contemplate the potential consequences of their actions. That is, the amount of information individuals have regarding risk and risk avoidance is endogenous, influenced in part by liability rules. The effects of liability rules on the incentives to acquire accurate information *ex ante* have been studied in more general contexts by several authors (see, for example, Kaplow and Shavell, 1992, 1996; Shavell, 1992; Ben-Shahar, 1999). Specifically, as the scope of liability for low-probability harms expands, individuals will have greater incentives to learn and anticipate these harms, and to take proper measures to avoid them (or liability for them). Thus, the unforeseeability doctrine should be replaced by a doctrine of 'expensive foreseeability': only risks that are too costly to anticipate and foresee will be excluded from the scope of liability. Therefore, in operating the hand formula to determine whether lack of care should be considered negligent, courts have to account not only for the direct costs of care, but also for the costs of figuring out the effects of care on harm (Calabresi, 1975; Grady, 1984; Landes and Posner, 1987, pp. 239–47).

Two prominent tort doctrines can further illustrate the role of foreseeability in monitoring incentives. The first doctrine distinguishes between *categories* of harms and can be illustrated by the well-known case of *Palsgraff v. Long Island RR* (162 NE 99 (1928)). In that case, as the result of a railroad employee's negligence, a parcel containing fireworks fell from the train, exploded and caused the crowd to panic and to knock down scales that were standing on the other platform, in a manner that injured a passenger. Since the employees did not know of the parcel's content, the court found the harm to be unforeseeable and outside the scope of negligence. This result is found by most economic writers to be justified (see Calabresi, 1975; Shavell, 1980; Landes and Posner, 1983, 1987, pp. 246–7). Since the injurer discounted the probability of that *type of accident*, liability would not have generated better incentives and would not have led

to prevention of the accident, or, if it did, at the cost of socially excessive investments to identify freak accidents.

Another well-known tort law doctrine is the *eggshell skull* doctrine, according to which courts impose liability for bodily harm equal to the full severity of the injury, even if the extent of the injury was unforeseeable due to a pre-existing condition of the victim. This may seem to contradict the basic economic insight, which established that when the probability of a high loss is systematically underestimated, holding the injurer liable for the total loss does not increase the incentive to take care. What is special about this case, however, is that there are symmetric cases of unforeseeable tolerance to harm, victims with ‘iron skulls’. If the law were to reduce the recovery of eggshell skull victims to the average societal level, it would have to correspondingly increase the recovery of iron skull victims to the average (that is, awarding these victims average damages despite the fact that such damages are known to overcompensate them). Put differently, if at the high end of the distribution of harms liability is capped, but at the low end of the distribution liability equals actual harm, average liability will fall short of average harm and the incentives for care will be diluted. As long as victims with low harms get their actual damages, victims with eggshell skulls should also get their full damages, to maintain the correct level of average liability *ex ante* (see Landes and Posner, 1983, 1987, pp. 249–50; Kaplow, 1994; Kaplow and Shavell, 1996). In addition, liability for an unlimited extent of injury may have a desirable activity-reducing effect, resulting from the injurer’s *de facto* strict liability.

3.13 Foreseeability in contract law

The doctrine of foreseeability in contract law operates to reduce the recovery by an aggrieved party below the full make-whole measure, to compensate only for consequential harms that are ‘normal’ and arise in the ‘natural course of things’. Illustrated famously by the case of *Hadley v. Baxendale* (9 Ex. 341, 156 ER 145 (1854)), a carrier who was hired to deliver a broken mill shaft to repair and failed to deliver it in time was *not* liable for the full harm from the delay, which in this case amounted to the lost profit from shutting down the mill for one week. The court reasoned that such severe consequences were not foreseeable – were special circumstances that were not ‘in the contemplation of the parties’. Courts have since adopted this test and excluded recovery for harms that do not arise ‘in the multitude of cases’, that ‘are not likely’, not ‘in the cards’, and so on.

Economic analysis can help clarify these infrequency or remoteness tests. The foreseeability limitation in contract law is equivalent to the causation requirement in tort law. The harm from breach is not foreseeable if breach is not the cause, in economic terms, of the harm. Breach is not the cause

of the harm if it did not increase the likelihood of the harm, or if other acts could have more cheaply reduced or prevented the harm. In *Hadley*, for example, breach did increase the likelihood of the actual harm that occurred, but it was the breached-against party, not the carrier, who was arguably the least-cost avoider. This party, the court reasoned, could have acted prudently by keeping a spare shaft, or by alerting the shipper to its idiosyncratic vulnerability, thereby enabling the shipper to tailor *ad hoc*, increased level of care. Ideally, carriers should increase their precautions when handling high-value shipments, but to avoid excessive investment on precautions for all other shipments, the high-value clients need to self-identify and purchase the added care. A foreseeability limitation is the law's way to induce this separating outcome (Bebchuk and Shavell, 1991).

An aggrieved party will bump against the foreseeability limitation when he could have taken some added precaution to limit the extent of the harm suffered, and when these added precautions constitute the least-cost avoidance measure. In another well-known case, *Evra v. Swiss Bank* (673 F.2d 951 (7th Cir. 1982)), a bank was instructed by a client to make a timely payment, but negligently executed the payment a few days late. The client suffered huge consequential loss, because the late payment led to the loss of a profitable transaction. The court – Judge Posner – held that this loss was not foreseeable because the client could have more cheaply avoided such risks of late payments. The client, knowing that the transaction requires timely payment, should have acted more prudently and ordered payment a day or two earlier, to account for the possibility of delayed execution. Interestingly, this case lies on the intersection between contracts and torts. Technically, it was a tort case, since the client did not have a contractual relation with the bank (the bank was merely an agent of the client's bank). Thus, within tort doctrine, the client failed to prove causation: the client's contributory fault was the primary cause for the harm. But the rhetoric of the decision is contractual, building on the *Hadley v. Baxendale* doctrine and contract law's foreseeability limitation. From an economic perspective, the two doctrines are founded on the same rationale.

The idea of prospective causation discussed in Section 3.3 can be illustrated in a striking way within the foreseeability doctrine of contract law. In the English case of *The Heron II* (3 All ER 686 (1967)), a carrier was contracted to deliver a load of sugar, to arrive in Basrah by a specified date. Had the sugar arrived as promised, the client would have been able to sell it for the market price on that day. The carrier breached his promise, deviated from the course, and arrived nine days late, by which time the market price of sugar had dropped and the client lost substantial revenue in the sale of this lot. The court held that such a decline in price was foreseeable ('it was not unlikely') and allowed the client to recover its full consequential

loss. Economic analysis would suggest a different result, even without reference to vague concepts such as ‘economics loss’. As nicely discussed by Epstein (1989), *ex ante* a nine-day delay is not associated with a loss due to price decline, because the delay could have led to a symmetric price increase. If the carrier cannot recover the benefit in the event that the price increases due to delay, why should he be liable for the loss from a decrease? Even if the price is known to fluctuate, the best *ex ante* estimate of the later price is the earlier price. Thus, it would not be cost-justified to invest added precaution just to avoid such a delay (not to mention that the client could have sold the goods prior to arrival and avoided the price decline risk). The only expected loss from the nine-day delay was the time value of money, and recovery should have been limited to that. The greater measure of recovery places too great an incentive on the carrier to arrive in time, a cost which the client would not have wanted to pay, *ex ante*. To be sure, if the delay were associated with a systematic decline in price (as when a ship carrying pumpkins arrives after Hallowe’en), the loss ought to include the price drop. But when the price fluctuation is random, it ought to be ignored – it ought to be ruled out under the causation logic underlying the foreseeability doctrine.

3.14 Causation and litigation costs

The restriction on the scope of liability that the causation requirement embodies has, in itself, an ambiguous effect on the administrative costs of the legal system. A restricted scope leads to a lower volume of suits that are filed, saving the litigation costs in cases that are clearly outside the scope of liability. On the other hand, if the scope is unrestricted there may be fewer harms (through a reduction in the level of activity) and thus fewer suits, and each suit that is filed may be less costly to litigate, as there is no causation issue to resolve (see Shavell, 1980, 1987, p. 109; Landes and Posner, 1983).

Informational imperfections and their legal treatment have important effects on the costs of resolving disputes. When courts are uncertain about causation, a significant portion of the trial effort may be devoted to disentangling the causation process. Applying simple standards such as the ‘preponderance of the evidence’ rule may reduce administrative costs sufficiently so as to overshadow its inferior incentive effects. Similarly, when the court’s *ex post* assessment of the probability of harm exceeds the injurer’s *ex ante* assessment, the administrative costs of determining liability may tip the scale towards categorizing the harm as unforeseeable. Lastly, when causation is difficult to verify *ex post*, but probabilistic linkage is known to exist *ex ante*, the costs of decentralized dispute resolutions may exceed the costs of a centralized regulatory scheme, outlining the proper bounds of the civil liability system.

Bibliography

- Abel, Richard L. (1986), 'Should Tort Law Protect Property against Accidental Loss?', *San Diego Law Review*, 23, 79–123.
- Assmann, Heinz-Dieter (1988), 'Multikausale Schäden im deutschen Haftungsrecht (Multicausal Injuries in German Tort Law)', in Attila Fenyves and Hans-Leo Weyers (eds), *Multikausale Schäden im Modernen Haftungsrechten*, Frankfurt a.M.: Metzner, pp. 99–151.
- Barnes, David W. and Lynn A. Stout (1992), *Economic Analysis of Tort Law*, St Paul, MN: West Publishing Company.
- Bebchuk, Lucian Arye and Steven Shavell (1991), 'Information and the Scope of Liability for Breach of Contract: The Rule of Hadley vs. Baxendale', *Journal of Law, Economics, and Organisation*, 7, 284–312.
- Ben-Shahar, Omri (1996), 'Multiple Causation and the Shapley Value: A Note on Apportionment of Damages', Unpublished Manuscript, Tel-Aviv University.
- Borgo, John (1979), 'Causal Paradigms in Tort Law', *Journal of Legal Studies*, 8, 419–55.
- Burrows, Paul (1984), 'Tort and Tautology: The Logic of Restricting the Scope of Liability', *Journal of Legal Studies*, 13, 399–414.
- Calabresi, Guido (1975), 'Concerning Cause and the Law of Torts: An Essay for Harry Kalven', *University of Chicago Law Review*, 43, 69–100.
- Celli, Andrew G., Jr (1990), 'Toward a Risk Contribution Approach to Tortfeasor Identification and Multiple Causation Cases', *New York University Law Review*, 65, 635–92.
- Cooter, Robert D. (1987), 'Torts as the Union of Liberty and Efficiency: An Essay on Causation', *Chicago-Kent Law Review*, 63, 522–51.
- Cooter, Robert D. (1989a), 'Towards a Market in Unmatured Tort Claims', *University of Virginia Law Review*, 75, 383–411.
- Cooter, Robert D. (1989b), 'Punitive Damages for Deterrence: When and How Much?', *Alabama Law Review*, 40, 1143–96.
- Cooter, Robert D. and Thomas S. Ulen (1986), 'An Economic Case for Comparative Negligence', *New York University Law Review*, 61, 1067–110.
- Craswell, Richard and John E. Calfee (1986), 'Deterrence and Uncertain Legal Standards', *Journal of Law, Economics, and Organization*, 2, 279–303.
- Culp, Jerome M. (1986), 'Causation, Economists, and the Dinosaur: A Response to Professor Dray', *Law and Contemporary Problems*, 49 (3), 23–46.
- Delgado, Richard (1982), 'Beyond *Sindell*: Relaxation of Cause-in-fact Rules for Indeterminate Plaintiffs', *California Law Review*, 70, 881–908.
- Epstein, Richard A. (1979), 'Causation and Corrective Justice: A Reply to Two Critics', *Journal of Legal Studies*, 8, 477–504.
- Epstein, Richard A. (1987), 'Causation – in Context: An Afterword', *Chicago-Kent Law Review*, 63, 653–80.
- Farber, Daniel A. (1990), 'Recurring Misses', *Journal of Legal Studies*, 19, 727–37.
- Faure, Michael G. (2003), 'Causal Uncertainty, Joint and Several Liability, and Insurance', in H. Koziol and J. Spier (eds), *Tort and Insurance Law, Liber Amicorum Pierre Widmer*, Vienna: Springer, pp. 79–98.
- Grady, Mark F. (1983), 'A New Positive Theory of Negligence', *Yale Law Journal*, 92, 799–829.
- Grady, Mark F. (1984), 'Proximate Cause and the Law of Negligence', *Iowa Law Review*, 69, 537–73.
- Grady, Mark F. (1988), 'Discontinuities and Information Burdens: Review of the Economic Structure of Tort Law by William M. Landes and Richard A. Posner', *George Washington Law Review*, 56, 658 ff.
- Grady, Mark F. (1989), 'Untaken Precautions', *Journal of Legal Studies*, 18, 139–56.
- Kahan, Marcel (1989), 'Causation and Incentives to Take Care under the Negligence Rule', *Journal of Legal Studies*, 18, 427–47.

- Kaye, David (1982), 'The Limits of the Preponderance of the Evidence Standard: Justifiably Naked Statistical Evidence and Multiple Causation', *American Bar Foundation Research Journal*, 487–516.
- Kaye, David and Mikel Aickin (1984), 'A Comment on Causal Apportionment', *Journal of Legal Studies*, 13, 191–208.
- Kelman, Mark G. (1987), 'The Necessary Myth of Objective Causation Judgments in Liberal Political Theory', *Chicago-Kent Law Review*, 63, 579–637.
- Kruskal, William (1986), 'Terms of Reference: Singular Confusion about Multiple Causation', *Journal of Legal Studies*, 15, 427–36.
- Landes, William M. and Richard A. Posner (1983), 'Causation in Tort Law: An Economic Approach', *Journal of Legal Studies*, 12, 109–34.
- Landes, William M. and Richard A. Posner (1984), 'Tort Law as a Regulatory Regime for Catastrophic Personal Injuries', *Journal of Legal Studies*, 13, 417–34.
- Levmore, Saul (1990), 'Probabilistic Recoveries, Restitution, and Recurring Wrongs', *Journal of Legal Studies*, 19, 691–726.
- Marino, Anthony M. (1991), 'Market Share Liability and Economic Efficiency', *Southern Economic Journal*, 57, 667–75.
- Marks, Stephen V. (1994), 'Discontinuities, Causation, and Grady's Uncertainty Theorem', *Journal of Legal Studies*, 23, 287–301.
- Miceli, Thomas J. (1996), 'Cause in Fact, Proximate Cause, and the Hand Rule: Extending Grady's Positive Economic Theory of Negligence', *International Review of Law and Economics*, 16, 473–82.
- Miceli, Thomas J. and Kathleen Segerson (1991), 'Joint Liability in Torts: Marginal and Infra-Marginal Efficiency', *International Review of Law and Economics*, 11, 235–49.
- Moore, Michael S. (1987), 'Thomson's Preliminaries about Causation and Rights', *Chicago-Kent Law Review*, 63, 497–521.
- Polinsky, A. Mitchell (1972), 'Probabilistic Compensation Criteria', *Quarterly Journal of Economics*, 86, 407–25.
- Porat, Ariel and Alex Stein (1997), 'Liability for Uncertainty: Making Evidential Damage Actionable', *Cardozo Law Review*, 18, 1891–960.
- Posner, Richard A. (1979), 'Epstein's Tort Theory: A Critique', *Journal of Legal Studies*, 8, 457–75.
- Rizzo, Mario J. (1981), 'The Imputation Theory of Proximate Cause: An Economic Framework', *Georgia Law Review*, 15, 1007–38.
- Rizzo, Mario J. (ed.) (1987a), 'Symposium on Causation in the Law of Torts', *Chicago-Kent Law Review*, 63, 397–680.
- Rizzo, Mario J. (1987b), 'Foreword: Fundamentals of Causation', *Chicago-Kent Law Review*, 63, 397–406.
- Rizzo, Mario J. and Frank S. Arnold (1980), 'Causal Apportionment in Tort Law: An Economic Theory', *Columbia Law Review*, 85, 1399–429.
- Rizzo, Mario J. and Frank S. Arnold (1986), 'Causal Apportionment: Reply to the Critics', *Journal of Legal Studies*, 15, 219–26.
- Robinson, Glen O. (1985), 'Probabilistic Causation and Compensation for Tortious Risk', *Journal of Legal Studies*, 14, 779–98.
- Rose-Ackerman, Susan (1990), 'Market-Share Allocations in Tort Law: Strengths and Weaknesses', *Journal of Legal Studies*, 19, 739–46.
- Rosenberg, David M. (1984), 'The Causal Connection in Mass Exposure Cases: "Public Law" Vision of the Tort System', *Harvard Law Review*, 97, 849–929.
- Rossello, Carlo (1990), *Il danno Evitabile. La Misura della Responsabilità tra Diligenza ed Efficienza* (Avoidable Damage: The Measure of Liability Between Due Care and Efficiency), Padova: CEDAM, 320 p.
- Schwartz, Alan (1987), 'Causation in Private Tort Law: A Comment on Kelman', *Chicago-Kent Law Review*, 63, 639–51.
- Shavell, Steven (1980), 'An Analysis of Causation and the Scope of Liability in the Law of Torts', *Journal of Legal Studies*, 9, 463–516.

- Shavell, Steven (1985), 'Uncertainty over Causation and the Determination of Civil Liability', *Journal of Law and Economics*, 28, 587–609.
- Spier, Jaap (2000), *Unification of Tort Law: Causation*, The Hague: Kluwer Law.
- Thomson, Judith Jarvis (1987), 'Causality and Rights: Some Preliminaries', *Chicago-Kent Law Review*, 63, 471–96.
- Weinrib, Ernest J. (1987), 'Causation and Wrongdoing', *Chicago-Kent Law Review*, 63, 407–50.
- Wittman, Donald A. (1981), 'Optimal Pricing of Sequential Inputs: Last Clear Chance, Mitigation of Damages and Related Doctrines in the Law', *Journal of Legal Studies*, 10, 65–91.
- Wright, Richard W. (1985), 'Actual Causation vs. Probabilistic Linkage: The Bane of Economic Analysis', *Journal of Legal Studies*, 14, 435–56.
- Wright, Richard W. (1987), 'The Efficiency Theory of Causation and Responsibility: Unscientific Formalism and False Semantics', *Chicago-Kent Law Review*, 63, 553–78.
- Young, Robert, Michael Faure and Paul Fenn (2007), 'Multiple Tortfeasors: An Economic Analysis', *Review of Law & Economics*, 3 (1), Article 7, available at: <http://www.bepress.com/rle/vol3/iss1/art7>.

Other references

- Ben-Shahar, Omri (1995), 'Informed Courts, Uninformed Individuals, and the Economics of Judicial Hindsight', *Journal of Institutional and Theoretical Economics*, 151, 613–30.
- Ben-Shahar, Omri (1999), 'Should Products Liability be Based on Hindsight?', *Journal of Law, Economics, and Organization*, 14, 325–57.
- Brown, John P. (1973), 'Toward an Economic Theory of Liability', *Journal of Legal Studies*, 2, 323–50.
- Calabresi, Guido (1970), *The Costs of Accidents*, New Haven: Yale University Press.
- Coase, Ronald C. (1960), 'The Problem of Social Costs', *Journal of Law and Economics*, 3, 1–44.
- Cooter, Robert C. (1989), 'Punitive Damages for Deterrence: When and How Much?', *Alabama Law Review*, 40, 1143–96.
- Cooter, Robert D. and Thomas Ulen (1989), *Law and Economics*, New York: Harper Collins.
- Dari-Mattiacci, Giuseppe and Nuno Garoupa (2008), 'Least Cost Avoidance', *Journal of Law, Economics, and Organization*, forthcoming.
- Epstein, Richard (1973), 'A Theory of Strict Liability', *Journal of Legal Studies*, 2, 151–204.
- Epstein, Richard (1989), 'Beyond Foreseeability: Consequential Damages in the Law of Contract', *Journal of Legal Studies*, 18, 105–38.
- Hart, H.L.A. and Tony Honoré (1985), *Causation in the Law*, Oxford: Oxford University Press, 2nd edition.
- Honoré, Tony (1983), 'Causation and Remoteness of Damages', *International Encyclopedia of Comparative Law*, XI (1).
- Kaplow, Louis (1994), 'The Value of Accuracy in Adjudication: An Economic Analysis', *Journal of Legal Studies*, 23, 307–401.
- Kaplow, Louis and Steven Shavell (1992), 'Private versus Socially Optimal Provision of Ex Ante Legal Advice', *Journal of Law, Economics, and Organization*, 8, 317–20.
- Kaplow, Louis and Steven Shavell (1996), 'Accuracy in the Assessment of Damages', *Journal of Law and Economics*, 39, 191–209.
- Keeton, W. Page, Dan Dobbs, Robert Keeton and David Owen (1984), *Prosser and Keeton on Torts*, St Paul, MN: West Publishing Company, 5th edition.
- Landes, William M. and Richard A. Posner (1980), 'Joint and Multiple Tortfeasors: An Economic Analysis', *Journal of Legal Studies*, 9, 517–55.
- Landes, William M. and Richard A. Posner (1987), *The Economic Structure of Tort Law*, Cambridge, MA: Harvard University Press.
- Porat, Ariel (2007), 'Offsetting Risks', *Michigan Law Review*, 106, 243–76.

- Roe, Mark (1984), 'Bankruptcy and Mass Tort', *Columbia Law Review*, 84, 846–922.
- Shavell, Steven (1984), 'Liability for Harm versus Regulation of Safety', *Journal of Legal Studies*, 13, 357–74.
- Shavell, Steven (1987), *Economic Analysis of Accident Law*, Cambridge, MA: Harvard University Press.
- Shavell, Steven (1992), 'Liability and the Incentives to Obtain Information about Risk', *Journal of Legal Studies*, 21, 257–70.
- Shavell, Steven (1993), 'The Optimal Structure of Law Enforcement', *Journal of Law and Economics*, 36, 355–88.

Cases

- Berry v. Borough of Sugar Notch*, 43 A 240 (1899).
- City of Piqua v. Morris*, 120 NE 300 (1918).
- Evra Corp. v. Swiss Bank*, 673 F.2d 951 (7th Cir. 1982).
- Hadley v. Baxendale*, 9 Ex. 341, 156 ER 145 (1854).
- The Herron II*, 3 All ER 686 (1967).
- Palsgraff v. Long Island RR* 162 NE 99 (1928).
- Sindell v. Abbott Laboratories* 607 P.2d 924 (1980).
- Summers v. Tice*, 199 P.2d 1 (1948).

4 Joint and several liability

Lewis A. Kornhauser and Richard L. Revesz***

4.1 Introduction

The law and economics analysis of the comparison of joint and several liability with several only (non-joint) liability examines the relative incentives for both deterrence and settlement generated by the two rules and their fairness. Section 4.2 provides a brief background of the legal regimes. Sections 4.3 and 4.4 compare, respectively, the settlement and deterrence effects of the two rules. Section 4.5 considers the fairness of the two regimes.

4.2 Legal regimes

The rule of joint and several liability may apply to any situation in which the plaintiff's injury arises from the actions of multiple parties. Under joint and several liability, if the plaintiff litigates against many defendants and prevails against only one, it can recover its full damages from that defendant; if the plaintiff prevails against all defendants but some are insolvent, it can recover its full damages from the solvent defendants; and if the plaintiff prevails against all defendants and all are solvent, it can nonetheless choose to recover its full judgment from any defendant or to recover a portion from each. In contrast, under several only (non-joint) liability, the plaintiff can recover from a losing defendant only the share of the damages attributable to that defendant.

For joint and several liability, the legal regime needs to be specified further. As shown in Kornhauser and Revesz (1993), the various choices presented below can affect the economic analysis of the consequences of joint and several liability.

First, a right of contribution permits a defendant that has paid a disproportionately large share of the plaintiff's damages as a result of the application of joint and several liability to obtain compensation from a defendant that has paid a disproportionately small share of these damages. Absent a right of contribution, such reallocation is not possible. Second,

* Alfred B. Engelberg Professor of Law, New York University.

** Lawrence King Professor of Law and Dean of the School of Law, New York University

contribution shares are usually determined either *pro rata* (equal division among the defendants) or by reference to comparative fault.

Third, the question of an appropriate set-off rule arises when the plaintiff settles with one defendant and litigates against another. Under the *pro tanto* set-off rule, the plaintiff's claim against the non-settling defendants is reduced by the amount of the settlement. In contrast, under the apportioned share set-off rule (sometimes referred to as a proportional set-off rule), the plaintiff's claim against the non-settling defendants is reduced by the share of the liability attributable to the settling defendants.

Fourth, under the *pro tanto* set-off rule, when one defendant settles and the others litigate and ultimately lose, the question arises whether the settling defendant is protected from contribution actions by the losing litigants.

Fifth, the legal regime must also specify whether settling defendants are entitled to bring contribution actions against defendants who settled for less than their share of the liability.

Sixth, under the *pro tanto* set-off rule, if the plaintiff enters into an inadequately low settlement with one defendant, the other defendant is responsible for the shortfall if it litigates and loses. To protect the interests of non-settling defendants, courts sometimes require 'good faith' hearings on the adequacy of settlements.

Seventh, if the plaintiff joins all the joint tortfeasors in a single suit, its claims against all of them will be adjudicated in the same proceeding. If the plaintiff chooses not to join all the tortfeasors as defendants, the question arises whether a named defendant can join another tortfeasor as a third-party defendant. Otherwise, the named defendant would have to file a separate action for contribution after the adjudication of its liability to the plaintiff.

4.3. Settlements

The basic framework for the analysis of the impact of joint and several liability on settlements is set forth in Kornhauser and Revesz (1994a), which deals with two, fully solvent defendants, and Kornhauser and Revesz (1994b), which deals with potentially insolvent defendants. The discussion here begins by reference to a numerical example, as in Kornhauser and Revesz (1993 and 1995), which serves to illustrate in a straightforward manner the game-theoretic interactions generated by the competing rules. The extension to n defendants follows Kornhauser and Takeda (2007). As in these prior papers, we interpret the examples and the formalism in the context of firms that deposited waste at a site. For the analysis of settlement, we assume that a release of the waste into the environment has occurred and that the plaintiff (in the United States, generally the

Environmental Protection Agency) initiates an action against the defendants to recover the costs of clean-up, which we normalize (without loss of generality) to 1. We model the following rule of joint and several liability. First, there is a right of contribution among defendants found jointly and severally liable. Second, in contribution actions, the relevant shares are determined by reference to the amount of waste deposited at the site by the defendant. Third, following a settlement, the plaintiff's claim against the non-settling defendants is reduced by the amount of the settlement (a *pro tanto* set-off rule); the effects of different formulations of the apportioned share set-off rule are analyzed in Kornhauser and Revesz (1993, pp. 465–9) and Klerman (1996). Fourth, a settling defendant is protected from any contribution actions. Fifth, a settling defendant can bring contribution actions against non-settling defendants. Sixth, there is no detailed judicial supervision of the substantive adequacy of settlements. Seventh, the claims involving the joint tortfeasors are litigated together in a single proceeding. Kornhauser and Revesz (1993) show that the results derived here are robust to many changes in the legal regime governing joint and several liability.

To perform the comparison between joint and several liability on the one hand, and non-joint liability on the other, we consider a situation in which the plaintiff has a claim of \$100 against two defendants, Row and Column, each equally at fault. All the parties are risk neutral. We assume initially that the defendants are sufficiently solvent that they can satisfy the plaintiff's judgment. Later, we consider the effects of limited solvency.

The probability that the plaintiff will prevail against each defendant is 50 percent. All the parties have accurate information about this value and the costs of litigation are zero. As shown in Kornhauser and Revesz (1994a), the results derived here hold even if the two defendants were not equally at fault, if the plaintiff's probability of success were not 50 percent, and if litigation costs were not zero.

With respect to the relationship between the plaintiff's probabilities of success against the two defendants, we consider two polar situations. In the first, these probabilities are independent. Thus, the plaintiff's probability of success against one defendant is 50 percent regardless of whether the plaintiff has prevailed against, lost to, or settled with, the other defendant.

In the second case, the probabilities are perfectly correlated. Thus, if the plaintiff litigates against both defendants, it either prevails against both (with a probability of 50 percent) or loses to both (also with a probability of 50 percent).

The parties may either litigate or settle the claim. Settlement negotiations have the following structure. The plaintiff makes settlement offers to the two defendants. Row and Column decide simultaneously whether

to accept these offers. (The effects of different offer structures are examined in Donohue, 1994; the effects of ‘Mary Carter’ agreements between the plaintiff and a subgroup of defendants is analyzed in Bernstein and Klerman, 1995.) We assume that the defendants’ costs of coordinating their actions are sufficiently high that they act non-cooperatively. The plaintiff then litigates against the non-settling defendants, if any. We adopt the convention that, if a party is indifferent between settlement and litigation, it settles.

The central conclusion of our analysis is that the comparison of the settlement inducing properties of joint and several liability and non-joint liability depends critically on the correlation of the plaintiff’s probabilities of success. When these probabilities of success are independent, joint and several liability unambiguously discourages settlements, relative to several only liability. When, in contrast, these probabilities are perfectly correlated, joint and several liability has a more complex effect: it encourages settlement when the litigation costs are low but may discourage settlements when these costs are high. Earlier analyses had focused, implicitly, only on perfectly correlated probabilities (Easterbrook, Landes, and Posner, 1980; Polinsky and Shavell, 1981).

4.3.1 Several only liability

The analysis of the choice between settlement and litigation under several only liability is straightforward. The plaintiff’s expected recovery from litigation is \$50: it has a 50 percent probability of obtaining \$50 from each defendant; each defendant’s expected loss is therefore \$25. Absent litigation costs, the plaintiff and the defendants are indifferent between litigation and settlement. For any level of litigation costs, settlement becomes preferable. For example, if each party’s litigation costs were \$5, the plaintiff’s expected recovery from litigation would be only \$20 and each defendant’s expected loss would be \$30. The plaintiff and each defendant would prefer any settlement between \$20 and \$30 to litigation.

The result that under several only liability the parties are indifferent between settlement and litigation in the absence of litigation costs and prefer to settle for any level of litigation costs does not change if the defendants have limited solvency. Say, for example, that Row’s solvency is only \$20. Then, in the absence of litigation costs, the plaintiff and Row are indifferent between litigation and a settlement for the plaintiff’s expected recovery of \$10 (a 50 percent probability of recovering Row’s solvency of \$20). For any level of litigation costs, the parties prefer to settle. Thus, while limited solvency affects the expected value of the plaintiff’s claim as well as the amount at which the case would settle, it does not affect the choice between settlement and litigation.

4.3.2 Joint and several liability with two defendants

4.3.2.1 Independent probabilities As a consequence of joint and several liability, the plaintiff recovers its full damages not only if it prevails against both defendants but also if it prevails against one and loses to the other. When the plaintiff's probabilities of success against the two defendants are independent, each of four different scenarios carries a probability of 25 percent: that the plaintiff prevails against both defendants, that the plaintiff prevails against Row and loses to Column, that the plaintiff prevails against Column and loses to Row, and that the plaintiff loses to both defendants. In the first three cases, carrying an aggregate probability of 75 percent, the plaintiff recovers its full damages of \$100. Thus, its expected recovery from litigating with both defendants is \$75. In turn, each defendant's expected loss is \$37.50.

A risk-neutral plaintiff will not accept a settlement with both defendants that yields less than \$75, but would find acceptable an aggregate settlement for \$75 or more. What would happen if the plaintiff made settlement offers to the two defendants for \$37.50 each, so that its aggregate recovery was equal to the expected recovery of litigating against both defendants? If one defendant, say Row, accepted the offer, would the other defendant accept it as well? Column would accept the settlement only if its expected loss from litigation is at least \$37.50. Under the *pro tanto* set-off rule, Column's exposure in the event of litigation is reduced to \$62.50: the plaintiff's damages of \$100 minus Row's settlement of \$37.50. But Column faces only a 50 percent probability of losing the litigation. Thus, in light of Row's settlement, its expected loss from litigation is only \$31.25.

It therefore follows that if the plaintiff were to make offers of \$37.50 to each defendant, at least one of them would reject the offer. The plaintiff's expected recovery would then be \$68.75 (Row's settlement of \$37.50 plus an expected recovery of \$31.25 from litigating against Column). This amount is lower than the plaintiff's expected recovery from litigating against both defendants. Thus, the plaintiff would never make offers of \$37.50 to each defendant. Similar logic establishes that no other pair of offers would give the plaintiff an expected recovery of at least \$75 and yet be acceptable to the two defendants. Also, there is no scenario under which the plaintiff would receive an expected recovery of at least \$75 by settling with one defendant and litigating against the other.

This phenomenon has two sources (1) the surplus that the plaintiff obtains from litigation as a result of joint and several liability when its probabilities of success against the defendants are independent, and (2) the benefit that a non-settling defendant receives from the set-off created by the plaintiff's settlement with the other defendant.

If the plaintiff were litigating against only one defendant rather than two, its expected recovery from litigation would be \$50 rather than \$75: it would have a 50 percent probability of recovering from that defendant its full damages of \$100. Similarly, as we have indicated, if the plaintiff were litigating against two defendants under non-joint liability, its expected recovery would also be \$50: it has a 50 percent probability of recovering \$50 from each of the defendants. Finally, if the plaintiff were litigating against two defendants under joint and several liability but its probabilities of success against the defendants were perfectly correlated, it would also have an expected recovery of only \$50 (a 50 percent probability of recovering its full damages if it prevails against both defendants).

As a result of the surplus that the plaintiff obtains from litigating under joint and several liability when the probabilities of prevailing are independent, the plaintiff will not accept from one defendant a settlement that is too low even if it intends to litigate against the other. Say, for example, that the plaintiff accepted a settlement of \$0 from Row and litigated against Column. Its expected recovery would then be only \$50 (a 50 percent probability of recovering \$100); the settlement with Row would have reduced its expected recovery by \$25. If the plaintiff accepted a settlement of \$10 from Row, its expected recovery from litigating against Column would be \$45 (a 50 percent probability of recovering \$90), for a total expected recovery of \$55; the loss from the low settlement with Row would be \$20.

So as not to lose its surplus, the plaintiff would thus have to demand a sufficiently high settlement from Row. But a settlement that is sufficiently desirable for the plaintiff to accept confers a benefit upon Column. If, for example, the plaintiff were to settle with Row for \$25, Column's expected loss from litigation would be \$37.50 – the same expected loss as if Row litigated. Any higher settlement with Row reduces Column's expected loss. We have already shown that a settlement with Row for \$37.50 reduces Column's expected loss from \$37.50 to \$31.25, giving it a benefit of \$6.25. In order to recover \$75, the plaintiff would have to obtain from Row a settlement of \$50 (which would leave an expected recovery from Column of \$25 and confer upon Column a benefit of \$12.50). Row, however, would not agree to such a settlement because, given that Column litigates, it is better off litigating as well and facing an expected loss of only \$37.50.

We have thus illustrated why the plaintiff cannot capture the full benefit of Row's settlement if its probabilities of success are independent. Part of this settlement confers an external benefit upon Column. It is this externality that stands in the way of settlement. Indeed, the only way in which the plaintiff can obtain the full benefit of a defendant's payment is by litigating, because if it settles part of the benefit accrues to the other defendant, reducing the plaintiff's expected recovery from litigation.

The role of joint and several liability in discouraging settlements is not limited to the case in which litigation costs are zero. The externality described above also impairs the possibility of settlement when litigation costs are positive but lower than a particular threshold.

4.3.2.2 Perfectly correlated probabilities The problem changes considerably when the plaintiff's probabilities of success against both defendants are perfectly correlated. If the plaintiff litigates against both defendants, it either prevails against both (with a probability of 50 percent) or loses to both (also with a probability of 50 percent). Its expected recovery from litigation is \$50 rather than \$75; each defendant's expected loss is then \$25.

In the case of perfectly correlated probabilities, the plaintiff will settle with both defendants. It is easy to see that the plaintiff will settle with at least one of the defendants. Say the plaintiff settles with Row for \$10, it faces a 50 percent probability of recovering \$90 from Column, and its total expected recovery is \$55 – \$5 higher than its recovery from litigating against both defendants. The effect of this settlement is to give the plaintiff \$10 with certainty, but reduces its expected recovery from litigation by only \$5. As a result, settlement with one defendant and litigation against the other is always more attractive to the plaintiff than litigation against both defendants. Unlike the case of several only liability, where the parties are indifferent between settlement and litigation when litigation costs are zero, here there is a positive surplus that the plaintiff and a defendant can divide if a settlement takes place.

It is also easy to show that, for the example that we are analyzing, the plaintiff in fact settles with both defendants, for \$25 and \$37.50, respectively. Given that Row settles for \$25, Column's expected loss through litigation is \$37.50 (a 50 percent probability of paying the plaintiff's damages of \$100 minus Row's settlement of \$25), and would therefore accept a settlement for that amount. Moreover, given that Column settles for \$37.50, Row's expected loss through litigation is \$31.25 (a 50 percent probability of paying the plaintiff's damages of \$100 minus Column's settlement of \$37.50), and would therefore prefer to settle for \$25. The same argument establishes that the plaintiff would be no better off settling with one defendant and litigating against the other.

We show elsewhere that, for perfectly correlated probabilities, the plaintiff settles with both defendants if their shares of the liability are sufficiently similar, and settles with one defendant – the one with the larger share of the liability – and litigates against the other if the defendants' shares of the liability are sufficiently different (Kornhauser and Revesz, 1994a).

4.3.2.3 The effects of limited solvency As indicated above, under several only liability, the limited solvency of the defendants does not affect the

choice between settlement and litigation. The situation is different under joint and several liability. We consider first how limited solvency would affect the choice between settlement and litigation if the plaintiff's probabilities of success are independent. If one of the defendants, say Row, has limited solvency, the plaintiff nonetheless litigates against both defendants if this solvency is above a threshold. For example, if Row's solvency is \$80 and the plaintiff litigates against both defendants, its expected recovery is \$37.50 from Column but only \$32.50 from Row (with a probability of 25 percent, the plaintiff prevails against both defendants and recovers \$50 from Row, and, also with a probability of 25 percent, the plaintiff prevails only against Row and recovers Row's solvency of \$80 rather than its full damages of \$100). In contrast, if the plaintiff settled with Column for \$37.50, Row's expected loss from litigation, and consequently the maximum settlement that it would offer, would be only \$31.25 (a 50 percent probability of paying the plaintiff's damages of \$100 minus Column's settlement of \$37.50).

When Row's solvency is sufficiently low, however, the plaintiff settles with both defendants. Consider the case in which Row's solvency is \$40. If the plaintiff litigates against both defendants, its expected recovery is \$60 (with a probability of 25 percent, it prevails only against Column and recovers \$100; with a probability of 25 percent, it prevails against both and recovers \$40 from Row and \$60 from Column; and with a probability of 25 percent, it prevails only against Row and recovers \$40). In turn, Row's expected loss is \$20 and Column's expected loss is \$40.

If the plaintiff offered Row a settlement of \$20, its expected recovery from Column is \$40 (a 50 percent probability of recovering its damages of \$100 minus Row's settlement of \$20), and Column would be willing to settle for this amount. In turn, if the plaintiff offered Column a settlement of \$40, its expected recovery from Row is \$20 (a 50 percent probability of recovering its solvency of \$40), and Row would be willing to settle for this amount. Thus, as in the case of non-joint liability, when the solvency of one of the defendants is sufficiently low and litigation costs are zero, the parties are indifferent between settling and litigating.

In summary, the result that joint and several liability discourages settlements when the plaintiff's probabilities of success are independent holds over a range of solvencies. A similar analysis (see Kornhauser and Revesz, 1994b) establishes that, when the plaintiff's probabilities of success are perfectly correlated, joint and several liability promotes settlements over a range of solvencies. For solvencies below a given threshold, however, joint and several liability has the same settling-inducing properties as non-joint liability. The relevant results are summarized in Table 4.1.

Table 4.1 *Effects of joint and several liability on settlements under different levels of solvency relative to several only liability*

	High solvency	Low solvency
Independent probabilities	Discourages settlement	Neutral effect
Perfectly correlated probabilities	Encourages settlement	Neutral effect

4.3.3 *Joint and several liability with $n > 2$ defendants*

Joint and several liability governs many situations in which more than two tortfeasors contribute to a harm suffered by a single individual. In the antitrust context, a price-fixing conspiracy may often involve more than two companies. Often, more than two generators deposit waste at a site that subsequently suffers a release of hazardous substances into the environment. Even a typical malpractice litigation may include a surgeon, an anaesthiologist, several nurses, and the hospital. It is therefore important to analyze the case $n > 2$. The cases of perfect positive correlation and independence among n defendants extend relatively straightforwardly. An extension to the general case, however, presents significant analytic problems.

The case $n = 2$ is simple because we may parameterize the space of 2×2 correlation matrices by the correlation in the closed interval $[-1, 1]$. The problem is thus one-dimensional. As n increases, however, the dimensionality of the problem apparently increases exponentially (at a rate of roughly $n(n-1)/2$). Further difficulties arise because characterizing the space of $n \times n$ correlations matrices is difficult. Indeed, as suggested by Budden et al. (2007), one cannot easily determine which positive hermitian $n \times n$ matrices are valid correlation matrices; the degree of correlation between the plaintiff's prospects of success against defendants 1 and 2 may constrain the correlations between defendants 1 and 3 and defendants 2 and 3.

Chang and Sigman (2000) introduced a special correlation structure which we, following Kornhauser and Takeda (2007), will call *group correlation*. In this structure, the n defendants fall into $1 < m < n$ groups. The plaintiff's prospects of success against the defendants within a group are perfectly correlated, but the plaintiff's prospects of success against the defendants in different groups are independent. This correlation structure may capture those situations in which a common set of facts establishes the liability of one group of defendants while another, independent set of facts establishes the liability of a second group. In the hazardous waste context, for example, one group of defendants may have used firm X to transport

and deposit the waste while a second set of defendants used firm *Y*. The records of firm *X* will provide evidence that the first group of defendants deposited at the site and the records of firm *Y* will provide evidence on the second group.

Within this correlation structure and when each defendant has an equal share of liability, Chang and Sigman showed that the plaintiff's return from settling with all the defendants exceeded her return from litigating against all the defendants. Unfortunately, settling with all the defendants, each of whom has an equal share, does not appear to be an equilibrium of this game when the plaintiff's prospects of success against a single defendant falls in a wide range. Kornhauser and Takeda (2007) provide a more complete analysis of the grouped correlation structure. They show that, when the plaintiff's prospects of success against any given group are sufficiently high, the plaintiff litigates against the member of each group with the smallest share and settles with all other defendants. The two-defendant case provides a reasonable intuition for this result. The grouped correlation structure combines the two extreme cases of independence and perfect correlation. The plaintiff's expected return from litigation rises with the number of groups against which she litigates. Litigating against more than one member of each group, however, does not increase her expected return from litigation. It thus pays for her to settle with all but one member of each group.

As p , the plaintiff's prospects of success against a single defendant, declines, however, this intuition misleads and other equilibria arise. The plaintiff reduces the number of groups against which she litigates from m to a smaller number. For sufficiently small p and for some distributions of shares, settlement with all may be optimal. In other cases, the plaintiff litigates against one member of some groups but settles with all members of remaining groups. Her return from settlement with additional parties outweighs the marginal increase in her expected return from litigation. The exact equilibrium depends not only on the plaintiff's probability of success against each group but also on the number of groups, the number of defendants, and the distribution of shares among the defendants.

In sum, the analysis of settlement reveals that, with a *pro tanto* set-off rule, the value of a claim under joint and several liability is higher than the value of a claim under several only liability. When the plaintiff's prospects of success against multiple defendants are not perfectly positively correlated, the value of a claim under joint and several liability exceeds its value under several only liability even with an apportioned set-off rule (which reduces the plaintiff's claim against litigating defendants by the shares of settling defendants). This conclusion implies that joint and several liability will have a greater deterrent effect than several only liability.

4.4 Deterrence: opening remarks

We compare here the deterrence effects of joint and several liability and several only liability, when coupled with rules of both negligence and strict liability. We perform the comparison first for cases in which the defendants are fully solvent (Kornhauser and Revesz, 1989), then consider the effects of exogenously given, limited solvency (Kornhauser and Revesz, 1990) and conclude with a brief discussion of the effects of endogenously given, but limited solvency.

We continue to develop our argument by reference to a model in which two firms, Row and Column, deposit hazardous wastes at a single landfill. The actors benefit from this dumping because the wastes are the by-product of profitable economic activity. At some time in the future, these wastes may leak into the environment and cause serious damage; we think of this damage as the cost of cleaning up the landfill and the surrounding area affected by the release. We take the damage function to be convex (the additional damage caused by one unit of waste increases with increasing amounts of waste in the landfill).

The expected damage of a release is a ‘social’ loss because it does not fall directly on the dumpers absent a legal provision shifting the liability to them. Instead, it falls on the victim that would have legal responsibility for the clean-up, or, alternatively, that would suffer the consequences if the problem were left unattended. Under our model, each dumper chooses the amount of waste that it will dump.

The socially desirable amount of waste is that which maximizes the social objective function: the sum of the benefits derived by the actors minus the social loss. An economically rational firm, however, does not make this decision based on the social objective function. Instead, it seeks to maximize its private objective function: the benefit that she derives from the activity that leads to the production of the waste minus whatever share of the social loss the legal regime allocates to her.

We model a joint and several liability regime with contribution shares determined by reference to the amount of waste dumped. (Other rules are considered in Landes and Posner, 1980; Kornhauser and Revesz, 1989; Tietenberg, 1989; and Wright, 1988, pp. 1169–79.) We assume that a plaintiff, say for example the government, sues both defendants in the same proceeding.

Our analysis of settlement in Part 4.3 has already established an important, perhaps the most important, difference in the deterrent effects of joint and several liability and several only liability. We saw that, regardless of the degree of correlation between plaintiff’s prospects of success against the two defendants, the value of a claim under joint and several liability exceeds the value of corresponding claims under a regime of

several only liability. As a first approximation, then, joint and several liability sets a higher price on malfeasance and consequently should have a greater deterrent effect than several only liability.

Two early papers that extended the work of Kornhauser and Revesz, Kahan (1996) and Spier (1994), noted this effect and some subtleties of it but it has not received adequate attention in the literature. Both Kahan and Spier restrict their attention to the case of perfect, positive correlation of probabilities. Spier assumes that the probability that the plaintiff prevails is independent of the level of care (or activity) in which the defendants engage. She finds that the ratio of the value of a claim under joint and several liability to the value of a claim under several only liability is inversely proportional to the plaintiff's (joint) prospects of success against the two defendants. For two defendants, when $p = 1$, the value of the claims is identical but as p goes to zero the ratio of the values goes to 2.

Kahan, by contrast, considers the case in which the defendants' actions (either of care or activity level) affect both the probability of an accident and the probability p that the plaintiff will prevail at trial. When $p = 0$ and $p = 1$, the value of the plaintiff's claims against the defendants is, for perfect positive correlation, identical under the two legal regimes. For all other p , however, the value of the plaintiff's claims under joint and several liability exceeds the value under several only liability. Deterrence, however, is determined by the marginal effects not the total effect and, in Kahan's model, joint and several liability might either over- or under-deter relative to several only liability.

Our analysis of settlement in Section 4.3 concluded that the value of the plaintiff's claims is always higher under joint and several liability than under several only liability. Consequently, Spier's conclusion that joint and several liability induces more deterrence than several only liability applies broadly when the plaintiff's prospects of success against each defendant are not influenced by the defendants' *ex ante* choices of care and activity levels. For the case of independence, the ratio of the two values is highest when $p = 0$ and equals 1 when $p = 1$.

In what follows, however, we make the counterfactual assumption that the value of the plaintiff's claims against defendants is uninfluenced by the liability rule. From this perspective, we find additional causes of variation in the deterrent effects of the two legal regimes.

4.4.1 *Full solvency*

4.4.1.1 *Negligence*

We assume in the case of negligence that the standard of care will be chosen at the level that maximizes social welfare;

departures from the social optimum in setting the standard of care are considered in Kornhauser and Revesz (1989, pp. 862–70). For expositional convenience, we assume that negligent actors are liable only for the losses that would have been prevented through due care (in this example, for the additional losses that result if a firm dumps more than the socially optimal amount, rather than the socially optimal amount). We show in Kornhauser and Revesz (1989) that essentially the same results hold if negligent actors are responsible for the full losses (even ones that would have occurred with due care). This argument shows that, under standard regularity conditions, it is a Nash equilibrium for each actor to meet its standard of care. As the standards of care are set at the socially optimal levels, this Nash equilibrium is efficient. We now show that this efficient Nash equilibrium is unique.

Under these circumstances, joint and several liability will produce the socially optimal result. If one of the actors, say Row, is non-negligent, it would not be rational for Column to be negligent. If this actor were contemplating dumping more than the standard of care, she would face liability for the full increase in the resulting damage. If the standard of care is set at the social optimum, the increased benefits that this actor would obtain through negligent conduct would be less than the increase in the damage for which she would be liable. Thus, assuming that one of the actors is non-negligent, the remaining actor will be non-negligent as well. Thus, an equilibrium in which both agents are negligent is not possible.

Now consider whether it would be rational for both actors to be negligent. These actors will, jointly, face liability equal to the full increase in the resulting damage. If negligent action on the part of these actors were preferable to non-negligent action for each of them, then the total social welfare would exceed that attainable when all actors meet the standard of care, which, once again, is not possible if the standard of care is set at the social optimum. Thus, regardless of how the increased damage was allocated between the defendants, at least one of them would have to pay more than the increased benefit that it obtained by acting negligently.

The analysis is different for a several only liability rule, under which a negligent defendant would not be liable for the share of the damage attributable to the non-negligent defendant. Instead, the negligent defendant would be liable for an amount proportional to the waste that it had dumped. Assume that Row is non-negligent and that Column is contemplating dumping more than the standard of care. Column would then pay only a fraction of the increase in damage. Under this apportionment rule, the remainder of the increase would be attributable to Row and would be unrecoverable by the plaintiff as a result of Row's lack of negligence. Thus, in this situation, several only liability leads to under-deterrence.

4.4.1.2 Strict liability The analysis is different for strict liability. Under strict liability, as long as both actors are fully solvent, there is no difference between joint and several liability and several only liability. Strict liability ensures that the victim is compensated for the full damage, and thus the question whether the victim will have to bear the share of the damage caused by the actions of non-negligent defendants does not arise.

Assume that Row is dumping the optimal amount of waste (the amount that would have met the standard of care if a rule of negligence had been in effect) and that Column is contemplating whether to dump more than this amount. Such a decision on the part of the Column would, of course, increase the damage to the victim. Column would, in turn, be liable for a larger share of the damage, as it would pay in proportion to the amount of waste that it dumped. As long as the damage function is convex, however, the increase in Column's liability is less than the increase in the social loss. Thus, Column's decision to dump more than the socially optimal amount has the effect of increasing Row's liability as well.

As a result of this externality, strict liability leads to under-deterrence, regardless of whether it is coupled with joint and several liability or several only liability.

Miceli and Segerson (1991) consider a modification of the strict liability rule that does in fact lead to efficiency in terms of both the level of care adopted and entry into the activity. Under their formulation, each actor is responsible for the marginal damage it causes. This rule, coupled with the assumption of convex costs, implies that total payments from two parties would exceed actual damages.

4.4.2 Limited, exogenously determined solvency

Here, each defendant is defined not only by its benefit function (the rate at which its generation of waste is transformed into net benefits) but also by a fixed solvency, which represents the actor's available amount of assets to offset her share of the social loss. Under this formulation of the problem, the actors cannot shed their solvencies over time. We present here the analysis for strict liability, which makes it possible to explain the basic intuitions. The comparison of joint and several liability and several only liability under negligence when the actors have limited solvency is presented in Kornhauser and Revesz (1990).

Consider a situation under which Row's solvency is zero and Column's solvency is infinite, and where both firms are otherwise identical. The liability rule thus transmits no deterrence incentive to Row. Thus, Row will dump to the point at which any additional benefit (in terms of reduced costs of production) from additional dumping becomes zero. This amount, which we call x^H , is greater than $x(\infty)$, the amount that Row would have

dumped if both defendants had been infinitely solvent. Note that, as a result of the under-deterrence caused by strict liability, discussed above, $x(\infty)$ is in turn larger than x^* , the socially optimal amount.

Under joint and several liability, because Row has no solvency, Column will be responsible for the whole liability and will dump an amount a (smaller than x^*), which is the optimal amount of dumping by Column conditional on Row being insolvent. The equilibrium is thus (x^H, a) . If Column is not infinitely solvent, there are two possible equilibria: (x^H, a) , if Column's solvency is greater than a critical solvency which we call s_{ij} , or (x^H, x^H) , if Column's solvency is lower.

In contrast, under several only liability, Column is not responsible for the whole liability, but only for its proportional share. If Column has infinite solvency, it will dump b , an amount larger than a , though smaller than x^* . Here, too, there are two possible equilibria if Column is not infinitely solvent: (x^H, b) , if Column's solvency is greater than a critical solvency which we call s_{nj} , or (x^H, x^H) , if Column's solvency is lower. Note that s_{nj} is smaller than s_j . Because for any level that Column dumps it faces less liability under a rule of several only liability, over a larger range of solvencies it chooses to act as if it were infinitely solvent rather than wholly insolvent. Table 4.2 summarizes the relevant equilibria.

Table 4.2 Equilibria under joint and several liability and several only liability

Region	Column's Solvency	Equilibria	
		Joint and Several Liability	Several only Liability
<i>A</i>	$0 - s_{nj}$	(x^H, x^H)	(x^H, x^H)
<i>B</i>	$s_{nj} - s_j$	(x^H, x^H)	(x^H, b)
<i>C</i>	$s_j - \infty$	(x^H, a)	(x^H, b)

From a social welfare perspective, an equilibrium at (x^H, a) , which occurs in certain instances under joint and several liability, is preferable to an equilibrium at (x^H, b) , which is sometimes the product of several only liability. When one actor is generating x^H , joint and several liability makes the other actor see the full social cost of its actions, whereas several only liability does not. Thus, a is the optimal response by Column to Row's choice of x^H . In region *C* in Table 4.1, joint and several liability is therefore preferable to several only liability.

In region *B*, however, the reverse is true. Joint and several liability induces Column to act in the same manner that it would if it were wholly

insolvent, dumping x^H , whereas several only liability induces Column to act in the same manner that it would if it were infinitely solvent, dumping b . Thus, in this region, several only liability has better social welfare properties. (Of course, in region A , both rules have the same properties.)

This discussion illustrates that, when solvency is exogenously given and limited, neither rule dominates the other. (The same is true under negligence (Kornhauser and Revesz, 1990).) The intuition behind this result is that Row's insolvency creates a 'domino' effect, leading Column, under certain circumstances, to act as if it were insolvent as well. Because under joint and several liability, Column is responsible for a greater proportion of the total harm, the range under which this 'domino' effect occurs is greater.

The analysis here and in Watts (1998) considers joint tortfeasors that are not in a contractual relationship with each other. Segerson (1994) considers the effect of joint and several liability on a landowner's level of discharge onto a piece of land when the owner may potentially sell the land to a third party. Both the initial landowner and the potential buyer are potentially insolvent with insolvency modeled, as in Watts (1998), as a probability of having no assets whatsoever. She finds that joint and several liability provides incentives to reduce contamination at least as great, and usually greater, than several only liability.

4.4.3 *Endogenous solvency*

The analysis of insolvency in Kornhauser and Revesz (1994b), Watts (1998), and Segerson (1994) is not fully satisfying because insolvency is given exogenously. In fact, economic theory suggests that firms will adjust their solvency in response to the legal rule. Indeed, Ringleb and Wiggins (1990) present evidence that firms, faced with potentially high tort liability, are less capital intensive than firms that do not face such liability.

Three articles have sought to make the solvency decision endogenous when tortfeasors have no contractual relation. Two of these, Yahya (2000) and Colpitts (2005), adopt a finance approach. They ask how the capital structure of the firm changes in the presence of joint and several liability. The third article, Klee and Kornhauser (2007), considers how joint and several liability influences the scale of the firm.

Consider first the finance models. Tort victims are involuntary creditors of the firm whose priority lies above equity but below secured credit. Clearly, in the case of a single, corporate tortfeasor, substituting debt for equity allows the firm to externalize some of the cost of the accidents the firm causes. Colpitts shows that the extent of potential liability influences the effects of joint and several liability on the firm's capital structure. When exogenously given, expected tort damages are low relative to the costs of bankruptcy, firms choose a capital structure that assures compensation for

tort victims when firm projects have high returns. As the expected costs of tort liability increase, however, firms increase the share of debt in their capital structures, thereby increasing the risk of insolvency.

In the simple model in Yahya (2000), the firm chooses both its capital structure and a risk of tort injury. He argues that negligence regimes dominate strict liability regimes because, at least for some levels of damage, negligence induces the firms to adopt more care. Neither regime – joint and several liability with negligence or several only liability with negligence – however, dominates the other.

In Klee and Kornhauser (2007), firms first choose their scale and then they choose their ‘capital intensity’. Thus, in this model, the legal regime influences the ‘solvency’ of the firm in two ways. First, it may influence the firm’s scale: the total amount of money it has available for payment to creditors in general and tort creditors in particular. Second, it may influence the probability that the firm goes insolvent as this probability depends on the firm’s capital intensity. Klee and Kornhauser show that both effects apply: firms are smaller in scale under joint and several liability than under several only liability and, for a given scale, they generate more waste because they are more likely to become insolvent. The net effect, however, remains open. Because firms under joint and several liability are smaller, it is logically possible that the industry causes less damage under joint and several liability than under several only liability.

Boyd and Ingberman (1997, 2003) have analyzed the problem when the originator of the threat is in contractual relations with another party. They reach similar conclusions. As in the prior case, joint and several liability encourages firms to externalize the risks they impose. As a consequence, under joint and several liability, firms have a lower capitalization and may increase output. An additional problem, however, arises. Firms now care about the capitalization of their partners; this concern might yield vertical integration. Nevertheless, in many instances, the greater incentives for care created by joint and several liability outweigh these costs and joint and several liability will yield higher welfare than several only liability.

4.5 Fairness: several remarks

The comparison of the relative fairness of joint and several liability and several only liability raises four principal issues (Kornhauser and Revesz, 1995). Three of these issues arise when the defendants are fully solvent: (1) the size of the plaintiff’s expected recovery when she litigates against the defendants; (2) the division of the plaintiff’s recovery among litigating defendants; and (3) the effects of settlements. A fourth issue arises when the defendants have limited solvency: the division of the burden of insolvency between the plaintiff and the solvent defendant (Wright, 1992). A question

relevant to all four issues is whether one should assess fairness *ex ante* (in terms of the parties' expected payments) or *ex post* (in terms of the actual payments in particular cases). We largely confine our remarks here to *ex ante* assessments.

4.6 Size of the plaintiff's recovery

First, as indicated in Section 4.4, except when the plaintiff's probabilities of success against the defendants are perfectly correlated, joint and several liability leads to a higher expected recovery than several only liability. Recall the example in which the plaintiff's damages are \$100 and her probabilities of success against each of the defendants are 50 percent, and the defendants are equally at fault and fully solvent. The plaintiff's expected recovery is \$50 under several only liability, \$50 under joint and several liability when the plaintiff's probabilities of success are perfectly correlated, and \$75 under joint and several liability when the plaintiff's probabilities of success are independent. (In the range between independence and perfect correlation, the plaintiff's recovery is between \$50 and \$75.)

Thus, except when the plaintiff's probabilities of success are perfectly correlated, an effect of joint and several liability is to transfer resources from the defendants to the plaintiff. The fairness consequence of this transfer depends upon why the plaintiff's probability of success against each of the defendants is only 50 percent. It could be that the defendants are in fact liable but that the plaintiff has difficulty in proving their liability. In this case, joint and several liability is attractive on fairness grounds because it brings a defendant's expected liability closer into line with the harm that is caused.

Alternatively, it could be that there is true uncertainty about whether the defendants are liable, and that this uncertainty is captured by the 50 percent probability that the plaintiff will succeed. Then, joint and several liability is undesirable because it increases a defendant's expected liability beyond the level of harm the defendant caused.

4.7 Division of the plaintiff's recovery

The second issue concerns the allocation of expected liability among litigating defendants. From this perspective, joint and several liability performs badly: it places a disproportionate burden on the defendant with the smaller share of the liability, except when the plaintiff's probabilities of success are perfectly correlated. Consider an example in which, instead of being equally at fault, Row and Column are 25 percent and 75 percent at fault, respectively; the plaintiff's probabilities of prevailing against each of the defendants remains at 50 percent and these probabilities are independent. There are then four possible scenarios, each carrying a probability of 25 percent:

1. the plaintiff prevails against both defendants and collects \$25 from Row and \$75 from Column;
2. the plaintiff prevails against Row and loses to Column, and collects \$100 from Row;
3. the plaintiff loses to Row and prevails against Column, and collects \$100 from column; and
4. the plaintiff loses to both defendants and does not recover anything

Thus, Row pays \$25 with probability 25 percent and \$100 with probability 25 percent; her expected liability is then \$31.25. In turn, Column pays \$75 with probability 25 percent and \$100 with probability 25 percent, and her expected liability is \$42.75. Thus, while Row's contribution to harm is only one-third that of Column's, her expected liability is about three-quarters that of Column's.

The preceding example shows that this disproportionate effect stems exclusively from the fact that under joint and several liability the plaintiff might prevail against the defendant with the lower responsibility for the harm but lose against the other defendant, and that the defendant with the lower responsibility is then required to pay the plaintiff's full damages. In contrast, under several only liability (and under joint and several liability when the plaintiff's probabilities of success are perfectly correlated), each defendant's expected liability is proportional to its responsibility for the harm.

4.8 The effects of settlements

The possibility of settlements introduces a third fairness issue, also by placing a disproportionate burden on the defendant with the smaller share of the liability. Indeed, for the legal regime analyzed in Section 4.4, which employs a *pro tanto* set-off rule, each defendant settles for the same amount, even when their shares of the harm are different. Consider the example in which the litigation costs are sufficiently high that they induce the parties to settle, and in which the plaintiff makes take-it-or-leave-it offers to the defendants.

The largest settlement that Row will accept, S_r , conditional on Column settling for S_c (which is less than the plaintiff's damages D) is given by

$$S_r = p(D - S_c) + t$$

Where p is the plaintiff's probability of success against each defendant, t is each defendant's litigation costs, and D are the plaintiff's damages. Similarly, the largest settlement that Row will accept, S_r , conditional on Column settling for S_r (which is less than the plaintiff's damages D) is given by

$$S_c = p(D - S_r) + t$$

Thus,

$$S_r = S_c = (Dp + t) / (1 + p)$$

As a result, when litigation costs are sufficiently high that the parties settle despite the independence of the plaintiff's probabilities of success, the plaintiff extracts from each defendant an equal settlement, regardless of the differences in the defendant's shares of the harm.

In contrast, recall that under several only liability, each defendant's expected liability is proportional to its responsibility for the harm. The plaintiff, if she made take-it-or-leave-it offers, could extract from each defendant in settlement this amount plus the defendant's litigation costs. If each defendant's litigation costs are independent of their share of the liability, the defendant with the smaller share will pay a disproportionate amount, but it will be less disproportionate than what she would have paid under joint and several liability.

4.9 Division of the burden of insolvency

The fourth fairness issue arises if one of the defendants has limited solvency. Our assessment of fairness here is neither fully *ex ante* nor fully *ex post*. A fully *ex ante* perspective would consider the likelihood that each defendant would become insolvent; instead our discussion assumes that one defendant is already insolvent. On the other hand, our discussion is not fully *ex post* because we assess fairness in terms of expected litigation (and settlement) outcomes.

We have studied elsewhere how the shortfall caused by the limited solvency of one defendant is allocated between the plaintiff and the remaining solvent defendant under joint and several liability (Kornhauser and Revesz, 1994b). That study revealed that, over a broad range of solvencies, the plaintiff bears the full shortfall, and it is never the case that the full shortfall is borne by the solvent defendant. This conclusion challenges the accepted wisdom that, under joint and several liability, the burden of one defendant's insolvency falls exclusively on its co-defendants (Sugarman, 1992).

The reason for the entrenchment of this erroneous view may be that judges and commentators implicitly consider only the situation in which the plaintiff's probabilities of success are perfectly correlated and the plaintiff litigates against both defendants. Then, any shortfall caused by one defendant's limited solvency is borne by the other defendant. If, however, the correlation of the probabilities is less than perfect, the plaintiff's

expected recovery is reduced because it might prevail only against the defendant with the limited solvency. Moreover, the focus on litigation overlooks the fact that settlement might occur. Thus, under joint and several liability, the shortfall caused by one defendant's limited solvency is generally shared between the solvent defendant and the plaintiff. In contrast, as shown in Section 4.4, under several only liability, the full shortfall is borne by the plaintiff.

4.10 Insurance under joint and several liability

The discussion thus far has ignored the existence of markets for insurance. Though commentators have asserted that joint and several liability undermines the market for insurance, particularly for environmental damage, there has been no systematic, economic analysis of the interaction of joint and several liability with insurance and insurance markets.

Critiques of joint and several liability from an insurance perspective (Abraham, 1988; Bergkamp, 2001; and Trebilcock, 1987) take two forms. The commentators argue first that joint and several liability creates legal uncertainty about the size of the prospective claim; consequently, joint and several liability increases the cost of insurance or prevents the market from forming. They argue second that joint and several liability is unfair because it may impose large amounts of liability upon parties that have had a relatively minor responsibility for the damage done.

We have addressed this latter complaint in the prior section and the presence of an insurance market does not alter our analysis. In this section, we offer some tentative remarks about three questions concerning how a regime of joint and several liability interacts with insurance markets: (1) How, if at all, would the presence of an insurance market affect the incentives of tortfeasors? (2) Would tortfeasors purchase insurance? And (3) Does joint and several liability reduce the likelihood that insurance markets will form? Our discussion is both cursory and tentative. As the prior analysis shows, the effects of joint and several liability may, as in the settlement context, depend on very subtle details of the actual regime. Without careful analysis, we cannot confidently assert how specific regimes of joint and several liability will function. Similarly, the interaction of joint and several liability will depend on the nature of the market for insurance and again the literature is largely silent about these details.

Consider first the effect of insurance on the incentives of tortfeasors. The literature on insurance for single tortfeasors shows that perfect, fair insurance has no effect on the incentive effects of liability rules. Insurance is fair when the premium equals the expected losses. Insurance is perfect when the insurer knows the precise risk that the insured poses; neither adverse selection nor moral hazard undermines the market. Of course, in real markets

insurance is neither perfect nor fair and the premium schedule will not perfectly communicate the incentives of the liability scheme. As risks will be pooled, some actors will be under-deterred and others over-deterred.

Consider next whether tortfeasors will purchase insurance. Again, the answer depends on the timing and size of the expected losses. If, as in the hazardous waste context, the potential loss is large and distant in time, the tortfeasor has little, if any, incentive to purchase insurance. Rather, she would rather take the money and run; that is, she would rather distribute the profits from the enterprise and leave no assets available to pay any subsequent tort claims. For smaller claims that occur contemporaneously with (or prior to) the accrual of profits from the enterprise, this strategy is not feasible and the tortfeasor has incentives to insure.

Finally, consider whether joint and several liability increases barriers to the formation of insurance markets. As Abraham (1988) and Trebilcock (1987) note, joint and several liability increases uncertainty about the size of the award that will be paid. As a consequence, one might expect the price of insurance to rise.

4.11 Conclusions

In sum, from the perspectives of inducing deterrence and inducing settlements, and promoting fairness, there is no dominant relationship between joint and several liability and several only liability. From a deterrence perspective, the comparison between the two rules turns on the levels of solvency of the defendants. In contrast, from settlement and fairness perspectives, the comparison turns on the correlation of the plaintiff's probabilities of success against the defendants.

Acknowledgements

This revises the initial entry in this Encyclopedia. Sections 4.2, 4.3 and 4.4 of the original entry also appeared in the entry on 'Joint and Several Liability' of *The New Palgrave Dictionary of Economics and the Law* (1998) published by Macmillan Reference Ltd/Stockton Press and appear here with the permission of the publisher.

Bibliography

- Abraham, Kenneth (1988), 'Environmental Liability and the Limits of Insurance', *Columbia Law Review*, 88, 942–88.
- Barnes, David W. and Mark Baerverstad (1982), 'Social Choices and Comparative Negligence', *DePaul Law Review*, 31, 273–306.
- Barnes, David W. and Lynn A. Stout (1992), *Economic Analysis of Tort Law*, St Paul, MN: West Publishing.
- Ben-Shahar, Omri and Alon Harel (1995), "'Blaming the Victim": Optimal Incentives for Private Precautions Against Crime', *Journal of Law, Economics, and Organization*, 11, 434–55.

- Bergkamp, Lucas (2001), *Liability and Environment*, The Hague: Kluwer Law International.
- Bernstein, Lisa and Daniel Klerman (1995), 'An Economic Analysis of Mary Carter Settlement Agreements', *Georgetown Law Journal*, 83, 2215–70.
- Boyd, James and Daniel E. Ingberman (1997), 'The Search for Deep Pockets: Is "Extended Liability" Expensive Liability?', *Journal of Law, Economics & Organization*, 13, 232–58.
- Boyd, James and Daniel E. Ingberman (2003), 'Fly by Night or Face the Music? Premature Dissolution and the Desirability of Extended Liability', *American Law and Economics Review*, 5, 189–232.
- Budden, Mark, Paul Hadavas, Lorrie Hoffman and Chris Pretz (2007), 'Generating Valid 4×4 Correlation Matrices', *Applied Mathematics E-Notes*, 7, 53–9.
- Chang, Howard and Hilary Sigman (2000), 'Incentives to Settle under Joint and Several Liability: An Empirical Analysis of Superfund Litigation', *Journal of Legal Studies*, 29, 205–36.
- Chung, Tai-Yeong (1993), 'Efficiency of Comparative Negligence: A Game Theoretic Analysis', *Journal of Legal Studies*, 22, 395–404.
- Colpitts, Jeffrey (2005), 'Tort Liability and Capital Structure', mimeo, Saunderson School of Business, University of British Columbia.
- Cooter, Robert D. and Thomas S. Ulen (1986), 'An Economic Case for Comparative Negligence', *New York University Law Review*, 81, 1067–110.
- Curran, Christopher (1992), 'The Spread of Comparative Negligence in the United States', *International Review of Law and Economics*, 12, 317–22.
- Curran, Christopher and David Haddock (1985), 'An Economic Theory of Comparative Negligence', *Journal of Legal Studies*, 14, 49–72.
- Donohue, John J. III (1994), 'The Effect of Joint and Several Liability on the Settlement Rate – Mathematical Symmetries and Metaissues about Rational Litigant Behavior: Comment', *Journal of Legal Studies*, 23, 543–58.
- Dopuch, Nicholas, Daniel E. Ingberman and Ronald King (1997), 'An Experimental Investigation of Multi-defendant Bargaining in Joint and Several and Proportional Liability Regimes', *Journal of Accounting and Economics*, 23, 189–221.
- Easterbrook, Frank H., William M. Landes and Richard A. Posner (1980), 'Contribution among Antitrust Defendants: A Legal and Economic Analysis', *Journal of Law and Economics*, 23, 331–67.
- Edlin, Aaron S. (1994), 'Efficient Standards of Due Care: Should Courts Find More Parties Negligent under Comparative Negligence?', *International Review of Law and Economics*, 14, 21–34.
- Flanigan, George B., Joseph E. Johnson, Daniel T. Winkler and William Ferguson (1989), 'Experience from Early Tort Reforms: Comparative Negligence since 1974', *Journal of Risk and Insurance*, 56, 525–34.
- Grady, Mark F. (1988), 'Common Law Control of Strategic Behavior: The Railroad and the Farmer', *Journal of Legal Studies*, 17, 15–42.
- Grady, Mark F. (1990), 'Multiple Tortfeasors and the Economy Prevention', *Journal of Legal Studies*, 19, 653–78.
- Haddock, David and Christopher Curran (1985), 'An Economic Theory of Comparative Negligence', *Journal of Legal Studies*, 14, 49–72.
- Kahan, Marcel (1996), 'The Incentive Effects of Settlements under Joint and Several Liability', *International Review of Law and Economics*, 16, 389–95.
- Klee, Elizabeth and Lewis Kornhauser (2007), 'Comparison of the Incentives for Insolvency under Different Legal Regimes', *Journal of Legal Studies*, 36, 141–70.
- Klerman, Daniel (1996), 'Settling Multidefendant Lawsuits: The Advantage of Conditional Setoff Rules', *Journal of Legal Studies*, 25, 445–62.
- Kornhauser, Lewis A. and Richard L. Revesz (1989), 'Sharing Damages among Multiple Tortfeasors', *Yale Law Journal*, 98, 831–84.
- Kornhauser, Lewis A. and Richard L. Revesz (1990), 'Apportioning Damages among Potentially Insolvent Actors', *Journal of Legal Studies*, 19, 617–51.

- Kornhauser, Lewis A. and Richard L. Revesz (1993), 'Settlements under Joint and Several Liability', *New York University Law Review*, 68, 427–93.
- Kornhauser, Lewis A. and Richard L. Revesz (1994a), 'Multidefendant Settlements: The Impact of Joint and Several Liability', *Journal of Legal Studies*, 23, 41–76.
- Kornhauser, Lewis A. and Richard L. Revesz (1994b), 'Multidefendant Settlements under Joint and Several Liability: The Problem of Insolvency', *Journal of Legal Studies*, 23, 517–42.
- Kornhauser, Lewis A. and Richard L. Revesz (1995), 'Evaluating the Effects of Alternative Superfund Liability Rules', in Richard L. Revesz and R. Stewart (eds), *Analyzing Superfund: Economics, Science, and Law*, Washington, DC: Resources for the Future.
- Kornhauser, Lewis A. and Keith Takeda (2007), 'N-Defendant Litigation and Settlement: The Impact of Joint and Several Liability', available at http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1019602.
- Kraakman, Reinier H. (1988), 'Auditor Liability and Information Disclosure: Discussion', *Journal of Accounting Auditing, and Finance*, 3, 341–8.
- Landes, William M. (1990), 'Insolvency and Joint Torts: A Comment', *Journal of Legal Studies*, 19, 679–90.
- Landes, William and Richard Posner (1980), 'Joint and Multiple Tortfeasors: An Economic Analysis', *Journal of Legal Studies*, 9, 517–55.
- Leong, A.K. (1989), 'Liability Rules When Injurers as Well as Victims Suffer Losses', *International Review of Law and Economics*, 9, 105–11.
- Low, Stuart and Janet Kiholm Smith (1992), 'The Relationship of Alternative Negligence Defense Rules to Litigation Behavior and Tort Claim Disposition', *Law and Social Inquiry*, 17, 63–87.
- Low, Stuart and Janet Kiholm Smith (1995), 'Decisions to Retain Attorneys and File Lawsuits: An Examination of the Comparative Negligence Rule in Accident Law', *Journal of Legal Studies*, 24, 535–57.
- Miceli, Thomas J., Katherine A. Pancak and C.F. Sirmans (1996), 'An Economic Analysis of Lead Paint Laws', *Journal of Real Estate Finance and Economics*, 12, 189–208.
- Miceli, Thomas J. and Kathleen Segerson (1991), 'Joint Liability in Torts: Marginal and Infra-marginal Efficiency', *International Review of Law and Economics*, 11, 235–49.
- Miceli, Thomas J. and Kathleen Segerson (1995), 'Defining Efficient Care: The Role of Income Distribution', *Journal of Legal Studies*, 24, 189–208.
- Orr, Daniel (1991), 'The Superiority of Comparative Negligence: Another Vote', *Journal of Legal Studies*, 20, 119–29.
- Polinsky, A. Mitchell and Steven Shavell (1981), 'Contribution and Claim Reduction among Antitrust Defendants: An Economic Analysis', *Stanford Law Review*, 33, 447–71.
- Rea, Samuel A., Jr (1987), 'The Economics of Comparative Negligence', *International Review of Law and Economics*, 7, 149–62.
- Ringleb, Al and Steven Wiggins (1990), 'Liability and Large-scale, Long-term Hazards', *The Journal of Political Economy*, 98, 574–95.
- Rubinfeld, Daniel L. (1987), 'The Efficiency of Comparative Negligence', *Journal of Legal Studies*, 16, 375–94.
- Schwartz, Gary T. (1978), 'Contributory and Comparative Negligence: A Reappraisal', *Yale Law Journal*, 87, 697–727.
- Segerson, Kathleen (1994) 'Property Transfers and Environmental Pollution: Incentive Effects of Alternative Policies', *Land Economics*, 70, 261–72.
- Shavell, Steven (1983), 'Torts in which Victim and Injurer Act Sequentially', *Journal of Law and Economics*, 26, 589–612.
- Spier, Kathryn E. (1994), 'A Note on Joint and Several Liability: Insolvency, Settlement, and Incentives', *Journal of Legal Studies*, 23, 559–68.
- Stanley, Timothy J. (1994), 'An Analysis of the Rules of Contribution and No Contribution for Joint and Several Liability in Conspiracy Cases', *Santa Clara Law Review*, 35, 1–122.
- Stout, Lynn A. and David D. Barnes (1992), *Economic Analysis of Tort Law*, St Paul, MN: West Publishing.

- Sugarman, Stephen D. (1992), 'A Restatement of Torts', *Stanford Law Review*, 44, 1163–208.
- Sullivan, Arthur M. (1990), 'Victim Compensation Revisited: Efficiency versus Equity in the Siting of Noxious Facilities', *Journal of Public Economics*, 41, 211–25.
- Thomas, Ewart A.C. (1985), 'On Calculating Optimal Contributory Negligence Rules', *Social Choice and Welfare*, 2, 65–85.
- Tietenberg, T. (1989), 'Indivisible Toxic Torts: The Economics of Joint and Several Liability', *Land Economics*, 65, 305–19.
- Trebilcock, Michael J. (1987), 'The Social Insurance Dilemma of Modern North American Tort Law: A Canadian Perspective on the Liability Insurance Crisis', *San Diego Law Review*, 24, 929–1002.
- Watts, Alison (1998), 'Insolvency and Division of Cleanup Costs', *International Review of Law and Economics*, 18, 61–76.
- White, Michelle J. (1989), 'An Empirical Test of the Comparative and Contributory Negligence Rules in Accident Law', *Rand Journal of Economics*, 20, 308–30.
- Winter, Harold (1994), 'Sequential Torts with Imperfect Information', *International Review of Law and Economics*, 14, 35–40.
- Wittman, Donald A., Daniel Friedman, Stephanie Crevier and Aaron Braskin (1997), 'Learning Liability Rules', *Journal of Legal Studies*, 16, 145–64.
- Wright, Richard (1988), 'Allocating Liability among Multiple Responsible Causes: A Principled Defense of Joint and Several Liability for Actual Harm and Joint Exposure', *University of California at Davis Law Review*, 21, 1141–211.
- Wright, Richard W. (1992), 'The Logic and Fairness of Joint and Several Liability', *Memphis State University Law Review*, 23, 45–84.
- Yahya, M. (2000), *Capital Structure in the Law and Regulation*, unpublished Ph.D. dissertation, University of Toronto.

5 Vicarious and corporate civil liability

*Reinier H. Kraakman**

5.1 Introduction

‘Vicarious liability’ is the absolute liability of one party – generally the legal ‘principal’ – for misconduct of another party – her ‘agent’ – the actor whose activities she directs. As such, traditional vicarious liability is a form of strict secondary liability, in contrast to secondary liability imposed on principals or other parties under a duty-based standard such as negligence. In the common law, the legal doctrine of *respondeat superior* is the principal vehicle for holding principals liable for the torts and other delicts of their agents. Under this doctrine, principals are jointly and severally liable for the wrongs committed within the ‘scope of employment’ by agents whose behavior they have the legal right to control (‘servants’). For the US, see Restatement (Second) of Agency, §§ 2, 219 (1958), 220, 229; and Restatement (Third) of Agency, § 7.07 (2006). Not only is English law similar (Rogers, 2002), but most Civil Code jurisdictions have inherited an almost identical rule of vicarious liability for torts from article 1384 (subsection 3) of the Napoleonic *Code Civil* of 1804. See generally, Spier (2002).

Thus, most corporate liability for torts, and in the United States for corporate crimes as well, is vicarious liability imposed under *respondeat superior* or its civil law analogues. To be sure, corporate liability may also be direct, as when the independent actions of several corporate agents cumulatively result in a business tort, although no single agent is individually culpable. But even in this case, the liability of corporate principals is best conceptualized as vicarious liability for the failure of the firm’s management to supervise its employees.

An overview of the literature on vicarious and corporate civil liability must address at least six areas of commentary: (a) the standard case for strict vicarious liability; (b) the factors militating against vicarious liability; (c) the interaction between vicarious liability and the structure of liability for agents; (d) alternatives to a strict vicarious liability standard; (e) alternative targets for vicarious liability; and (f) the choice between civil and criminal corporate liability.

* Ezra Ripley Thayer Professor of Law, Harvard Law School. © Copyright 2008 Reinier H. Kraakman.

5.2 The standard case for vicarious liability

The initial issue raised by a regime of vicarious liability for torts is the Coasian question: why should an allocation of liability between principals and agents matter if these parties are able to reallocate liability among themselves by agreement? The fundamental analysis of vicarious liability, developed with the aid of principal–agent models by Kornhauser (1982) and Sykes (1981, 1984), looks to the insolvency of agents and to the limitations on the ability of the parties to shift liability as the basic conditions favoring vicarious liability. As a general matter, Kornhauser (1982), Sykes (1984) and Shavell (1987) agree that vicarious liability for ordinary torts is more likely to increase social welfare as the disparity between agent assets and the magnitude of prospective tort liability increases. By contrast, where tort liability would leave both principals and agents solvent and the costs of negotiation between principals and agents are slight, vicarious liability is likely to have few efficiency consequences (see, for example, Kornhauser, 1982, pp. 1351–2; Sykes, 1984, p. 1241). Nevertheless, when principals are knowledgeable about tort risks and agents are not, vicarious liability can be efficient even if both parties are solvent – as when, for example, principals can monitor their agents but cannot convey their knowledge of risk to their agents directly.¹

Given that principals can satisfy prospective tort liability but agents cannot, vicarious liability may or may not be efficient. Consider first the considerations that weigh in favor of vicarious liability when agents are insolvent but corporate principals are not.

To begin, the likely efficiency of vicarious liability increases with the ability of principals to monitor and control agent risk-taking. The analysis is straightforward. Absent vicarious liability, personal liability gives insolvent agents insufficient incentive to take care, since they lack the wealth to pay tort damages (Sykes, 1981, p. 168; Shavell, 1987, pp. 170–171). Moreover, their principals have no incentive to urge greater care, since the only liability cost they face (in the absence of secondary liability) is the wage expense of offsetting agents' expected liability costs – which, by assumption, are small. Thus, under a regime of purely personal liability, insolvent agents will lead firms that are otherwise able to monitor their agents to take too little care and/or to initiate too much risky activity or misconduct. By contrast, these principals will seek to control their agents to ensure optimal precautionary measures if they are vicariously liable

¹ Shavell (2007) offers the example of holding a parent vicariously liable for a motorboat accident caused by a teenage child who is unaware of the hazards associated with operating motorboats.

for their agents' actions. Correlatively, of course, vicarious liability is less likely to be efficient if principals are poor monitors of their agents' behavior (see, for example, Epstein and Sykes, 2001; Shavell, 2007; and Posner and Sykes, 2007).

The traditional doctrine of *respondeat superior* fully accords with this analysis by linking vicarious liability explicitly to the principal's costs of monitoring or otherwise controlling employee behavior (Landes and Posner, 1987, p. 208). For example, agency law determines the principal's tort liability based not only on her capacity to monitor her agent's actions but also on her ability to contractually alter her agent's incentives, as when the scope of employment rules condition vicarious liability on whether the culpable agent acted, at least in part, to benefit his principal (Restatement (Second) of Agency, 1958, § 228(1)(c); Restatement (Third) of Agency, 2006, § 7.07(2)).

Apart from inducing principals to control agent misconduct through monitoring and preventive measures, vicarious liability can also force principals to internalize the costs of misconduct when agents are judgment proof. All else equal, forcing firms to internalize the costs of corporate misconduct leads to an efficient scale of production as private costs come to equal the social costs of firm activity (see, for example, Shavell, 1980; Kramer and Sykes, 1987, p. 286). Thus, even if principals cannot control caretaking by their agents, vicarious liability ensures that they at least face the full expected costs of wrongdoing, and so do not undertake too much risky activity – providing, of course, that their agents are also strictly liable for the underlying harms at issue (Polinsky and Shavell, 1993).

As Shavell (1987, pp. 173–4) notes, moreover, several other considerations also favor a rule of vicarious liability. First, as mentioned earlier, principals may be better informed than agents about accident risks, or better able to limit these risks by reorganizing the workplace. Second, principals – and particularly firms – may be better able to monitor and discipline agents than the courts. Thus, vicarious liability may be socially advantageous if principals are less likely than courts to err in reviewing agent conduct. Third, principals may be more attractive targets of liability as a consequence of what Kornhauser (1982, pp. 1370–71) terms the problem of 'multiple agents'. That is, an outside plaintiff may find the task of determining which of a firm's many agents has caused a tort extremely costly, even when one of the firm's agents is clearly responsible. But if the firm faces liability, it may be able to locate and discipline the culpable agent – or, even if it cannot, it may be able to reduce tort costs through other means such as training programs or screening measures. Fourth, as most commentators acknowledge, shifting liability to principals under a vicarious liability rule is likely to reduce risk-bearing costs, at least in the

paradigmatic case where agents are risk averse or insolvent, principals are firms, and victims are risk-averse individuals (for example, Kramer and Sykes, 1987, p. 278; Chapman, 1996).

Finally, in addition to the justifications for vicarious liability resting on the assumption of rational, utility-maximizing actors, some commentators have proposed justifications based on limited or defective rationality, particularly on the part of corporate agents (for example, Croley, 1996; Schwartz, 1996a). In these accounts, defective rationality blunts the incentive effects of liability on wayward agents, much as insolvency, or external constraints on sanctions, can limit the power of liability to deter agents in more conventional accounts of vicarious liability.

5.3 Factors militating against strict vicarious liability

Although the preceding considerations make a persuasive case for imposing vicarious liability in many circumstances, they also point to several factors that weigh against doing so. Agents who are knowledgeable and well-capitalized (especially in relationship to their principals) are better left to bear full personal liability for business torts on both incentive and risk-bearing grounds. As Shavell (1987, p. 174) argues, apart from the conventional context of delicts committed by the employees of large enterprises, ‘there is no natural presumption’ about the comparative capitalization of principals and agents – or about the ability of principals to observe the loss avoidance behavior of agents. Imposing liability on principals who cannot monitor their agents is unlikely to reduce accident costs and, as Sykes (1984, p. 1249) notes, may actually decrease safety by lowering the expected liability of agents for their own negligence. Finally, most commentators agree that whatever the advantages of vicarious liability in deterring misconduct, it clearly increases costs of administering the tort system by including additional defendants in litigation (Epstein and Sykes, 2001).

Depending on the nature of agent misconduct, vicarious liability may sometimes be inappropriate even in the context of large firms. One example arises when senior managers intentionally release fraudulent information into the capital market to protect their jobs or secure personal benefits. As Arlen and Carney (1992) note, vicarious liability is unlikely to deter top managers, who are otherwise charged with supervising the firm, when these managers are trapped in an end game and take desperate measures to avoid bankruptcy. Further, the risk-bearing rationale for imposing liability on the firm rather than on its agents is weak for such self-conscious misconduct because managers can avoid risk of liability simply by refraining from making misleading statements. Finally, making the firm liable for damages inflicted by its top managers on a subset of its own investors has perverse

consequences. Absent strong evidence that such liability leads managers to monitor one another, its effect is simply to shift assets (net of litigation expenses) from one class of innocent investors to another. In large part for these reasons, '[W]hat is most notable [today] is how many scholars from across the ideological spectrum have now joined the doubters of enterprise liability, at least with respect to private securities litigation' (Langevoort, 2007, at p. 629; see also Coffee, 2006). An open question that remains, however, is that the costs that one firm's misrepresentations impose on similar market-traded firms might provide an alternative rationale for enterprise liability.

Arlen (1994) also identifies a second circumstance in which holding firms vicariously liable for their agents' intentional wrongdoing can generate perverse incentives and increase enforcement costs. Where an agent's misconduct is difficult to detect, her firm is likely to enjoy a considerable advantage over outsiders in monitoring for it. Yet the firm will not monitor optimally under a vicarious liability regime – and may not monitor at all – if the information that the firm acquires by monitoring increases its own probability of incurring vicarious liability. The reason is straightforward: increased monitoring lowers the firm's expected liability costs by raising its ability to deter or prevent misconduct, but increased monitoring also raises the firm's expected liability costs by increasing the probability that, should misconduct occur, the firm will be held vicariously liable for it.

Although Arlen (1994) directs her analysis to corporate crimes, the 'potentially perverse' effect that she identifies extends to vicarious civil liability for torts that may be difficult to detect without monitoring by the principal. A related observation, made in Arlen and Kraakman (1997, pp. 712–17), is that a separate credibility problem arises where strict vicarious liability is used to induce firms to monitor or investigate misconduct. The crux of the problem is that, absent a commitment device such as reputation, firms may not have an incentive to actually monitor, or to investigate and report, misconduct after it has occurred. While threats to implement these measures would deter misconduct if they were credible, agents may not perceive them as such because of the costs they would impose, if implemented, on the monitoring firms themselves. In this case vicarious liability adds nothing to deterrence except enforcement costs and enhanced liability risks for firms. Put differently, some firms may be unable to make credible enforcement threats because wayward agents rightly suspect that implementing these threats would be acting against their interest. By contrast, an element of duty-based liability such as a negligence rule can assure the credibility of enforcement threats, just as it can overcome the perverse effects associated with traditional vicarious liability (Arlen and Kraakman, 1997, pp. 717–18).

An additional set of problems associated with strict vicarious liability arises in the context of legal entities such as governmental bodies and non-profit corporations or foundations which are not subject to ordinary market constraints. Without knowing the extent to which these institutions are optionally funded in the first instance, it is impossible to tell whether vicarious liability for harms committed by their agents will result in optimal caretaking and self-policing, or in efficient risk-bearing. For example, holding states liable for the actions of their agents or their citizens will result in the politically efficient level of monitoring but not in the socially efficient investment in monitoring (Posner and Sykes, 2007, pp. 87–93). Furthermore, vicarious liability is a poor instrument for regulating the activity levels of principals who function outside of market environments (see Kramer and Sykes, 1987, pp. 278–83). It is simply unclear how cost internalization affects the scale of the non-market enterprise – it might yield too much or too little activity (Kramer and Sykes, 1987, p. 286). For this reason, a duty-based or negligence-based liability regime might be preferred to strict vicarious liability for non-market entities such as cities (Kramer and Sykes, 1987, p. 294) – just as it might sometimes be preferable for rival firms where perverse incentive and credibility problems are severe.

Recent commentators also point to additional limitations on the vicarious liability doctrine as it is traditionally employed. Hamdani (2003) examines strict liability as a method of motivating ‘gatekeepers’, such as underwriters and accountants, to monitor their clients. Like other commentators, Hamdani reminds us that strict liability is efficient only to the extent that gatekeepers can detect wrongdoing by their clients (for analytical purposes, their ‘agents’). In addition, Hamdani underscores the risk of adverse selection in the market for gatekeeping services if gatekeepers cannot distinguish between law-abiding and high-risk clients *ex ante*, and charge for gatekeeping services accordingly. On a different tack, Arlen and MacLeod (2005) critique the traditional distinction between ‘servants’, whom the principal has a legal right to control, and ‘independent contractors’, whom the principal does not control (although they may be ‘agents’ in the legal sense), and therefore for whose misconduct the principal escapes vicarious liability under common law. As Arlen and MacLeod point out, this distinction encourages principals to adjust their organizational structure to minimize liability costs by relying on judgment-proof independent contractors, even if, under a regime of vicarious liability, they could mobilize the monitoring resources to greatly reduce social costs from their agents’ misconduct (ibid. at 139–40).

The principal’s power to evade liability by resorting to independent contractors closely parallels the ability of equity holders in corporations

or other limited-liability organizational forms to mold the legal structure of enterprises to minimize liability costs. For example, although there are well-established reasons for limiting shareholder liability for a company's contractual obligations, the case for limiting shareholder liability for the company's torts is at the very least contestable (see Hansmann and Kraakman, 1991). Among the arguments against limiting shareholder liability for tort costs is that this rule allows entrepreneurs to opt out of compensatory damage rules at will, either by assigning high-risk steps in the manufacturing process to subsidiaries, or by contracting with thinly capitalized but ostensibly independent companies precisely in order to externalize tort costs (*ibid.* at 1913–15).

Finally, Mattiacci and Parisi (2003) point out that vicarious liability regimes arbitrate between two 'third parties' – the principal and the injured party, who might be incentivized to control the costs of agent wrongdoing. The principal is generally the lowest-cost monitor, but the potential injured party may have a cost advantage in implementing precautionary measures. Mattiacci and Parisi (2003) conclude that specifically in an employment relationship between agent and principal – but not necessarily in other agent–principal relationships – efficiency is best served by shifting the costs of accidents to the principal rather than to the injured party.

5.4 The interaction between principal and agent liability

An important question in the literature concerns the relationship between vicarious liability and the legal regime under which the principal's agent incurs personal liability. Vicarious liability is a form of strict liability: the principal is absolutely liable for the delicts of the agent *as if* the principal actually were the agent. Put differently, the agent and the principal share exactly the same liability: the principal and the agent both wear the *same* shoes, legally speaking. Nothing that the principal has done, or might have done, bears on this liability. Yet whether this complete identity of principal and agent liability is appropriate is open to challenge in many circumstances.

Consider first whether the agent and the principal should face the same liability. In the standard case where the principal is an enterprise, the agent is an employee, and the agent's actions trigger significant liability, a rule of vicarious liability generally makes the enterprise rather than the agent liable as a practical matter (Kraakman, 1984a, 1984b). At most, the culpable agent faces the loss of his job and the risk of losing limited assets in a civil lawsuit. Chapman (1996) argues that this shift from individual to enterprise liability protects firms from the agency problem of overcompliance that might otherwise arise as managers sought to reduce their risk of personal liability.

As Polinsky and Shavell (1993) observe, however, the opposite problem may also arise: the firm may not be able to administer private sanctions severe enough to induce its employees to take optimal care where the social costs of torts are large. Thus, it may be appropriate to not only sanction employees as well as firms, but also to administer different sanctions – for example, criminal sanctions such as fines and imprisonment – to employees, even when the firm remains liable for only civil damages. Polinsky and Shavell (1993) propose criminal liability for employees, then, not because employees are inherently blameworthy, but rather because their limited assets may insulate them from the limited range of contractual sanctions that are at the disposal of the firms who are their principals. Of course, if the firm's agents become criminally liable, the firm must pay wages to compensate its employees for their greater liability costs and its own vicarious liability should be reduced accordingly. Failure to reduce the firm's liability in this fashion would distort its activity level and undesirably discourage consumption (Polinsky and Shavell, 1993, p. 241). It should also be noted that non-monetary sanctions such as imprisonment are costly to impose on employees. Thus, an independent rationale for imposing liability on the firm in lieu of its agents is that firms are more likely than their agents to be able to pay monetary fines and are therefore less costly to sanction (Shavell, 1985).

Next, consider whether firms and agents ought to face liability under precisely the same circumstances as they currently do under a traditional regime of vicarious liability. Polinsky and Shavell (1993, pp. 251–3) argue that vicarious liability may often be underinclusive in effect, because firms should be strictly liable for harms associated with their production processes while their employees ought to be liable only under a negligence standard. One argument offered by Polinsky and Shavell (1993) is that a negligence standard offers a stronger incentive for caretaking than strict liability does when agents are partially insulated from liability by limited assets. Other arguments for a negligence standard include its value in economizing on costly criminal sanctions such as imprisonment, and its potential value in limiting the risk-bearing costs of risk-averse corporate agents.

A different issue associated with holding agents and principals liable in precisely the same circumstances arises when principals are vicariously liable for the negligence of agents – as distinct from facing strict liability for the underlying misconduct (as Polinsky and Shavell, 1993, propose). Because negligence standards govern much of tort law, firms are often strictly liable for employee negligence under the traditional vicarious liability regime. But establishing the negligence of corporate employees who act deep within the enterprise may be extremely difficult without the assistance

of the corporate principal itself. As Chu and Qian (1995) point out, this juxtaposition of corporate liability and monitoring leads to a familiar problem: vicarious liability gives the principal a powerful incentive to withhold monitoring evidence from the court precisely because the principal cannot be vicariously liable unless its agent is found negligent in the first instance. This effect parallels Arlen's (1994) analysis of possible perverse effects associated with vicarious corporate criminal liability insofar as it turns on the difficulty of detecting misconduct (here the agent's negligence) without enlisting the cooperation of the principal. If, as proposed by Polinsky and Shavell (1993), a corporate principal is strictly liable for its agent's wrongdoing regardless of whether its agent was negligent, the principal's incentive to withhold information about its agent's negligence is clearly mitigated. Yet this incentive will not disappear entirely, as long as monitoring by a corporate principal increases its prospective liability costs (Chu and Qian, 1995, p. 320).

5.5 Negligence and composite vicarious liability regimes

As the preceding discussion indicates, traditional vicarious liability is a relatively rigid regime that, in some circumstances, may fail to satisfy one of the fundamental objectives of tort law: either providing for the internalization of tort costs or motivating optimal monitoring and precautionary measures. In most cases, strict vicarious liability does force firms to internalize tort costs. In fact, when principals cannot monitor their agents' behavior, the only justification for vicarious liability is the internalization of tort costs and the concomitant regulation of activity levels. It is possible, however, that principals may be in a position to prevent some forms of misconduct that are not usually assigned to the marginal costs of the enterprise. In this case, a negligence rule that imposes liability only when principals fail to take reasonable steps to prevent misconduct may dominate strict vicarious liability, precisely because such a rule does not charge the full cost of misconduct to the firm (Sykes, 1988, pp. 577–9). In the more conventional case where tort costs are appropriately assigned to the enterprise, a chief drawback of traditional strict liability is the perverse monitoring incentive analyzed by Arlen (1994) and Chu and Qian (1995): that is, the risk that principals will not monitor their agents optimally because doing so might increase their risk of incurring vicarious liability. Here too, as was discussed in Section 5.3, a negligence standard that imposes secondary liability only on principals who failed to take reasonable steps to monitor their agents is a natural solution to the risk of inadequate monitoring under a strict liability regime, especially if this negligence regime extended to 'agent–principal' relationships beyond those typically reached by *respondeat superior*.

There are, however, important drawbacks to a regime of 'negligence-based' vicarious liability, as it is termed by Kramer and Sykes (1987, p. 283). For example, a negligence standard will not regulate activity levels efficiently by assuring that firms fully internalize the costs of their torts. In addition, a negligence regime is arguably poorly suited to inducing firms to undertake other kinds of measures to prevent misconduct – such as reorganizing production processes – that do not involve monitoring or affect the principal's risk of incurring liability. Finally, a high level of judicial error in evaluating the negligence of judgment-proof agents will reduce the incentive of the principal to invest in monitoring and controlling the agent (Choi and Bisso, 2007). The latter effect also suggests that the law not interfere with the principal's discretion to discipline agents under 'negligence-based' vicarious liability regimes (*ibid.* at p. 10).

In the case of intentional torts and crimes, Arlen and Kraakman (1997) discuss three types of 'mixed' liability regimes that are designed to induce corporate principals to undertake appropriate monitoring measures (and possibly to report agent misconduct as well), while simultaneously encouraging preventive measures and assuring that firms internalize the full costs of their agents' misconduct. The first type includes regimes that, through use of immunity or privilege doctrines, attempt to insulate corporate principals from any increase in their probability of prosecution arising from their internal monitoring and investigatory efforts. An example is coupling strict liability for environmental harms with an environmental audit privilege, to ensure that firms retain their incentives to undertake such audits. The second type is a regime of strict liability with a variable sanction that declines to offset any increase in the expected liability that a firm would otherwise incur from monitoring for employee misconduct. Finally, the third type includes 'composite' regimes that combine a negligence rule to regulate corporate monitoring and investigation of misconduct with a residual element of strict liability to ensure that corporate principals adopt preventive measures and internalize the costs of agent misconduct. Here an example is the liability regime created by the US Federal Sentencing Guidelines for corporate crimes (see Arlen and Kraakman, 1997, pp. 745–52).

Arlen and Kraakman (1997) argue that the range of mixed vicarious liability regimes – extending from evidentiary privileges through adjusted sanction regimes to composite regimes – are increasingly costly to administer effectively but are also increasingly likely to satisfy the multiple enforcement objectives of a vicarious liability regime. To be sure, some commentators oppose any resort to a negligence standard to supplement strict liability (as is necessary in a composite regime) on the grounds that judicial error in administering the standard will inevitably create liability

in excess of the social cost of misconduct (Fischel and Sykes, 1996, pp. 328–9). This effect, however, can be ameliorated by downwardly adjusting the composite liability regime's residual liability level.

It follows that the traditional American rule of strict vicarious liability is well-suited to the ordinary case of wrongdoing in which the costs of agent misconduct are appropriately charged to the principal, and misconduct is unlikely to escape detection. Whenever one of these conditions fails, however, strict vicarious liability may be dominated by either negligence-based vicarious liability or a mixed regime that includes elements of both strict and negligence-based liability.

5.6 Reaching beyond the principal: alternative liability targets

Traditional vicarious liability makes the legal 'principal' liable for her agent's torts. But other actors besides the principal may also be in a position to monitor safety precautions or thwart third-party misconduct: for example, senior managers within the firm who supervise lower-level employees; or the lawyers, accountants and underwriters who facilitate fraudulent public issues of securities. In fact, secondary liability (if not necessarily traditional strict vicarious liability) for the torts and delicts of primary wrongdoers is a common legal control strategy well outside the domain of principal–agent relationships.

In some cases, the secondary liability of parties other than the organizational principal or enterprise serves as a backstop for traditional vicarious liability. For example, Kraakman (1984a, 1984b) argues that the personal liability of corporate managers for garden-variety torts protects against the possible inadequacy of corporate assets to satisfy the firm's liability. Thus, in a reversal of the traditional justification for vicarious liability discussed above in Section 5.1, Kraakman (1984a, pp. 869–71, 1984b) suggests that most personal liability of managers for corporate torts should be understood as protecting tort victims against undercapitalized *firms* rather than agents, since well-capitalized firms invariably insulate their managers from liability through insurance or indemnification contracts.

In some cases, however, the law blocks the indemnification of managers for their own misconduct or extends liability for corporate misconduct to a broader circle of influential actors beyond the group of top managers, such as outside directors and accountants associated with companies. Kraakman (1984a, 1984b) describes this as a 'gatekeeper strategy' that is designed to augment potentially inadequate levels of liability imposed on the firm itself. Thus, just as vicarious corporate liability can enhance legal controls over judgment-proof agents, so in extreme cases the personal liability of corporate managers, directors, and even outside directors can partially offset the inadequacy of corporate liability.

In addition, the potential uses of secondary liability, whether civil or criminal, and the value of the gatekeeper strategy, extend well beyond the corporate enterprise. An important research agenda turns on identifying contexts where these liability strategies are or are not cost effective. Kraakman (1986) examines several considerations bearing on the costs and benefits of imposing secondary liability on a contracting party in order to deter or prevent the misconduct of the counter-party to the contractual relationship. The chief enforcement tool at the disposal of a private 'gatekeeper' is the power to withhold goods, services, or facilitation from a counter-party engaged in risky or suspect behavior, just as the principal's chief incentive device in the traditional agency relationship is the threat to fire an agent who engages in risky behavior. Moreover, whether gatekeeper liability is likely to prevent misconduct depends in part on the same considerations that contribute to an effective regime of vicarious liability, such as the assets and the expertise of the gatekeeper relative to those of the potential tortfeasor. But especially in the case of intentional misconduct, the efficacy of gatekeeping turns in large part on how easily would-be wrongdoers can contract around honest gatekeepers who withhold their services from suspect endeavors (Kraakman, 1986, pp. 66–74).

Several commentators have undertaken more particularized assessments of the costs and benefits of gatekeeper liability for individual classes of strategic gatekeepers. For example, Franzoni (1996) examines gatekeeper enforcement of tax laws through imposing liability on auditors. Choi (1998) offers a skeptical analysis of the costs and benefits of gatekeeper liability imposed on underwriters in the securities market. Jackson (1993) and Wilkins (1993) consider gatekeeper liability imposed on lawyers in the context of banking regulations. Coffee (2006) examines gatekeeper liability in the wake of Enron and Worldcom, the defining corporate frauds of the early 21st century.

5.7 Corporate civil liability versus criminal liability

The vicarious liability regime that accounts for most corporate liability in the United States makes no distinction between civil and criminal liability. It is well-accepted that when corporate agents commit crimes within the scope of their employment, firms can be criminally prosecuted on a theory of vicarious liability – just as firms are vicariously liable for the civil torts of their agents. Recent literature on vicarious liability, however, questions the value of imposing specifically criminal liability on corporate principals, as distinct from imposing vicarious *civil* liability for the criminal acts of corporate agents.

The critique of corporate criminal liability proceeds on several fronts. Fischel and Sykes (1996, pp. 322–4) point out that the specifically criminal

sanction of incarceration is unavailable against corporations, and that the criminal law objective of incapacitating criminals through incarceration makes little sense in the context of corporate liability. Equally important, Fischel and Sykes (1996) argue, criminal sanctions are uncalibrated to the level of harm associated with crime, which may be appropriate to penalties imposed on individuals but is inappropriate to penalties operating on the corporate level.

Criminal penalties imposed on individuals for intentional crimes such as murder create little risk of overdeterrence: less murder is always better. But penalties imposed on the corporate level lack this character, precisely because they are corporate penalties. Corporations are, in Fischel and Sykes's (1996, p. 323) phrase, 'webs of contractual relationships consisting of individuals who band together for their mutual economic benefit.' Corporate crimes typically involve actions committed by some corporate agents without the knowledge and approval of others. It follows that the primary function of penalties imposed on the corporate level is not to deter in the conventional sense but to induce firms to monitor their agents and prevent crimes: that is, the classic justification for vicarious liability (see Fischel and Sykes, 1996, p. 324; Parker, 1996). The baseline penalty imposed on the corporation, then, should be civil liability equal to the social cost of crime discounted to reflect its probability of detection.

At least in the United States, there is little reason to believe that civil penalties systematically underdeter corporate offenders (at least in the area of defective products) except when these offenders are judgment proof, in which case additional criminal fines imposed at the corporate level are unlikely to increase marginal deterrence (Wheeler, 1984). But where corporate defendants are already solvent and adequately subject to civil liability, additional criminal liability is likely to lead to the various costs of overdeterrence, such as costly products arising from excessive design and manufacturing precautions. Then, too, there are the additional administrative costs that arise from private and public legal actions, particularly when multiple public authorities have standing to bring suit regarding the same incident or possible delict (*ibid.*). One might argue that the large potential damage awards at stake in civil actions justify replacing civil liability with the more rigorous and defendant-friendly procedures of criminal law. Conversely, however, one might counter that since criminal convictions are hard to obtain, a criminal law regime requires even *larger* fines than damage awards under a civil regime to deter tort-like wrongdoing such as the manufacture of defective products, and that larger fines will further aggravate the underdeterrence problem presented by undercapitalized corporations.

A second critique of corporate criminal liability does not question penalty levels *per se* but asks: why prefer criminal penalties over equivalently scaled civil liability? The feature that arguably distinguishes criminal sanctions on the corporate level – social stigma and reputational loss – render these penalties less predictable and more costly than parallel civil penalties (see Karpoff and Lott, 1993; Khanna, 1996, pp. 1501–12). Moreover, in most cases, the administration costs of criminal prosecution are likely to be larger than the costs of civil lawsuits by government agencies (Khanna, 1996, pp. 1512–31).

In light of these multiple critiques of corporate criminal liability, the justification for vicarious criminal liability for corporate principals – or principals more generally – remains an important topic for future research. If no plausible justification can be found, the implications for law reform are clear: vicarious corporate liability should be decriminalized.

Bibliography

- Arlen, Jennifer H. (1994), 'The Potentially Perverse Effects of Corporate Criminal Liability', *Journal of Legal Studies*, 23, 832–67.
- Arlen, Jennifer H. (1995), 'Commentary on Part IV – The Effect of Corporate Liability on Whistleblowing Bounties: A Comment on Houst and Daniels', in Ronald J. Daniels and Randall Morck (eds), *Corporate Decision-Making in Canada*, Calgary: University of Calgary Press, pp. 635–47.
- Arlen, Jennifer H. and William J. Carney (1992), 'Vicarious Liability for Fraud on the Market: Theory and Evidence. Vicarious Liability for Fraud on Securities Markets: Theory and Evidence', *University of Illinois Law Review*, 1992, 691–740.
- Arlen, Jennifer H. and Reinier H. Kraakman (1997), 'Controlling Corporate Misconduct: A Comparative Analysis of Alternative Corporate Incentive Regimes', *New York University Law Review*, 72, 687–779.
- Arlen, Jennifer and W. Bentley Macleod (2005), 'Beyond Master-servant: A Critique of Vicarious Liability', in M. Stuart Madden (ed.), *Exploring Tort Law*, New York: Cambridge University Press, pp. 111–42.
- Boyd, James and Daniel E. Ingberman (1996), 'The Polluter Pays Principle: Should Liability be Extended when the Polluter Cannot Pay?', *Geneva Papers on Risk and Insurance*, 21.
- Chapman, Bruce (1992), 'Limited Auditors' Liability: Economic Analysis and the Theory of Tort Law', *Canadian Business Law Journal*, 20, 180–214.
- Chapman, Bruce (1996), 'Corporate Liability and the Problem of Overcompliance', *Southern California Law Review*, 69, 1679–703.
- Choi, Albert H. and Juan Carlos Bisso (2007), 'Optimal Agency Contracts: The Effects of Vicarious Liability and Judicial Error', Working Paper of 3 September 2007. Available at SSRN: <http://ssrn.com/abstract=894903>.
- Choi, Stephen (1998), 'Market Lessons for Gatekeepers', *Northwestern University Law Review*, 92, 916–66.
- Chu, C.Y. Cyrus and Yingy Qian (1995), 'Vicarious Liability under a Negligence Rule', *International Review of Law and Economics*, 15, 305–22.
- Coffee, John C. (2006), 'Reforming the Securities Class Action: An Essay on Deterrence and its Implementation', *Columbia Law Review*, 106, 1534–86.
- Croley, Steven P. (1996), 'Vicarious Liability in Tort: On the Sources and Limits of Employee Reasonableness', *Southern California Law Review*, 69, 1705–38.
- Epstein, Richard A. and Alan O. Sykes (2001), 'The Assault on Managed Care: Vicarious Liability, Erisa Preemption, and Class Actions', *Journal of Legal Studies*, 30, 625–59.

- Fischel, Daniel R. and Alan O. Sykes (1996), 'Corporate Crime', *Journal of Legal Studies*, 25, 319–49.
- Franzoni, Luigi Alberto (1996), 'Independent Auditors as Fiscal Gatekeepers', Working Paper, Department of Economics, University of Bologna.
- Hamdani, Assaf (2003), 'Gatekeeper Liability', *Southern California Law Review*, 77, 53–122.
- Hansmann, Henry and Reinier Kraakman (1991), 'Toward Unlimited Liability for Shareholder Torts', *Yale Law Journal*, 100, 1879–934.
- Jackson, Howell E. (1993), 'Reflections on Kaye, Scholer: Enlisting Lawyers to Improve the Regulation of Financial Institutions', *Southern California Law Review*, 66, 1019–74.
- Karpoff, Jonathan M. and John R. Lott, Jr (1993), 'The Reputational Penalty Firms Bear from Committing Criminal Fraud', *Journal of Law and Economics*, 36, 757–802.
- Khanna, V.S. (1996), 'Corporate Criminal Liability: What Purpose does it Serve?', *Harvard Law Review*, 109, 1477–534.
- Kornhauser, Lewis A. (1982), 'An Economic Analysis of the Choice between Enterprise and Personal Liability for Accidents', *California Law Review*, 70, 1345–92.
- Kraakman, Reinier H. (1984a), 'The Economic Functions of Corporate Liability', in Klaus J. Hopt and Gunther Teubner (eds), *Corporate Governance and Directors' Liabilities*, New York: de Gruyter, pp. 178–207.
- Kraakman, Reinier H. (1984b), 'Corporate Liability Strategies and the Costs of Legal Controls', *Yale Law Journal*, 93, 857–98.
- Kraakman, Reinier H. (1986), 'Gatekeepers: The Anatomy of a Third-Party Enforcement Strategy', *Journal of Law, Economics, and Organization*, 2, 53–104.
- Kramer, Larry and Alan O. Sykes (1987), 'Municipal Liability under Section 1983: A Legal and Economic Analysis', *Supreme Court Review*, 1987, 249–301.
- Langevoort, Donald C. (2007), 'On Leaving Corporate Executives "Naked, Homeless and Without Wheels": Corporate Fraud, Equitable Remedies, and the Debate over Entity versus Individual Liability', *Wake Forest Law Review*, 42 (2007), 627.
- Levmore, Saul (1995), 'Gomorrhah to Ybarra and More: Overextraction and the Puzzle of Immoderate Group Liability', *Virginia Law Review*, 81, 1561–604.
- Mattiacci, Giuseppe Dari and Francesco Parisi (2003), 'The Cost of Delegated Control: Vicarious Liability, Secondary Liability and Mandatory Insurance', *International Review of Law and Economics*, 23, 453–75.
- Parker, Jeffrey (1996), 'Doctrine for Destruction: The Case of Corporate Criminal Liability', *Managerial and Decision Economics*, 17, 381–98.
- Polinsky, A. Mitchell and Steven Shavell (1993), 'Should Employees be Subject to Fines and Imprisonment Given the Existence of Corporate Liability?', *International Review of Law and Economics*, 13, 239–57.
- Posner, Eric A. and Alan O. Sykes (2007), 'An Economic Analysis of State and Individual Responsibility under International Law', *American Law and Economics Review*, 9, 72–134.
- Rapakko, Timo (1987), *Corporate Control and Parent Firms' Liability for their Controlled Subsidiaries: A Study on the Regulation of Corporate Conduct*, Helsinki: Helsinki School of Economics.
- Rogers, W.V. Horton (2002), 'Liability for Damages Caused by Others under English Law', in J. Spier (ed.), *Unification of Tort Law: Liability for Damages Caused by Others*, Den Haag: Kluwer Law International, pp. 63–84.
- Schwartz, Gary T. (1993), 'Tobacco Liability in the Courts', in Robert Rabin and Stephen Sugarman (eds), *Smoking Policy: Law, Politics, and Culture*, New York: Oxford University Press, pp. 131–60.
- Schwartz, Gary T. (1996a), 'The Hidden and Fundamental Issue of Employer Vicarious Liability', *Southern California Law Review*, 69, 1739–67.
- Schwartz, Gary T. (1996b), 'Assessing the Adequacy of State Products Liability Lawmaking', *Yale Journal on Regulation*, 13, 359–70.
- Shavell, Steven (1985), 'Criminal Law and the Optimal Use of Nonmonetary Sanctions as a Deterrent', *Columbia Law Review*, 85, 1232–62.

- Shavell, Steven (1997), 'The Optimal Level of Corporate Liability Given the Limited Ability of Corporations to Penalize their Employees', *International Review of Law and Economics*, 17, 203–13.
- Shavell, Steven (2007), 'Liability for Accidents' in A.M. Polinsky and S. Shavell (eds), *Handbook of Law and Economics*, Vol. 1, Amsterdam: Elsevier, pp. 139–82.
- Spier, Jaap (ed.) (2002), *Unification of Tort Law: Liability for Damages Caused by Others*, Den Haag: Kluwer Law International.
- Sykes, Alan O. (1981), 'An Efficiency Analysis of Vicarious Liability under the Law of Agency', *Yale Law Journal*, 91, 168–206.
- Sykes, Alan O. (1984), 'The Economics of Vicarious Liability', *Yale Law Journal*, 93, 1231–80.
- Sykes, Alan O. (1988), 'The Boundaries of Vicarious Liability: An Economic Analysis of the Scope of Employment Rule and Related Legal Doctrines', *Harvard Law Review*, 101, 563–609.
- Verkerke, J. Hoult (1995), 'Notice Liability in Employment Discrimination Law', *Virginia Law Review*, 81, 273–385.
- Wheeler, Malcolm E. (1984), 'The Use of Criminal Sanctions to Regulate Product Safety', *Journal of Legal Studies*, 13, 593–618.
- Wilkins, David B. (1993), 'Making Context Count: Regulating Lawyers after Kaye, Scholer', *Southern California Law Review*, 66, 1145–220.

Other references

- Landes, William M. and Richard A. Posner (1987), *The Economic Structure of Tort Law*, Cambridge, MA: Harvard University Press.
- Restatement (Second) of Agency (1958), American Law Institute.
- Restatement (Third) of Agency (2006), American Law Institute.
- Shavell, Steven (1980), 'Strict Liability versus Negligence', *Journal of Legal Studies*, 9, 1–25.
- Shavell, Steven (1987), *Economic Analysis of Accident Law*, Cambridge, MA: Harvard University Press.

PART III

DAMAGES

6 Tort damages

*Louis T. Visscher**

6.1 Introduction

In the economic analysis of tort law, minimization of primary accident costs (deterrence), secondary accident costs (optimal risk spreading and risk bearing) and tertiary accident costs (administrative costs) is regarded as the central objective (Calabresi, 1977, pp. 24 ff). The prospect of being held liable and having to pay damages provides potential tortfeasors with behavioral incentives. Obviously, these incentives are greatly determined by the amount of damages the liable injurer has to pay. The desired incentives might also be provided by compensation in other forms than money damages, such as the duty to repair damaged property or to demolish an unlawfully built structure (Zervogianni, 2004). However, in this chapter, only literature regarding money damages will be discussed.

In this chapter, I will focus on the primary cost reduction, but in Section 6.17 I will discuss secondary cost reduction. Throughout the whole chapter, where relevant, remarks on tertiary cost reduction are made.

Even though the economic analysis of tort law in general and the differences between negligence and strict liability in particular will be discussed in detail in other chapters of this Encyclopedia, it is useful to provide a short summary of these insights at this point, in as far as they are relevant to the topic of tort damages.

In engaging in activities, people create externalities, that is, a probability that others will suffer losses as a result of this activity. Tort law is regarded as an instrument that can provide behavioral incentives to the actors, so that they internalize these externalities. In other words, due to the threat of being held liable, actors incorporate the possible losses of others in their decision on how much care to take, and how often to engage in the activity. By taking more care and/or by reducing his activity level, the actor can lower the probability of an accident, and thereby the expected accident losses. Optimal care and optimal activity are taken when the marginal costs of taking more care or further reducing the activity level equal the marginal benefits thereof in the sense of a reduction in the expected accident

* Rotterdam Institute of Law and Economics (RILE), Erasmus University Rotterdam. © Copyright 2008 Louis Visscher.

losses (see among many others Posner, 1972; Brown, 1973; Shavell, 1980; Polinsky, 1980b; Shavell, 1987; Landes and Posner, 1987; Polinsky, 1989; Cooter and Ulen, 2004; Shavell, 2004; Schäfer and Ott, 2005).

In unilateral accident settings, where only the injurer can influence the accident risks, under a rule of strict liability the injurer is always liable for the losses he has caused, so that he always bears the total accident costs, which consist of the care costs and the expected accident losses. He will choose the level of care which minimizes this sum. This is the optimal care level. Furthermore, because he bears the full total accident costs, he only engages in the activity if it yields him more utility than the full costs. Therefore, he also chooses the correct activity level. Obviously, his decisions should be based on the full social losses caused by his activity, so that in principle, tort damages should lead to full compensation of the losses of the victim.

In addition, the injurer in some cases should bear (part of) the litigation costs of the victim. If the victim would have to bear his own litigation costs, he might decide not to bring suit, so that the injurer is not confronted with all losses he has caused. Furthermore, the litigation costs themselves form social costs, which are caused by the injurer. If allowing only compensatory damages would lead to the situation that the victim will not bring suit due to the litigation costs, it is desirable that the injurer also bears a large enough part of the victim's litigation costs, in order to induce the latter to bring suit in cases where the injurer did not take optimal care. Ideally, in cases where the injurer took optimal care *ex ante*, the victim should not bring suit *ex post*, because this only causes additional (litigation) costs while the injurer already took optimal care. However, in order for strict liability to be able to provide the correct care incentives to the injurer *ex ante*, victims should *ex ante* always be willing and able to bring suit if they are injured. If taking care influences the magnitude of the losses, the optimal outcome is reached if the compensatory damages plus compensation for litigation costs are *higher* than the full litigation costs if the injurer took inadequate care, but *lower* if the injurer took optimal care. After all, the victim will then bring suit if the injurer took too little care, which will induce the injurer to take care, which will bar the victim from bringing suit. Hence, optimal care is taken and no suit is brought. On the other hand, if litigation costs are low enough, victims will bring suit even if the injurer took optimal care. Reducing compensatory damages in such cases to make the suit unattractive avoids these administrative costs, but retains the correct care incentives (Polinsky and Rubinfeld, 1988. Also see Shavell, 1997 and 2004, pp. 282 ff, and Hylton, 2002. For empirical research regarding litigation costs, see Hersch and Viscusi, 2007 and Black et al., 2007).

Under a negligence rule, still in unilateral accident settings, the injurer is only liable if he did not take the level of care that he was legally required

to take. If courts set this due care level equal to the optimal care level, the injurer is induced to take optimal care. By definition, it is cheaper to take due care and not be liable, than to take lower care and be liable. However, because a non-negligent injurer does not bear the expected accident losses, he essentially externalizes these costs upon the victim and engages in his activity as long as it yields more utility than the costs of due care. His activity level will therefore be too high.

It should be noted that tort damages under a negligence rule do not have to fully compensate the victim, in order to induce the injurer to take due care. As long as the costs of taking due care are lower than the costs of a lower care level plus damages, the injurer will take due care. So, even damages that do not fully compensate harm can provide the correct care incentives, as long as they make taking due care the more attractive strategy. However, Kahan points out that if the court requires a causal relationship between the negligence and the losses, so that the injurer only has to compensate the losses that were caused by the negligent character of his behavior, this difference between strict liability and negligence disappears. Full compensation then is required under negligence as well (Kahan, 1989. Also see Grady, 1983, 1989; Miceli, 1996).

If courts can make mistakes in determining true care and/or due care, injurers might take excessive care in order to avoid being held liable by mistake (see, for example, Calfee and Craswell, 1984; Craswell and Calfee, 1986; Cooter and Ulen, 2004, pp. 339 ff and 364 ff; Shavell, 2004, pp. 224 ff). Lowering the amount of damages might ameliorate this situation. Again, requiring a causal connection between the negligence and the losses changes this result. Courts' mistakes might now lead to inadequate care, so that damages should be supra-compensatory to solve the problem (Kahan, 1989).

In bilateral accident settings, where not only the injurer but also the victim can influence the accident probability, the victim should receive incentives to take due care as well. Under a negligence rule, the victim is the residual risk bearer (assuming that the injurer indeed takes due care) and hence he will correctly weigh the costs and benefits of taking additional care himself. However, under strict liability the victim receives no care incentive at all, because the injurer is always liable. A defense of contributory or comparative negligence is needed to provide the victim with such incentives. Irrespective of the rule chosen, it is not possible to provide both actors with the proper activity incentives, because only the residual risk bearer will compare his utility from the activity with the full costs.

In 'bilateral risk' situations, each actor is both a potential tortfeasor and a potential tort victim. Arlen argues that the negligence rule (with or

without a defense of contributory negligence) as well as strict liability with a defense of contributory negligence can provide the correct care incentives to all parties. It is always best for each actor to take due care, irrespective of what the other party will do. Damages need not fully compensate the losses, as long as they are high enough to make due care more attractive than being (contributory) negligent. Under pure strict liability, however, neither actor is confronted with the full costs he imposes on the other, because he also expects to receive some damages in return. Hence, neither party takes optimal care (Arlen 1990a, 1990b, 1992a. Also see Wittman et al., 1997). Kim and Feldman argue that Arlen's conclusions change when it is accepted that there is uncertainty about the proportion of total damages each party would suffer from an accident. If parties do not know in advance who will be injured ('role-type uncertainty') and their subjective beliefs about the probability that *they* will be the victim do not add up to unity, pure comparative negligence and the equal division rule have better efficiency properties than other negligence-based rules, because they are independent of the role-types (Kim and Feldman, 2006, p. 466).

Regarding the issue of litigation costs, negligence can provide equally good care incentives as strict liability, but with a lower level of litigation. After all, if due care is set at the optimal level, an injurer that takes optimal care will not be negligent, so that victims will not sue (Polinsky and Rubinfeld, 1988).

6.2 Full compensation of harm?

A plaintiff who wants to sue for damages has to have suffered harm. In economic terms, harm is a downward shift in the victim's utility of profit function (Cooter and Ulen, 2004, pp. 311 ff; Schäfer and Ott, 2005, p. 129). The victim can be brought back to the original utility curve by repairing the material damage (or curing the injuries) at the expense of the tortfeasor. If repair is more expensive than replacement, damages should be based on the replacement costs. If repair or replacement is not (completely) possible, the tortfeasor should pay an amount of money that provides enough utility to bring the plaintiff back to his original utility curve.

As a general starting point, damages should *fully* compensate the victim for his losses, because only then will the injurer internalize the negative externalities that he has caused (Posner, 2003, p. 192; Cooter and Ulen, 2004, pp. 312 ff and pp. 323 ff; Shavell, 2004, p. 236). However, as mentioned above, under (contributory) negligence damages need not be full, as long as they make taking due care more attractive than applying a lower care level. Furthermore, to induce victims to optimally mitigate their losses, damages should be restricted to the optimally mitigated losses plus the mitigation costs (Wittman, 1981; Shavell, 2004, pp. 248, 249). In

addition, costs that the victim would have incurred in any case should not be compensated (if, for example, the victim's car has to be repaired after an accident, the costs of a rental car should be compensated, but not the costs of gasoline for the rental car). Finally, any benefits the victim might have derived from the tort decrease his net harm and should be deducted from the damages. Otherwise, the victim would profit from the tort, which might provide adverse incentives. Other deviations from the idea of full compensation will be discussed in subsequent sections.

Full compensation implies that the injurer has to compensate the losses of the plaintiff, even if those losses are higher than normal. The principle that 'the injurer takes his victim as he finds him' (also known as the 'thin skull plaintiff rule'), according to which the injurer also has to fully compensate an unusually sensitive plaintiff, therefore makes economic sense. On the contrary, using legal ideas such as foreseeability or adequacy to limit damages to the losses that the injurer could reasonably foresee, leads to inadequate care incentives for the injurer (Shavell, 2004, p. 239).

It takes a certain period of time before a victim who has suffered losses recovers these losses, due to the time necessary to find the tortfeasor, the duration of the trial or settlement negotiations, etc. Full compensation requires the injurer to pay interest over this period of time (Shavell, 1987, p. 141). Without such prejudgment interest, the victim would not be fully compensated and the injurer would not be optimally deterred. Furthermore, the latter would have an incentive to delay the procedure (Knoll, 1996a, pp. 296 ff). Knoll argues that the interest should be compounded (so, 'interest over interest'), it should correspond to the interest rate that the defendant pays or can pay for unsecured debt and it should be a floating interest rate, because fixed interest rates interfere with the parties' incentives to settle (Knoll, 1996b, pp. 306 ff, pp. 317 ff. Also see Patell, Weil and Wolfson, 1982).

Damages for lost earnings should be based on the pre-tax wage, because otherwise the tortfeasor does not internalize the full social losses he has caused. However, the victim should only receive compensation of his post-tax wage because that is the amount he has lost. Compensating pre-tax wages could provide adverse incentives to the victim. The desired compensation can be reached by either granting compensation for post-tax wages, or by taxing pre-tax based damages. In the United States, the victim receives untaxed compensation for pre-tax wages (Shavell, 1987, pp. 143, 144). Blackburn argues that without this tax exclusion of personal injury damages, fewer plaintiffs would be willing to settle their case. However, not all forms of personal injury damages should be excluded. For example, interest received over deferred payment should be taxed, as should injuries to business reputation, economic losses (for example, lost wages) and

punitive damages (Blackburn, 1989, pp. 689 ff. Also see Brooks, 1988 and Dodge, 1992).

Cooter and Porat argue that non-legal sanctions such as loss of reputation should be deducted from damages to provide better incentives. These non-legal sanctions do not only harm the wrongdoer, they also benefit other persons, for example, by informing them about the wrongdoer or by transferring (part of) the wrongdoer's business to them. These benefits form positive externalities, which the wrongdoer cannot internalize. If they are not deducted from the damages, unintentional wrongdoing is over-deterred. The compensation goal, which is undermined, should not be aimed for by tort law, but by private insurance (Cooter and Porat, 2001).

Van Wijck and Winters analyze an alternative interpretation of 'full compensation'. If the injurer had taken due care, the victim would have faced a certain amount of expected harm. Full compensation after a tort has been committed should bring the victim back to this position, not to the position where he suffers no harm at all. Hence, the injurer does not compensate the victim for losses that he would have suffered if the injurer had taken due care. This alternative rule provides better care incentives than the regular negligence rule, which in essence was already argued by Kahan (1989), but inferior activity incentives (Van Wijck and Winters, 2001). Singh further analyzes this rule in a bilateral setting and it appears that the alternative rule is not always superior then. In particular, if the courts set the due care level of the injurer too high, it depends on the behavior of the victim whether the injurer will take optimal care (Singh, 2004, p. 231). Furthermore, if the expected liability payments of the injurer are lower than the actual harm he has caused (for example, the damages are set too low or the injurer sometimes escapes the trial), the injurer might decide to take inadequate care, because he only bears a fraction of the increase in expected accident losses caused by his negligence. The traditional negligence rule could still have provided adequate care incentives in such situations (Singh, 2004, pp. 232 ff).

6.3 Pecuniary and nonpecuniary losses

Pecuniary losses are either monetary losses or losses of replaceable goods, where the replacement costs are a good measure of the losses. Nonpecuniary losses consist of damage to irreplaceable things such as family portraits, but also health and emotional well-being (Shavell, 1987, p. 133; Shavell, 2004, p. 242).

For pecuniary losses, the concept of full compensation is relevant, because damages can make the victim indifferent between the situation without the tort on the one hand, and the situation with the tort and with damages on the other hand. For nonpecuniary losses, the idea of

indifference often is useless, because money cannot compensate the loss (Cooter and Ulen, 2004, pp. 368, 369).

In order to provide the correct incentives to the injurer, tort damages should equal the sum of pecuniary and nonpecuniary losses (Faure, 2000a, p. 121; Shavell, 2004, p. 242). It is therefore necessary that courts make an assessment of both pecuniary and nonpecuniary losses. See further Sections 6.4 and 6.6 below.

6.4 Assessment of losses

Both pecuniary and nonpecuniary losses lower the utility of the victim. Assessing these losses entails costs, and the higher these 'assessment costs', the more difficult it is to make a good assessment (Polinsky, 1980a, p. 1079; Krier and Schwab, 1995, pp. 453 ff. For an analysis of the efficiency of liability rules when courts miss-assess the damage, see Singh, 2003). In assessing the losses, a more objective or a more subjective approach can be followed. The subjective, concrete approach assesses the loss as it was actually suffered by this particular victim in this particular case. The objective, abstract approach on the contrary disregards many specifics of the case and assesses how large the losses generally speaking would be in comparable situations.

The abstract method is more efficient than the concrete method, in the sense that it is less expensive to administer. In suitable cases, such as frequently occurring damages to goods, it leads to good results. For example, if a car is damaged, the costs of repair by a competent mechanic are a good assessment of the losses, even if in a specific case the victim can repair the car himself or if he does not have the car repaired at all. The reduction in tertiary costs outweighs the possibility that the behavioral incentives are not perfectly fine-tuned. This problem could, for example, consist in a victim profiting from the money damages, because his subjective valuation of the damaged good was lower than its market price (Zervogianni, 2004, p. 529).

It remains to be seen if a more accurate assessment of the losses provides better incentives. After all, if the injurer cannot *ex ante* assess how many losses he will cause, a better assessment *ex post* does not change his behavior. As long as the assessment of the losses is correct on average, the injurer receives the correct incentives (Kaplow and Shavell, 1996, 2002, pp. 265 ff).

If the losses are systematically overestimated, it is generally argued that the injurer will take excessive care and will choose a too low activity level, and vice versa. Nussim and Tabbach argue that this result might change if one relaxes the assumptions of the standard model that the costs of care and the expected harm are proportional to the activity level. The existence of durable precautionary measures (which may be effective or endure for all, or at least more than one activity level) forms a reason to relax these

assumptions. Learning effects and fatigue are other reasons to question the proportional ratio between care costs and activity level. Furthermore, marginal expected harm might not be linear to the activity level (think about exposure to toxics for example). An overestimation of losses that is unrelated to activity level or actual harm leads to an increase in care level. Due to the interdependency of care and activity level, it might now be optimal for the injurer to increase his activity level as well, instead of reducing it. Alternatively, an overestimation of losses caused by an overestimation of the activity level induces the injurer to reduce his activity level. This might reduce care through complementarity instead of increasing it (Nussim and Tabbach, 2006, pp. 17 ff).

Pecuniary losses are relatively easy to assess, because they equal a money loss, costs of repair or cost of replacement. Nonpecuniary losses are much more difficult to assess, because they cannot be observed directly (Shavell, 2004, p. 242). This opens possibilities of strategic behavior. It is therefore suggested that nonpecuniary losses should not be compensated at all when they are likely to be small, or to use simple tables or formulas to determine damages. However, if nonpecuniary losses are large, in order to provide adequate incentives, more effort should be spent trying to make a better assessment. Damages for fatal accidents are an important example of such situations.

6.5 Damages for fatal accidents

6.5.1 Introduction

In many jurisdictions, if the victim of a tort dies, his surviving relatives are entitled to receive compensation for the funeral costs, and for their loss of maintenance, in as far as they were (still) dependent on the deceased. Hence, the financial losses caused by the fatal tort are compensated. The nonpecuniary losses of the relatives, however, are often not compensated or not fully (Magnus, 2001, p. 210).

Moreover, the loss of the life of the deceased himself is not compensated. From an economic point of view, this leads to under-deterrence (Arlen, 1985). This raises the question of what damages would provide correct behavioral incentives to the injurer. In Section 6.5.2, literature regarding the optimal amount that the injurer should pay is discussed. Section 6.5.3 focuses on the optimal amount that the victim (or better, his surviving relatives) should receive.

6.5.2 Optimal amount that injurers should pay

In order to let the injurer fully internalize the losses he has caused in a fatal accident, it is necessary to try to estimate the value of a human life.

Extensive literature regarding the so-called Value of a Statistical Life (VSL) exists.

This VSL is derived from all kinds of decisions that individuals take and which affect health and safety. Examples are installing an airbag in a car, using seatbelts, installing a smoke detector, buying dangerous products, accepting dangerous work conditions, etc. Such market choices contain an implicit tradeoff between money and risks, and these tradeoffs are used to estimate the VSL. If a person decides to install an airbag because it reduces the chance of being involved in a fatal accident, this person apparently values the decrease in risk higher than the price he has to pay. By analyzing many such decisions, a VSL can be determined.

This VSL should not be regarded as a universal constant, or a 'correct amount' indicating the true value of a human life. It is rather the tradeoff that results from given research. It is therefore not possible to use a VSL from, for instance, labor research for another labor situation or a non-labor setting just like that. Different populations have different risk preferences and safety valuations (Viscusi and Aldy, 2003, p. 18). Most American labor-related research results in a VSL of between \$3.8 and \$9.0 million and according to Sunstein, the VSL is currently set at about \$6.1 million (Sunstein, 2004, p. 205; Posner and Sunstein, 2005, p. 563). Non-labor research (for example, regarding buying and using smoke detectors, bicycle helmets, cigarettes or the way in which the price of houses responds to dangerous waste dumps in the area) results in comparable, albeit somewhat lower amounts. The American VSL is comparable to the VSL found in other developed countries, but higher than in developing countries (Viscusi and Aldy, 2003, pp. 24, 35 and 63).

The Value of a Statistical Life Year (VSLY) makes it possible to distinguish on the basis of the age of the potential victim(s). A young life saved is worth more in the sense that more life years are saved than with an elderly person. An activity that especially endangers young persons causes more expected accident losses than an activity that mostly endangers older people (Sunstein, 2004, p. 2). Optimal damages therefore should be higher in the first case, in order to provide the correct care and activity incentives.

Posner and Sunstein conclude that damages for fatal accidents, if based on the VSLY, should be around \$6 million or higher. This is far more than the current legal standard of loss of income of the surviving relatives and funeral costs. Moreover, they also argue that the damages should be increased by the emotional losses of the surviving relatives, which could amount to several millions of dollars as well (Posner and Sunstein, 2005, pp. 586, 590).

In the field of health economics, the concept of Quality Adjusted Life Years (QALYs) is used to assess the benefits of healthcare measures. It is

a measure of the value of living one year with a certain health condition, where '0' denotes death and '1' perfect health.

It is interesting to think about the possibilities of applying QALYs in the field of tort damages, both for fatal accidents as well as for accidents with personal injuries. In order to be able to do so, a money value has to be attached to the QALY. The available attempts to monetize the QALY have led to very different outcomes. The American Food and Drug Administration (FDA) has used figures ranging from \$100,000 to \$500,000 per QALY (Adler, 2006). The British National Institute for Clinical Excellence (NICE) uses figures of £20,000–30,000 (\$40,000–\$60,000), although Devlin and Parkin argue that these figures should be a bit higher (Devlin and Parkin, 2004, p. 450). Finally, the figure of \$50,000 is mentioned as a lower boundary for a QALY, given that this is the cost of a year's kidney dialysis, which is a treatment that is considered worthwhile (Weinstein, 2005, pp. 5, 6; Ashenfelter, 2006, p. 10). Weinstein provides an overview of the number of QALYs that can be gained per million dollars when applying different medical interventions, ranging from under ten to over 200 (Weinstein, 2005, p. 5).

If future research were to result in a commonly accepted (minimum) monetary value of a QALY, this value might be used to calculate damages in fatal accidents or tort cases with personal injuries. Suppose a QALY were monetized at \$100,000. In a given accident, the victim is killed. If his pre-accident health were, for example, 0.8 (so he was not in perfect health) and if according to life expectancy statistics his remaining life expectancy was 20 years, tort damages for the loss of life would amount to $\$100,000 * 20 \text{ years} * 0.8$, so \$1.6 million. Analogously, if this person suffered personal injuries which were valued at 0.1 QALY and which lasted for two years, damages would amount to \$20,000. However, much research is needed before QALYs can be utilized in this way. In this research, attention also has to be paid to the insight that people adapt to injuries more rapidly than is commonly thought, so that the damages for pain and suffering might have to be adjusted downward (Sunstein, 2007; Adler and Posner, 2007; Bagenstos and Schlanger, 2007).

6.5.3 Optimal amount that the surviving relatives should receive

The prevention goal of tort law implies that injurers should pay damages, but not necessarily that victims should receive those damages. Especially in cases of fatal accidents where damages are based on VSL, VSLY or QALY, it remains to be seen if the surviving relatives should receive this large amount. After all, these measures are used to assess the loss that was caused by the fatality, that is, the loss of life of the deceased. Paying this amount of money to the surviving relatives does not serve the deterrence

goal, but would only cause administrative costs. It is even possible that the prospect of receiving millions of dollars might cause moral hazard issues on the side of the relatives, which represents another reason not to award these high damages to them.

As mentioned above, according to Posner and Sunstein, the tortfeasor should also pay for the emotional losses of the relatives. These are indeed true losses that he has caused, and full internalization of externalities requires that he pays for these costs as well. Whether or not the relatives should receive compensation for this type of losses will be discussed in Section 6.6 below, on compensation for nonpecuniary losses.

6.6 Compensation for nonpecuniary losses?

In previous sections, it became clear that tortfeasors should in principle pay damages that include nonpecuniary losses in order to receive the correct behavioral incentives. Only if these losses are small is it better to disregard them in order to save on the administrative costs of assessing them.

In the literature, it is however argued that the victim should not receive compensation for nonpecuniary losses. On this line of reasoning, the amount of damages that the victim should receive is determined by the amount of losses against which a rational individual would purchase insurance. It is well known that a rational risk-averse individual will purchase insurance against *pecuniary* loss. After all, the pecuniary loss has lowered his wealth. Due to the decreasing marginal utility of wealth, the marginal utility of an additional euro is higher in the post-accident state than in the pre-accident state. The individual therefore would like to transfer money from the pre-accident stage to the post-accident stage. This is done by the insurance contract. The utility that is lost in the pre-accident stage by paying the insurance premium is more than outweighed by the expected utility yielded by the insurance coverage.

However, a *nonpecuniary* loss generally does not increase the marginal utility of wealth (Friedman, 1982, pp. 82 ff; Adams, 1989, p. 215; Cooter, 1989a, p. 293; Friedman, 2000, pp. 95 ff; Shavell, 2004, pp. 270 ff). It remains the same, or might even decrease. In the latter case, for example, where the victim dies or becomes comatose, the victim would even prefer a 'reversed insurance' with which he could transfer money from the post-accident stage to the pre-accident stage, so a market in unmaturing tort claims (Shukaitis, 1987; Cooter, 1989a). Because the marginal utility of money does not increase after the accident, a rational individual is not willing to buy an insurance against nonpecuniary losses. The premium would cost more utility than the expected insurance coverage would yield (Shavell, 1987, p. 229). An alternative to insurance could be based on the idea of *ex ante* compensation, where potential victims are compensated for

the risks imposed upon them, before and irrespective of any harm occurring to them. However, such a system would probably be unworkable, because many risks have to be calculated and countless transactions have to be executed (Friedman, 1982; Graham and Peirce, 1984; Fraser, 1984a; Friedman, 2000, pp. 95 ff).

The above line of reasoning implies that victims should not receive compensation for nonpecuniary losses, because they would not self-insure against such losses. Croley and Hanson, however, argue that compensation for nonpecuniary losses makes sense after all. It is true that the marginal utility of wealth does not change due to the nonpecuniary loss. Yet, the whole level of utility, the so-called *baseline utility*, decreases. The money that would be received from insurance against nonpecuniary loss could mitigate this decrease in the utility level. In practice, insurance against nonpecuniary losses is indeed purchased, albeit under different names (for example, life insurance on the life of a child). In cases where such insurances are not bought, according to Croley and Hanson the reason for this is not that there is no need for them. It is rather a lack of information or legal restrictions that keep people from purchasing such insurance (Croley and Hanson, 1995, pp. 1845 ff).

In as far as a rational individual would not self-insure against nonpecuniary losses, incorporating these losses in the damages that the tortfeasor has to pay can lead to a sort of 'forced' insurance. For example, if products liability damages include nonpecuniary losses, the price of the products will reflect these losses and the consumer in fact is forced to insure himself through the higher price (Priest, 1987, pp. 1535 ff).

A different argument for not compensating nonpecuniary losses is provided by Adams. He argues that not compensating these losses provides the victim with care incentives, even in cases where a defense of comparative or contributory negligence is not able to do so, for example, because not taking a certain care measure is not regarded as a fault of the victim (Adams, 1989, p. 215). In unilateral accidents or accidents where most or all of the losses are nonpecuniary, however, they should be incorporated in the damages in order to provide adequate incentives to the tortfeasor (Adams, 1989, p. 217). The problem with Adams' line of reasoning is that it would provide inadequate incentives to the tortfeasor if he does not have to pay for the nonpecuniary losses he has caused. It is, however, an additional argument that supports the claim from the insurance theory that the victim should not receive compensation for these losses.

The above implies that the amount of damages that the injurer should pay is not the same as the amount of damages that the victim should receive. In other words, liability should be *decoupled* from compensation (Danzon, 1984; Shavell, 1987, pp. 231 ff; Polinsky and Che, 1991; Geistfeld, 1995,

pp. 799 ff. However, Choi and Sanchirico, 2004 argue that this conclusion does not always hold). This result can be reached by letting the injurer pay a fine on top of the damages he pays to the victim. Also taxing compensatory damages leads to a situation where the amount that the injurer pays exceeds the amount the victim receives. Rubinfeld argues that the costs the victim incurs in order to receive compensation, such as litigation costs and attorney's fees, also cause a divergence between the amount the injurer pays and the amount the victim receives (Rubinfeld, 1984).

6.7 Uncompensated losses

Law and economics scholars argue that in bilateral accident settings, injurers as well as victims should receive behavioral incentives. Both the negligence rule and strict liability with a defense of contributory or comparative negligence are able to provide these incentives. It follows that law and economics arguments are opposing introducing strict liability without a defense of contributory or comparative negligence in bilateral settings.

An often-heard response from lawyers to this line of reasoning is that victims, especially in traffic accidents such as between motorists and pedestrians or bicyclists, will behave carefully anyway. Their fear of being involved in an accident, in which they could be injured or even killed, would provide much stronger behavioral incentives than the threat of the defense of contributory or comparative negligence could do. This fear would lead them to want to avoid the accident in any case.

Apart from the anecdotic empirical observations that pedestrians and bicyclists do *not* take all justified care measures to lower the accident probability (for example, using good lighting, waiting for traffic lights to turn green before crossing, indicating the direction in which the bicycle is going to turn and looking over the shoulder before actually taking the turn, etc.), this line of reasoning introduces the concept of *uncompensated losses*. After all, it is argued that a rule of strict liability does not need a defense of contributory or comparative negligence, because the victim receives care incentives from the desire not to be involved in an accident in the first place. This implies that the amount of compensation received after the accident is not enough to make him indifferent between not being involved in an accident on the one hand, and being involved in an accident and receiving compensatory damages on the other hand. Hence, part of his losses remains uncompensated, either because they cannot be fully compensated or because the law does not recognize these losses as compensable.

If the victim does not *receive* full compensation, the injurer does not *pay* full compensation. It can be shown that the problem of uncompensated losses is larger under a rule of strict liability than under a rule of negligence. After all, the injurer only bears a fraction of the losses he has caused. He

therefore does not compare his care costs with liability for the full losses, but only with liability for a fraction of the losses. The ‘reward’ for careful behavior is larger under a rule of negligence than under a rule of strict liability. Under the former rule, the injurer escapes liability altogether by being careful, while under the latter rule he only lowers the probability of being held liable. Given that the reward is larger under negligence, the fraction of losses that the injurer has to compensate can be lower to still provide adequate care incentives. The injurer under negligence takes due care as long as the costs of taking due care are lower than the costs of lower care plus the expected liability. Under strict liability, he takes due care only as long as the costs of due care plus expected liability at due care are lower than the costs of a lower care level plus the expected losses at that care level. The injurer’s private costs at due care are therefore lower under negligence than under strict liability.

This all implies that if the fraction of losses that is compensated lies below the ‘critical fraction’ of negligence, none of the liability rules provides the correct incentives. If the fraction lies above the critical level of negligence but below the critical level of strict liability, only the negligence rule provides the correct incentives. If the fraction lies above the critical level of strict liability, both rules provide the correct care incentives. Hence, the argument of uncompensated losses that was introduced to justify strict liability without a defense of contributory or comparative negligence turns out to be an argument against strict liability and in favor of negligence (Visscher, 1998). If courts make mistakes in setting the due care level, this advantage of negligence might disappear. That result comes as no surprise, given the insights from economic literature regarding the comparison of negligence and strict liability (see also the chapter dealing with this distinction in this Encyclopedia).

6.8 Punitive damages

The law and economics literature provides several arguments in favor of punitive damages. (See, among many more, Ellis, 1982; Cooter, 1982, 1989b; Eisenberg et al., 1997; Polinsky, 1997; Polinsky and Shavell, 1998; Karpoff and Lott, 1999; Shavell, 2004, pp. 243 ff; Duggan, 2006, pp. 308 ff). The topic of punitive damages will be elaborated upon in a specific chapter in this Encyclopedia, but at this point, a brief overview of the above-mentioned arguments will be given.

First and foremost, punitive damages can be used to offset the problems caused by the fact that the probability that a tortfeasor will actually be held liable is below 100 percent. The victim might not start a lawsuit and if he does, he might not be able to prove fault (if required), causation or losses. Courts might make mistakes in setting the due care level or in determining

the true care level. If tortfeasors are not held liable in all situations where they should be liable, their expected liability is lower than the losses they have caused. This could provide inadequate care incentives and could lead to excessive activity levels. A possible solution to this problem is to multiply the damages by the reciprocal of the probability that the injurer will be found liable in the suitable cases. So, if this probability is for example 50 percent, damages should be doubled in order to provide the correct incentives (Cooter, 1989b; Polinsky and Shavell, 1998; Shavell, 2004, p. 244). Hylton and Miceli argue that the multiplier should be set by striking a balance between the problem of the too low probability of being held liable on the one hand, and the desire to optimize litigation costs on the other hand. This leads to a lower optimal multiplier (Hylton and Miceli, 2005. Also see Yun, 2004). In situations where victims do not start a lawsuit because their losses are lower than the costs of filing a claim, besides awarding punitive damages, allowing collective actions might solve this problem of 'rational apathy' (see, for example, Schäfer, 2000, pp. 184 ff and Van Aaken, 2003, pp. 55 ff).

Second, the injurer might derive social illicit utility from causing harm. This implies that society wants to discourage this harmful act and in order to do so, damages must exceed the utility the injurer derives from his act. If the injurer's utility exceeds the harm, damages have to be supra-compensatory. The same holds if taking care causes special disutility for the injurer which is not considered relevant for social welfare (Shavell, 2004, p. 245). Friedman objects to such a line of reasoning. Ignoring certain benefits by labeling them as illicit assumes the conclusion of undesirability instead of proving it (Friedman, 2000, pp. 229 ff).

Third, in situations where a potential tortfeasor is able to negotiate with a potential victim about the price to pay for his activity, it is often preferred that he does so. Market transactions are preferred over the forced transactions through tort law, because of the possibility that damages do not cover all losses. For example, subjective valuations are difficult to assess and tort damages might not encompass all losses. Punitive damages encourage market transactions, because committing the tort becomes more expensive (Shavell, 2004, pp. 245, 246).

Finally, victims who claim damages in essence serve the social goal of deterrence. However, starting a lawsuit entails costs, which are privately borne. This might lead to too few lawsuits being brought. Increasing the expected damages of victims by awarding punitive damages might ameliorate this situation.

Victims receiving supra-compensatory damages might start behaving strategically in order to increase the chances of being involved in an accident where they can claim these damages. The problem of taking

inadequate care might be tackled by incorporating a defense of contributory negligence. Victims, however, might also choose an excessive activity level. Decoupling liability so that victims only receive compensatory damages in the first place can solve this problem.

6.9 Pure economic loss

In order to provide actors with the correct incentives to prevent losses, damages should be based on the social losses caused by the actors. In cases of pure economic loss, the private losses of the victim often exceed the social losses. The private losses of the victim might be (partially) offset by private gains elsewhere, so that there is no loss of wealth, but rather a redistribution. If, for example, firm A cannot produce because a power cable was negligently damaged, firm B might be able to produce and sell more products which are substitutes for the products of firm A. In the law and economics literature, this is regarded as an important reason not to compensate pure economic loss (Bishop, 1982; Shavell, 1987, pp. 135 ff; Landes and Posner, 1987, pp. 251 ff; Gómez and Ruiz, 2004; Schäfer and Ott, 2005, p. 301; Dari-Mattiacci and Schäfer, 2007, p. 10).

However, it cannot always be argued that in cases of pure economic loss, no social losses occur. First, the products of firm B might not be perfect substitutes, so that consumers suffer a loss of consumer surplus. This problem occurs even more in cases of services rather than products (Schäfer and Ott, 2005, p. 306).

Second, in order for firm B to be able to satisfy the increased demand, there has to be overcapacity, which in itself is inefficient. After all, it is only if firm B has overcapacity that it can increase its production to meet the additional demand of customers from firm A. Resources which are kept as overcapacity do not yield the highest possible return, because if the overcapacity is not utilized after all, the resources remain idle. Not compensating pure economic loss leads to less liability and hence more accidents, so that even more overcapacity is needed (Rizzo, 1982b, p. 202). Rizzo argues that compensating pure economic loss through tort law causes high tertiary costs, so that the claims should be channeled through contract law: the party suffering physical losses also sues for pure economic loss from his contractual partners. Firm A and the phone company agree that the latter will compensate the pure economic loss due to the damaged phone line, and that it will sue the tortfeasor both for the physical losses (the damaged phone cables) and the pure economic loss of its customers. Instead of compensating A for the actual pure economic loss, it is also possible to agree upon *ex ante* compensation through the contract, that is, a lower price for the phone services (Rizzo, 1982a, pp. 291 ff; Gómez and Ruiz, 2004). According to Schäfer, compensation through tort law *is* possible. The

extent of the pure economic loss is determined by the amount the excess resource could have yielded elsewhere (Schäfer, 2001a, p. 11).

Third, in cases where the pure economic loss is suffered, for example, because an accountant has negligently approved the balance sheet of a firm so that people buying the stock might have paid too high a price, there will not only be a redistribution of wealth between buyers and sellers of stock. There will also be social loss due to a decrease in trust in the information provided by accountants. Moreover, money is sub-optimally invested on the basis of incorrect information, which entails a social loss as well (Schäfer, 2001b, p. 7).

In situations where on the basis of a contract a risk is allocated to one of the contract parties and this risk can be influenced by a potential tortfeasor, liability for pure economic loss might make sense because it resembles subrogation (Gómez and Ruiz, 2004). If, for example, an employer has to continue to pay the wages of an employee who was injured in a tort and temporarily cannot work, the employer suffers pure economic loss. The employer in a sense acts as the insurer of this risk of the employee. Without the contractual obligation to pay the wages, the employee himself could have sued the tortfeasor for loss of income. The mere fact that the labor contract has transferred this risk to the employer should not lead to the situation that the tortfeasor is not liable for these losses anymore.

Furthermore, tort liability for pure economic loss might serve as a surrogate for contractual liability. If a third party suffers pure economic loss as a result of a breach of contract, this third party cannot sue on the basis of the contract. Nor can the contracting partner, because he does not suffer the losses. Tort liability can solve this problem. For example, a public notary is negligent in drafting a will, so that an intended beneficiary does not become a beneficiary after all. There is a social loss (the last will of the deceased is not properly executed), but the intended beneficiary cannot sue out of contract. If he can sue the public notary for his pure economic loss out of torts, this problem could be solved (Gómez and Ruiz, 2004). However, it remains to be seen what the proper amount of damages would be. The amount of money that the intended beneficiary did not inherit is not necessarily connected to the social loss of the last will not being properly executed.

Finally, Dari-Mattiacci argues that the true problem of pure economic loss is caused by the fact that the activity of the injurer causes both negative and positive externalities. Simply adding those does not provide actors with the correct incentives. Dari-Mattiacci does not view overcapacity as inefficient, but as a care measure that parties can take to avoid or lower the pure economic loss. Injurers should receive correct care and activity incentives, while victims and third parties should get an incentive to maintain optimal overcapacity. In order to achieve this, liability has to be decoupled:

the injurer is liable for the pure economic loss but is compensated for the benefits of third parties, the victim is not compensated for pure economic loss but is compensated for benefits of third parties, and the third parties are allowed to keep their benefits. No traditional tort rule can achieve this result (Dari-Mattiacci, 2004).

6.10 Harm to the victim or gain to the injurer?

Wittman has asked the question if compensation should be based on the cost to one side or benefit to the other side. He focuses on which party – in a situation of information asymmetry – should decide on how much care the injurer should take. The side with a comparative advantage in information about the other side's costs and benefits from taking care should make the decision (Wittman, 1985, pp. 176, 177).

Polinsky and Shavell analyze whether liability should be based on the harm the injurer has inflicted upon the victim, or on the gains that the injurer derived from the tort. They argue that the harm of the victim is the better measure. After all, if damages are based on the gain to the injurer but the court underestimates these gains, the incentives for the injurer are inadequate. As long as he expects a part of his gain to remain after paying damages, he benefits from committing the tort, irrespective of the size of the losses of the victim (Polinsky and Shavell, 1994, pp. 431, 434). Hence, even though the prevention goal of tort law is regarded as an argument for basing damages on profits to ensure that wrongdoing is not more profitable than law abiding behavior (Magnus, 2001, p. 187), due to the risk of underestimation of profits, it is better to base the damages on the losses of the victim.

In some jurisdictions, the victim can ask the court to estimate the damages on the basis of (part of) the profits of the injurer. The problem mentioned by Polinsky and Shavell does not occur here, because if the losses of the victim exceed the profits of the injurer, the victim will not ask to base the damages on the profits in the first place. However, if the profits exceed the costs to the victim, the act of the injurer could actually increase social welfare. If the victim can collect the full profits, the injurer might refrain from the activity so that the activity level is too low.

Alternatively, the injurer might take excessive care to avoid liability. On the other hand, in cases where liability based on the losses of the victim provides inadequate incentives (for example, due to too low a probability of being held liable), using the profits as the standard for damages might solve the problem. Also, if it is difficult for the victim to prove the losses, basing damages on profits avoids the problem of too low a threat of liability. Especially in cases of infringements upon intellectual property this approach makes sense, because the infringer could have sought a voluntary

transaction. Determining damages on the basis of profits induces the tortfeasor to actually do this (Schäfer and Ott, 2005, pp. 253, 254). In essence, basing tort damages on the profits of the injurer induces the latter to make use of a contract instead.

6.11 Future losses

What is the proper form of damages for future losses: lump sum or periodic contingent payments? Traditional arguments for periodic contingent payments are the uncertain nature of future losses, the resulting future risk the victim faces with a lump-sum award and the possibility the victim might misallocate lump-sum awards (Rea, 1981, p. 132).

Rea proposes several reasons why a lump-sum payment might be preferred. First, the victim that prefers a periodic payment can transfer his lump-sum payment into a periodic payment himself. He can use the lump-sum payment to buy insurance (if available) against the risk of a wrong assessment of the losses. With periodic contingent payments, the court has to administer the payments, while with insurance a private insurer would administer them. Courts are not well suited to this task.

Second, periodic contingent payments amount to uncertainty for the defendant. If he is risk-averse, he might want to buy some insurance, which adds to the costs of this form of damages.

Third, periodic contingent payments might lead to moral hazard on the part of the plaintiff. If the payments, for example, consist of the difference between the wage he could have earned without the tort and the wage he actually earns now, he has no incentive to earn more, because this only reduces the damage payment.

Finally, periodic contingent payments cause additional costs for the plaintiff during a much longer time period, for example, a loss of privacy due to the monitoring which is necessary to determine the extent of the losses.

Obviously, the injurer should only pay the present value of the losses, so they should be discounted for the interest rate (Shavell, 1987, p. 141).

In an empirical study regarding damages for loss of future earnings in England and Wales, it is argued that courts have generally undercompensated victims. Important reasons are the fact that courts underestimate the growth in earnings over a claimant's working life, as well as the adverse effects of residual disability on post-injury employment. In American cases, more attention is paid to the results of labor market analysis to predict future patterns of earnings and employment (Lewis et al., 2002, pp. 408, 414). According to the authors, because courts in England and Wales do not incorporate those insights, 88 percent of cases in their survey were undercompensated. Over half of those claimants would have received at

least 50 percent more, and a third of them at least 100 percent more. The differential is most significant for men, younger claimants and victims with post-injury earnings potential (Lewis et al., 2002, p. 433).

6.12 Role of defendants' wealth

Should the wealth of the defendant influence the damages he has to pay? After all, the duty to pay a given amount of damages weighs more heavily on the utility level of a poorer defendant than on the utility level of a wealthier defendant.

In the standard analysis, injurers are assumed to be identical and risk neutral, so that the issue plays no role there (Abraham and Jeffries, 1989; Arlen, 1992b. Also see Miceli and Segerson, 1995). However, if parties are risk averse and the goal is to maximize total social welfare, measured as the sum of individual utility levels, the result changes. The optimal care level rises as the defendant is wealthier. After all, spending an additional euro on care costs him less utility than it would a less wealthy person. In order to induce the wealthier person to take more care, damages should be raised for him. Hence, the optimal level of damages would depend on the wealth of the defendant. Arlen argues that this conclusion might be rejected, because it might reduce the incentive to accumulate wealth, and it raises administrative costs (Arlen, 1992b).

Furthermore, it is commonly argued that tort law is not the best instrument for redistributing wealth (Polinsky, 1989, p. 10; Kaplow and Shavell, 1994; Kaplow and Shavell, 2000; Weisbach, 2002). The basic argument is that any tax on income, whether imposed directly as income tax or indirectly via the legal system, distorts work incentives in the sense that people will work less than they would in the absence of taxes. However, use of the legal system also distorts the underlying activity being regulated (Avraham et al., 2002, p. 4). Therefore, legal rules should only focus on efficiency, not on redistribution. Avraham et al. argue, referring to the work of Sanchirico, that introducing heterogeneity with regard to the skill in taking care and with regard to the ability to generate income and relaxing the assumption that the social planner has complete information challenges this conclusion (Avraham et al., 2002, p. 6; Sanchirico, 2000, 2001). Income-dependent tort rules enable wealthy defendants to lower their expected liability in two ways: taking more care and/or working less. Income-independent tort law only provides the option of taking more care. Because people differ in their ability to take care and to acquire income, there is no simple way to determine this mix for every individual, so that the conclusion of Kaplow and Shavell that income-dependent tort law leads to excessive care by wealthy defendants and inadequate care by poor defendants is rejected. Fine-tuning the tax system to the characteristics of

every individual so that their conclusion would still hold requires too much information from the social planner (Avraham et al., 2002, pp. 7 ff).

6.13 Mitigation of losses

As already indicated in Section 6.2, victims should be induced to optimally mitigate their losses, so that damages should be restricted to the optimally mitigated losses plus the mitigation costs (Wittman, 1981; Shavell, 2004, pp. 248 ff). This way, the victim is induced to take these optimal measures. After all, not taking these measures leads to higher losses that are not fully compensated, and taking more than the optimal measures increases the costs, but not the damages. The injurer is confronted with the costs (of both the losses and the mitigation measures) he has caused, which are minimized due to the mitigating measures.

In legal literature the question has arisen whether the costs of keeping reserve equipment available in case an accident happens can be (partly) recouped from the liable injurer. If, for example, a bus company keeps a spare bus available to be able to rapidly replace a bus that was involved in an accident, it avoids having to pay a commercial rent for a replacement bus. Legal problems with this topic are the fact that the costs of the spare bus have been incurred prior to and unrelated to the accident. After all, if there had not been an accident, the costs of the spare bus would have been the same. Hence, the causal link between the accident and these costs is problematic. Furthermore, it is difficult to determine which part of the costs should be borne by the injurer. From an economic point of view, the costs of the spare bus, if it is kept in consideration of possible accidents and if this is cheaper than renting replacement buses after accidents have happened, should be regarded as mitigation costs that should be compensated by the injurer. It is irrelevant that the costs were already made before any accident. If the bus company cannot recoup these costs, it will be induced to have too little spare material available, because the costs of renting a replacement bus are regarded as losses that the injurer has to compensate. The decision as to how much spare material to keep will then only be taken on the basis of how often buses break down due to factors for which no one can be held liable. Furthermore, the injurer would not internalize all the losses he has caused.

Optimal mitigation costs should be compensated by the injurer, care costs should be borne by the actor himself. It can be difficult to distinguish between both types of costs, especially if both types of measures have already been taken before the accident. Many economic analyses regard the size of the losses as fixed, so that care only influences the accident probability. The distinction between care measures and mitigation measures is then easy: care measures lower the accident probability; mitigation

measures restrict the size of the losses after an accident has happened. However, some measures that reduce the size of losses are not regarded as compensable mitigation measures, such as wearing a seatbelt, so that the above distinction does not suffice. A possible distinction might be made as follows: measures that reduce the probability of an accident in general are care measures. They should not be compensated because that would only imply a transfer of money, without lowering the total accident costs. Measures that lower the size of losses can be either care measures or mitigation measures. If they limit the size of the losses *at the time of the accident*, they should be regarded as uncompensable care measures, such as wearing a seatbelt or having an airbag installed. Measures that limit the size of the losses *after the initial losses have materialized* on the other hand, such as using a fire extinguisher after an accident, are mitigation measures and should be compensated in as far as they have reduced the total accident costs.

6.14 Judicial moderation, limitation of damages and insolvency

Courts often have the authority to moderate damages, if full compensation is regarded as too heavy a burden on the tortfeasor in the given circumstances, for example, because minor mistakes can lead to enormous losses in modern society and because strict liability can make someone liable without having done anything wrong. Furthermore, statutes might limit the maximum amount of damages, for example, to the amount that could reasonably be insured.

Given the economic point of departure of full compensation, both restrictions of liability are debated. The argument of uninsurability that is often invoked fails to recognize that it is not primarily the size of the losses, but rather the uncertainty regarding the accident probability that causes this problem. Restricting liability therefore does not solve the problem, but actually increases the primary accident costs by lowering the care incentives and increasing the activity level (Jost, 1996, p. 262; Cooter and Ulen, 2004, pp. 358 ff; Shavell, 2004, pp. 230 ff; Faure, 2005, pp. 251 ff; Van den Bergh and Visscher, 2006, pp. 536 ff).

Furthermore, it can increase the secondary accident costs by leaving part of the victim's losses uncompensated. On the other hand, the secondary costs might be lowered if the injurer is risk averse and cannot fully insure his losses, because the restricted liability spreads losses that exceed the limit over the injurer and the victim.

The restricted liability might induce a risk-averse injurer to engage in an activity from which he would refrain under full liability. This is positive in situations where the total costs of the activity are lower than the benefits, but where the risk attitude of the actor inhibits him from engaging in the

activity. However, if the total costs are higher than the benefits, restricted liability might lead him to engage in the activity where he would have better refrained from it.

Dari-Mattiacci and De Geest analyze the influence of insolvency of the injurer, but argue that their results also hold in other situations where the injurer has caused more losses than he has to compensate, for example due to limitation (Dari-Mattiacci and De Geest, 2005, p. 38).

The existing literature investigates the influence of judgment proofness in situations where the care level influences the accident probability. The result is that the injurer will take inadequate care, because he weighs his care costs against the limited liability. This problem is more severe under strict liability than under negligence, because taking care under strict liability only reduces expected liability, while under negligence taking due care makes the injurer escape liability altogether. Therefore, taking due care under negligence is worthwhile as long as the expected liability (which is lower than the expected losses, due to the judgment proofness) is higher than the costs of due care (Summers, 1983; Landes and Posner, 1984, pp. 420 ff; Shavell, 1986; Shavell, 1987, p. 167; Faure, 2002, pp. 368 and 371. Also see Beard, 1990, who argues that bankruptcy can lead to inadequate, but also to excessive care under strict liability). This difference disappears if a causal relationship between the negligence and the losses is required (Kahan, 1989). A possible solution to the judgment-proof problem is to let the injurer pay punitive damages in those cases where harm is lower than his assets, to correct for the cases where he is judgment proof. After all, this increases his expected liability (Boyd and Ingberman, 1994; Lewis and Sappington, 1999). Dari-Mattiacci and De Geest argue that this same result can be achieved by having the injurer pay average damages in each case. The advantage according to them is that this requires less information, demanding knowledge only about average harm, not about real harm in specific cases (Dari-Mattiacci and De Geest, 2005, pp. 48 ff).

Dari-Mattiacci and De Geest label the above model where care influences only the accident probability as the 'probability model'. Besides this model, they distinguish three other models. In the 'magnitude model', care only influences the possible magnitude of the losses. In the 'joint probability-magnitude model', the care measure simultaneously influences the accident probability and the magnitude of the losses. In the 'separate probability-magnitude model', some care measures influence the accident probability while others influence the magnitude of the losses (Dari-Mattiacci and De Geest, 2005, pp. 42 ff. Also see Nussim and Tabbach, 2006, pp. 23 ff).

The traditional outcome of the probability model that insolvency leads to inadequate care has to be revised in the magnitude model. If care of the injurer influences the magnitude of the losses, the injurer can decide

whether or not the harm will exceed his assets (or another threshold). If he decides not to be judgment proof (he remains in the 'solvent zone'), he will take optimal precautions. However, if he decides to be in the 'judgment proof zone', he will choose no care at all, because that does not reduce his liability but would only entail care costs.

In the separate probability-magnitude model, if the injurer chooses optimal magnitude-reducing precautions, he is solvent and hence will also take optimal probability-reducing precautions. He will do this if the threshold is sufficiently high. If he chose to take no magnitude-reducing care on the other hand, all probability-reducing care levels are possible and they depend on the threshold. Less than optimal care is possible due to the familiar judgment-proof argument. However, (more than) optimal care is also possible, because by taking no magnitude-reducing care, liability costs *if* an accident happens are higher than optimal. Taking excessive probability-reducing care can mitigate this by lowering the accident probability.

In the joint probability-magnitude model, if the injurer chooses to be in the solvent zone, he will take optimal care. He will do this if the threshold is sufficiently high. If he chooses a lower than optimal care level in order to enter the judgment-proof zone, however, he will still take some care measures to lower the accident probability. The lower the threshold, the lower the care level chosen.

In all four models, negligence leads to better results than strict liability. The explanation is that the negligence rule gives an implicit harm subsidy to non-negligent injurers. Judgment proofness, on the other hand, provides an implicit harm subsidy to negligent injurers, which increases with a decreasing care level. Strict liability only has the latter harm subsidy, while negligence has both. Therefore, injurers receive better care incentives under negligence (Dari-Mattiacci and De Geest, 2005, p. 51). Again, if a causal relationship is required between the negligence and the losses, this result will no longer hold (Kahan, 1989).

6.15 Loss of a chance

In a separate chapter of this Encyclopedia, the topic of uncertainty over causation is discussed. A possible response to this problem is proportional liability, implying that a tortfeasor is held liable if there is a positive probability that he has caused the losses, but the magnitude of liability is reduced by multiplying the losses by the probability of causation.

A closely related topic, relevant to this chapter on tort damages, is called 'loss of a chance', which is especially known in professional liability. It refers to situations where the victim suffers losses because a benefit that could have been yielded with a certain probability has become impossible, or a harm that could have been avoided with a certain probability has

materialized (Frasca, 2005, p. 2). For instance, a doctor makes a mistake, the patient suffers harm, this harm could have materialized as well without the mistake, but the mistake has ruined the chance of recovery. The recoverable losses consist of this loss of a chance. So if the patient suffers losses of 100,000 and the chance of recovery without the mistake is established at 25 percent, damages amount to 25,000.

A problem with uncertainty over causation, and with applying proportional liability, is that it is uncertain whether the tort of the injurer has caused the losses of the victim. In other words, there is only a certain probability that the tort was the but-for cause of the losses. The doctrine of loss of a chance regards the lost chance in itself as the recoverable loss, and the tort was a necessary cause of this loss. A crucial difference between loss of a chance and proportional liability in cases of mass losses is that in the latter cases statistical data are used to determine the probability that a causal relationship between the tort and the losses exists, while with loss of a chance, statistics and probability theory are used to assess the magnitude of the losses, given that it is already established that the injurer is liable for the losses. The fact that one first has to establish that the tort is a but-for cause of the loss of a chance circumvents the danger of proportional liability that liability is based on a coincidental 'relationship' between the activity of the injurer and the losses (see, for example, King, 1981 on the distinction between causation (what was the cause of the loss) and valuation (the process of identifying and measuring the loss that was caused)).

From a deterrence point of view, if a tortfeasor always escapes liability if it is uncertain whether his tort actually caused the losses, he would receive inadequate behavioral incentives. His tort has reduced the victim's probability of recovery or it has reduced the probability of yielding a benefit. If the tortfeasor does not internalize these externalities, his behavior will not be efficient. In essence, the same arguments that can be used to support proportional liability can be applied here. The reader is referred to the chapter dealing with causation for literature on this topic.

It is noteworthy that generally speaking a victim can only claim recovery for loss of a chance if he actually suffered harm (Frasca, 2005, p. 5). This implies that the injurer will not fully internalize the harm he has caused by his tort, because only in cases where harm has materialized will he be held liable, yet only for a fraction of the losses. The fact that in many jurisdictions the defendant is held fully liable if the probability of causation exceeds 50 percent, so a *preponderance of the evidence* rule (Frasca, 2005, pp. 14 ff) ameliorates this problem, yet it might bring back the problem of excessive care incentives which is familiar from the literature on uncertainty over causation (specifically with regards to loss of a chance, see Fischer, 2001, pp. 627 ff; Kötz and Schäfer, 2003, pp. 239 ff).

Goldberg argues that the idea of loss of a chance should not be extended to legal malpractice. Tort law requires harm on the part of the victim. Mere negligence by the injurer (be it a doctor or a lawyer) is not enough. If a tort suit could be based on the mere imposition of risk, instead of on causing harm, several problems would arise. First, courts are not well able to calculate the risks imposed and the money value of the expected harm. Second, there is no good reason to entitle a plaintiff who did not suffer any harm to compensation. Third, the law would interfere too much with the freedom of individuals to engage in activities that increase risk to others (Goldberg, 2003, p. 1207). Goldberg sees no reason why legal malpractice plaintiffs would have more problems with proof regarding causation than other plaintiffs. Furthermore, in contrast to medical malpractice cases, clients of lawyers are sometimes well able to protect themselves through contracts and monitoring of attorney performance, for example, if the client is a firm. Also, in medical malpractice cases, the doctor might have failed to reduce the risk of a fatal disease, illness or condition, while legal malpractice cases are dealing with the right to legal recourse. In addition, the client does not want to be restored to the *status quo ante*, but to a situation that is counterfactual. Finally, the problems of proof differ between medical and legal malpractice claims. All these elements bring Goldberg to the conclusion that the doctrine of loss of a chance, justified as it may be in medical malpractice cases, should not be extended to legal malpractice (Goldberg, 2003, pp. 1210 ff).

6.16 Multiple tortfeasors

In most cases where multiple tortfeasors are involved, they are jointly and severally liable for the losses, so that the victim is able to sue one (or a few) of them and collect the total damages, which in subsequent recourse claims might be divided between all defendants. The alternative is formed by non-joint liability, where each injurer is only liable for the part of the losses which can be attributed to him. This topic is discussed in detail in the chapter dealing with joint and several liability, but below the relevant insights regarding damages will be presented.

Under strict liability, solvable injurers receive sub-optimal care incentives under joint and several liability as well as under non-joint liability. After all, each injurer is only confronted with a part of the losses, so that the damages are too low to provide the correct incentives. The injurers will all take inadequate care and externalize the rest of the losses to other tortfeasors (Kornhauser and Revesz, 1989, pp. 856 ff; Kornhauser and Revesz, 1990, p. 637). Only if tortfeasors operate as a group, will they weigh total care costs against total losses and take optimal care (Shavell, 1987, pp. 164 ff). The victim will not sue more defendants than is necessary to receive

full compensation, in order to save on litigation costs. Injurers that do not expect to have to pay damages to the victim only receive care incentives through recourse claims. If recourse is not 100 percent successful, this implies that some injurers will receive inadequate care incentives, which increases expected accident losses, which in its turn will increase the care level of those injurers that do expect to be sued by the victim (Tietenberg, 1989, pp. 313 ff. Also see Bergkamp, 2000 and 2001 and Faure, 2003b on the possible problems of joint and several liability). Insolvent injurers will take even less care, because they do not focus on the losses they have caused, but on the expected damages, which are lower due to their insolvency. This induces the solvent injurers in the group to take more care, because they expect to have to bear this part of the losses. Under non-joint liability, this last shift does not occur. Solvent injurers still take excessive care (although less than under joint and several liability), because the total losses, of which they have to pay a fraction in damages, are higher due to the careless behavior of the insolvent injurers. If all injurers are insolvent, the degree of insolvency determines which rule provides the best behavioral incentives (Kornhauser and Revesz, 1990, pp. 640 ff).

Under negligence, where due care is put at the optimal care level, joint and several liability can contribute to deterrence of solvent injurers. After all, the reduction in care costs due to taking less care is always lower than the liability that is created by his negligence (Landes and Posner, 1980, pp. 523 ff; Shavell, 1987, pp. 164 ff; Kornhauser and Revesz, 1989, pp. 847 ff; Tietenberg, 1989, p. 311; Kornhauser and Revesz, 1990, p. 644). Non-joint liability causes care problems if a negligent injurer does not bear the full increase in expected accident losses caused by his own negligence (Kornhauser and Revesz, 1989, pp. 849 ff; Kornhauser and Revesz, 1998, p. 372). If injurers are insolvent, the same problems occur as with strict liability (Kornhauser and Revesz, 1990, p. 645).

Cooter and Porat propose to hold every injurer liable for the total 'excessive harm', that is, the amount at which the actual total harm exceeds the optimal total harm. It is often easier to establish total harm than to prove the harm that each individual injurer has caused. If each injurer is liable for the total excessive harm, each injurer has an incentive not to cause excessive harm. Liability will then be zero, and no injurer has an incentive to deviate from this strategy. If an injurer takes inadequate care by mistake, the other injurers gain from helping him to correct this mistake (Cooter and Porat, 2007, pp. 67 ff). If the authorities underestimate social harm by a certain amount, injurers will take inadequate care. If the authorities overestimate social harm by a certain amount, injurers will still take optimal decisions, because that minimizes their costs. If the error is not additive, but multiplicative, marginal values change and the conclusions

might change. Especially if the number of injurers becomes very large, the rule of total liability for excessive harm is no longer practical, because there is a high possibility that mistakes will be made (Cooter and Porat, 2007, pp. 71 ff).

6.17 Secondary accident cost reduction

Rules regarding liability and rules regarding damages both determine which party bears which risk. For example, if a certain activity is subject to a rule of strict liability, but damages rules exclude certain types of losses from recovery, then the victim is the residual risk bearer of these losses. Hence, the combination of both types of rules determines the actual risk distribution.

If all parties are risk-neutral, they are only concerned with the *expected loss*, and the above analysis holds. However, if risk aversion is introduced into the analysis, the results might change. Especially if parties differ in the degree of risk averseness, the rules of liability and damages influence the way in which a given loss affects social welfare. The goal of secondary cost reduction aims at minimizing the impact of a loss on social welfare, by spreading it over a larger group, and/or by transferring it to the parties who are best able to bear it.

Shavell defines the socially ideal situation as a situation where all parties make optimal decisions regarding their care level and their activity level, and where risk-averse parties do not bear risk, either because they are perfectly spread through insurance arrangements, or because they are transferred to risk-neutral parties (Shavell, 2004, p. 259).

If insurance is not available, strict liability causes the injurer to bear the risk of the losses that are incorporated into the damages, while the victim bears the risk of the not-incorporated losses. Having to bear these risks can cause risk-averse parties to take excessive care measures, and/or to choose too low an activity level. Shavell therefore argues that if injurers are risk-averse and insurance is not available, it might not be socially desirable to make them fully liable (Shavell, 1982, 2004, p. 260). Under a negligence rule, the injurer can avoid having to bear risk by taking due care, so that the above problems do not occur. However, risk-averse victims now face the risk, which can cause them to take excessive care and/or reduce their activity level too much. If the injurer is risk-neutral and the victim risk-averse, strict liability with full damages leads to the best outcome.

If insurance *is* available, parties will buy insurance to cover their risks. Tort liability then only needs to focus on providing optimal care and activity incentives, if insurers can observe care. If they cannot observe care, problems of moral hazard and adverse selection enter the analysis. One possible solution to those problems is incomplete coverage, but this again

causes the insured to bear (some) risk, which frustrates the socially ideal situation (Shavell, 2004, pp. 261 ff).

6.18 Empirical research

In the above sections, law and economics insights regarding tort damages have been presented and discussed. It is interesting to see how ‘real world’ tort damages compare to theoretical insights. Dewees, Duff and Trebilcock provide an extensive overview of empirical research on accident law, in which they analyze to what extent tort law in five different categories of accidents (automobile, medical, product-related, environmental and workplace accidents) is able to achieve the goals of deterrence, compensation and corrective justice (Dewees et al., 1996, pp. 5 ff). They perform both an *input analysis* (how does real tort law relate to the theoretical optimal rules?) and an *output analysis* (how does the system perform in practice?). In the current section, I will briefly discuss their findings, in as far as they are relevant to tort damages, the topic of this chapter. The interested reader is referred to the extensive references at the end of each chapter in their book.

In automobile accidents, tort damages fall short of the theoretical ideal of full compensation which is needed to minimize the social costs of accidents. First, many jurisdictions impose limits on recovery for pain and suffering. In Sections 6.3 and 6.6 above, it became clear that those losses should be included in the amount the injurer has to pay, unless they are so small that the reduction in administrative costs yielded by neglecting them outweighs the decrease in care incentives. Second, in some jurisdictions collateral benefits are subtracted from tort damages, so that the injurer is not faced with the full costs he has caused. Third, damages for fatal accidents are very low, when compared to theoretically desirable amounts (Hensler et al., 1991; Viscusi, 1991; Galanter, 1996; Dewees et al., 1996, pp. 17 ff). Furthermore, economic losses are generally undercompensated, and this problem increases with the severity of the injuries.

Tort law in automobile accidents also fails to reach the compensation goal, where optimal compensation is based on the amount for which a rational person would insure. Most rules are negligence-based so that non-negligent losses are not compensated, and neither are the losses that the victim inadvertently inflicts upon himself. Furthermore, the defense of contributory negligence completely bars recovery, even if the victim has only made a small mistake. More than one third of the victims of traffic accidents is left without compensation (Dewees et al., 1996, p. 30). Finally, tort law is a slow and expensive way of providing compensation (Dewees et al., 1996, pp. 34 ff).

In medical malpractice, as in automobile accidents, recovery for pain and suffering is limited, collateral benefits are deducted and damages for fatal

accidents are too low. In addition, in contrast to automobile accidents, only a small fraction of all victims files a claim. In cases that are being tried, juries tend to award high damages in medical malpractice cases. However, over 90 percent of cases are settled out of court. The settlement awards are often too low, partly due to the pressing need of injured plaintiffs (Deweese et al., 1996, pp. 98 ff).

Product liability suffers from the same problems, and even fewer victims consider filing a claim. It turns out that punitive damages are not used as an instrument to tackle this problem, as was suggested in Section 6.8 (Deweese et al., 1996, pp. 194 ff).

In environmental accidents, plaintiffs can recover for economic loss, costs of restoration and pain and suffering, but generally not for pure economic loss, emotional stress, aesthetic or recreational loss or increased risk of injury in the absence of actual proof of injury. Hence, not all social losses are encompassed in tort damages. This holds even more for losses to the ecosystem where no individual can sue, or future losses. Punitive damages do not seem to solve this problem. Only a few cases are tried, due, for example, to problems of proving causation, statutes of limitation and standing (Deweese et al., 1996, pp. 272 ff).

In workplace injuries, finally, damages are too low as well, especially in fatal accidents. With regard to occupational diseases, the long latency period (of, for example, asbestos disease) further decreases the potential deterrent role of tort law, due to the discount factor applied to future costs and benefits. And in cases where the disease has killed the employee, the problem of undercompensation for fatalities enters again. Many work-related accidents and diseases happen to people not poor enough for subsidized legal aid, but for whom the costs of a lawsuit might be too high to actually file a claim. Hence, the expected damages for the employer fall even further (Deweese et al., 1996, pp. 350 ff. Also see Lott and Manning, 2000).

Helland and Tabarrok investigate the effect of the composition of the jury pool on tort damages. According to their research, the average tort award increases as black and Hispanic county population rates increase and especially as black and Hispanic county poverty rates increase. A 1 percent increase in these populations leads to an average increase in tort damages of 3–10 percent (Helland and Tabarrok, 2003).

6.19 Conclusion

As a starting point, tort damages should be *full* in the sense that the injurer should internalize all externalities he has caused, in order to provide him with the correct care and activity incentives. Under a negligence rule, however, damages only need to be high enough to make due (optimal) care

more attractive than a lower care level. Whether or not the victim's litigation costs should be compensated depends on the productiveness of care measures and the willingness to sue. Victims should receive incentives to take optimal care themselves, and to optimally mitigate losses.

The injurer should pay for both pecuniary and nonpecuniary losses, unless the increase in administrative costs caused by the need to assess the latter outweighs the improvement in care and activity incentives. Pure economic loss should not always be compensated, as it does not always lead to social losses. The desired level of accuracy in assessing losses is determined by a weighing of administrative costs and behavioral incentives.

Damages for fatal accidents are too low from a law and economics point of view, because they do not incorporate the loss of life from the deceased. Literature regarding the value of a statistical life, the value of a statistical life year and quality adjusted life years might provide valuable insights in order to reach a better level of damages for fatal accidents. It remains to be seen whether the surviving relatives should receive these damages. The same is true of damages for nonpecuniary losses, because a rational victim would not insure against those losses. Hence, the injurer should pay damages for these losses, but the victim should not receive compensation. Therefore, liability should be decoupled.

Topics such as uncompensated losses, limitation and judgment proof suggest that negligence rules function better than strict liability. The difference is mainly caused by the fact that the reward on careful behavior is larger under negligence. However, if a causal relationship between the negligence and the losses is required, this difference disappears.

Punitive damages are seen as an instrument to combat the problems that occur when the injurer receives too few behavioral incentives from the tort system. Increasing the amount he has to pay when found liable can improve his incentives.

Empirical research suggests that many features of tort law deviate from the theoretically optimal system. Damages for nonpecuniary losses are inadequate, collateral benefits are sometimes subtracted from damages, and fatal accidents remain grossly undercompensated. Furthermore, the probability of being held liable is far below 100 percent, yet punitive damages are not used to tackle this problem. The insights developed in the law and economics literature regarding tort damages might be used as guidelines in order to improve the functioning of the tort system.

Acknowledgments

The bibliography on tort damages provided by Jennifer Arlen in the previous edition of this Encyclopedia has proven to be invaluable in writing this

chapter. I have included her bibliography integrally and have updated it with more recent literature.

Bibliography

- Abraham, Kenneth S., and John C. Jr Jeffries (1989), 'Punitive Damages and the Rule of Law: The Role of Defendant's Wealth', *Journal of Legal Studies*, 18, 415–25.
- Acton, Jan Paul (1976), 'The Value of Life: An Overview and Critique of Alternative Measures and Measurement Techniques', *Law and Contemporary Problems*, 40, 46–72.
- Adams, Michael (1989), 'Warum kein Ersatz von Nichtvermögensschäden? (Why No Damages for Nonpecuniary Losses?)', in Claus Ott and Hans-Bernd Schäfer (eds), *Allokationseffizienz in der Rechtsordnung*, Berlin: Springer, pp. 210–17.
- Adler, Matthew D. (2006), 'QALYs and Policy Evaluation: A New Perspective', *Yale Journal of Health Policy, Law and Ethics*, 6 (1), 1 ff.
- Adler, Matthew D. and Eric A. Posner (2007), 'Happiness Research and Cost-benefit Analysis', University of Chicago Olin Law and Economics Program Research Paper No. 345.
- Alberts, Robert J., Terrence M. Clauretje and Mel Jameson (1994), 'Ordinary and Reverse Tax Effect in Personal Injury and Wrongful Death Cases', *Journal of Forensic Economics*, 7 (3), 245–66.
- Albrecht, Gary R. (1994a), 'Modeling Taxes in Personal Injury and Wrongful Death Award Calculations', *Journal of Forensic Economics*, 7 (3), 239–43.
- Albrecht, Gary R. (1994b), 'The Application of the Hedonic Damages Concept to Wrongful Death and Personal Injury Litigation', *Journal of Forensic Economics*, 7 (2), 143–50.
- Anderson, Gary A. and Robert D. Willig (1985), 'Economic Theory and the Present Value of Future Lost Earnings: An Integration, Unification, and Simplification of Court Adopted Methodologies', *University of Miami Law Review*, 39, 723–56.
- Anderson, Gary A. and Joel R. Barber (1992), 'A Simple Procedure for Computing the Present Value of Non-annual Damages', *Journal of Forensic Economics*, 6 (1), 3–6.
- Arlen, Jennifer (1985), 'An Economic Analysis of Tort Damages for Wrongful Death', *New York University Law Review*, 60, 1113–36.
- Arlen, Jennifer (1990a), 'Re-Examining Liability Rules when Injurers as well as Victims Suffer Losses', *International Review of Law and Economics*, 10, 233–9.
- Arlen, Jennifer (1990b), 'Reconsidering Efficient Tort Rules for Personal Injury: The Case of Single Activity Accidents', *William and Mary Law Review*, 32, 41–103.
- Arlen, Jennifer (1992a), 'Liability Rules for Physical Injury when Injurers as well as Victims Suffer Losses', *Journal of Law, Economics and Organization*, 8, 411–26.
- Arlen, Jennifer (1992b), 'Should Defendants' Wealth Matter?', *Journal of Legal Studies*, 21, 413–29.
- Arlen, Jennifer (1992c), 'Book Review: W. Kip Viscusi, Reforming Products Liability', *Journal of Economic Literature*, 30, 2170–72.
- Arlen, Jennifer (1993), 'Compensation Systems and Efficient Deterrence', *Maryland Law Review*, 52, 1093–136.
- Arlen, Jennifer and Reinier Kraakman (1997), 'Controlling Corporate Misconduct: An Analysis of Corporate Liability Regimes', *New York University Law Review*, 72, 687–779.
- Arrow, Kenneth (1971), 'Insurance, Risk, and Resource Allocation', in *Essays in the Theory of Risk-Bearing*, Chicago, IL: Markham.
- Arrow, Kenneth (1974), 'Optimal Insurance and Generalized Deductibles', *Scandinavian Actuarial Journal*, 1–42.
- Arthur, W. Brian (1981), 'The Economics of Risks to Life', *American Economic Review*, 71, 54–64.
- Ashenfelter, Orley (2006), 'Measuring the Value of a Statistical Life: Problems and Prospects', IZA Discussion Paper Series No. 1911.
- Avraham, Ronen, David Fortus and Kyle Logue (2002), 'Revisiting the Role of Legal Rules

- and Tax Rules in Income Redistribution', University of Michigan John M. Olin Center for Law and Economics Paper 02-004.
- Backhaus, Jürgen G. (1978), 'Lawyers' Economics vs. the Economic Analysis of Law: A Critique of Professor Posner's "Economic Approach to Law with Reference to a Case Concerning Damages for Loss of Earning Capacity"', *Munich Social Science Review*, 3, 57-80.
- Bagenstos, Samuel R. and Margo Schlanger (2007), 'Hedonic Damages, Hedonic Adaptation, and Disability', *Vanderbilt Law Review*, 59, 101-53.
- Baldus, David and John C.M.D. MacQueen (1995), 'Improving Judicial Oversight of Jury Damages Assessments: A Proposal for the Comparative Additur/Remittitur Review of Awards for Nonpecuniary Harms and Punitive Damages', *Iowa Law Review*, 80, 1109-267.
- Beard, T. Randolph (1990), 'Bankruptcy and Care Choice', *RAND Journal of Economics*, 21, 626-34.
- Becker, Gary S. (1991), *A Treatise on the Family*, Cambridge, MA: Harvard University Press, enlarged edition.
- Becker, William E. and Richard A. Stout (1992), 'The Utility of Death and Wrongful Death Compensation', *Journal of Forensic Economics*, 5, 197-208.
- Bell, Edward B. and Allan J. Taub (1994), 'An Analysis of Alternative Methods of Calculating Tax-Adjusted Awards', *Journal of Forensic Economics*, 7 (3), 267-74.
- Ben-Zion, Barry and Ronald G. Reddall (1985), 'Life Expectancy and Actuarial Present Values: A Note to Forensic Economists', *Research in Law and Economics*, 7, 160-71.
- Bergkamp, Lucas (2000), 'The Proper Scope of Joint and Several Liability', *Tijdschrift voor Milieuaansprakelijkheid*, 14, 153-6.
- Bergkamp, Lucas (2001), *Liability and Environment*, The Hague: Kluwer Law International.
- Berla, Edward P., Robert G. Meyer and Paul Andrews (1995), 'The Lost Pleasure of Life Scale: A Reply to Caragonne', *Journal of Forensic Economics*, 8 (3), 273-5.
- Berla, Edward P., William Brookshire and Stan V. Smith (1990), 'Hedonic Damages and Personal Injury: A Conceptual Approach', *Journal of Forensic Economics*, 3 (1), 1-8.
- Bigus, Jochen and Hans-Bernd Schäfer (2007), 'Die Haftung des Wirtschaftsprüfers am Primär- und am Sekundärmarkt – eine rechtsökonomische Analyse', *Zeitschrift für Betriebswirtschaft*, 77, 19-49.
- Binger, Brian, Robert Copple and Elizabeth Hoffman (1995a), 'Contingent Valuation Methodology in the Natural Resource Damage Regulatory Process: Choice Theory and the Embedding Problem', *Natural Resources Journal*, 35, 443-59.
- Binger, Brian, Robert Copple and Elizabeth Hoffman (1995b), 'The Use of Contingent Valuation Methodology in Natural Resource Damage Assessments: Legal Fact and Economic Fiction', *Northwestern University Law Review*, 89, 1029-116.
- Bishop, William (1982), 'Economic Loss in Tort', *Oxford Journal of Legal Studies*, 2, 1-29.
- Bishop, William and John Sutton (1986), 'Efficiency and Justice in Tort Damages: The Shortcomings of the Pecuniary Loss Rule', *Journal of Legal Studies*, 15, 347-70.
- Black, Bernard, David A. Hyman, Charles Silver and William M. Sage (2007), 'Defense Costs in Medical Malpractice and Other Personal Injury Cases: Evidence from Texas, 1988-2004', University of Texas Law School Law and Economics Research Paper No. 99; University of Illinois Law and Economics Research Paper No. LE07-012.
- Blackburn, Joseph W. (1989), 'Taxation of Personal Injury Damages: Recommendations for Reform', *Tennessee Law Review*, 56, 661-91.
- Blomquist, Glenn S. (1979), 'Value of Life Saving: Implications of Consumer Activity', *Journal of Political Economy*, 87, 540-58.
- Blomquist, Glenn S. (1981), 'The Value of Human Life: An Empirical Perspective', *Economic Inquiry*, 19, 157-64.
- Blomquist, Glenn S. (1982), 'Estimating the Value of Life and Safety: Recent Developments', in M.W. Jones-Lee (ed.), *The Value of Life and Safety*, Chicago, IL: University of Chicago Press.

- Blumstein, James F., Randall R. Bovbjerg and Frank A. Sloan (1991), 'Beyond Tort Reform: Developing Better Tools for Assessing Damages for Personal Injury', *Yale Journal on Regulation*, 8, 171–212.
- Boulter, Bryan L. (1995), 'A Valuation of a Generic Child – The Investment Approach: A Comment', *Journal of Forensic Economics*, 8 (1), 81–8.
- Bovbjerg, Randall R., Frank A. Sloan and James F. Blumstein (1989), 'Public Policy: Valuing Life and Limb in Tort: Scheduling "Pain and Suffering"', *Northwestern University Law Review*, 83, 908–76.
- Boyd, James and Daniel Ingberman (1994), 'Noncompensatory Damages and Potential Insolvency', *Journal of Legal Studies*, 23, 895–910.
- Brady, Dennis, Michael Brookshire and William Cobb (1985), 'The Development and Solution of a Tax-Adjusted Model for Personal Injury Awards: A Response', *Journal of Risk and Insurance*, 52, 520–21.
- Brenza, Lindley J. (1987), 'Asbestos in Schools and the Economic Loss Doctrine', *University of Chicago Law Review*, 54, 277–311.
- Broder, Ivy and Thomas Husted (1990), 'The Effect of Post-Trial Activity on Large Jury Awards', *International Review of Law and Economics*, 11, 251–60.
- Brooks, Jennifer J.S. (1988), 'Developing a Theory of Damage Recovery Taxation', *William Mitchell Law Review*, 14, 759–805.
- Brookshire, Michael L. and Thomas R. Ireland (1994), 'Converting from a Present Value Lump Sum to a Future Payment Stream', *Journal of Forensic Economics*, 7 (2), 151–7.
- Broome, John (1978), 'Trying to Value a Life', *Journal of Public Economics*, 9, 91–100.
- Brown, John P. (1973), 'Toward an Economic Theory of Liability', *Journal of Legal Studies*, 2, 323–50.
- Brown, Ralph J. and Dennis A. Johnson (1983), 'Wrongful Death and Personal Injury: Economics and the Law', *South Dakota Law Review*, 29, 1–23.
- Bruce, Christopher J. (1984), 'An Efficient Technique for Determining the Compensation of Lost Earnings', *Journal of Legal Studies*, 13, 375–78.
- Bruce, Christopher J. (1987), 'Measure of Damages for the Wrongful Death of a Child', *Canadian Bar Review*, 66, 344–59.
- Brush, Brian C. and Charles H. Breeden (1994), 'Income Taxes and Economic Damages', *Journal of Legal Economics*, 4 (2), 51–63.
- Buchanan, James M. and Roger L. Faith (1979), 'Trying Again to Value a Life', *Journal of Public Economics*, 12, 245–8.
- Burke, John F. and Harvey S. Rosen (1983), 'Taxes and Compensation for Lost Earnings: A Comment', *Journal of Legal Studies*, 12, 195–200.
- Cahill, Gerard A. and Gerald F. Goldberg (1993), 'Life Insurance as an Offset to Economic Loss in Wrongful Death Cases: A Note', *Journal of Forensic Economics*, 6 (3), 277–9.
- Cahill, Gerard A. and Gerald F. Goldberg (1995), 'Life Insurance as an Offset to Economic Loss in Wrongful Death Cases: A Reply', *Journal of Forensic Economics*, 8 (1), 91 ff.
- Calabresi, Guido (1977), *The Cost of Accidents: A Legal and Economic Analysis*, 5th edition, New Haven, CT: Yale University Press.
- Calfee, John and Richard Craswell (1984), 'Some Effects of Uncertainty on Compliance with Legal Standards', *Virginia Law Review*, 70, 965–1003.
- Calfee, John and Paul H. Rubin (1992), 'Some Implications of Damage Payments for Nonpecuniary Losses', *Journal of Legal Studies*, 21, 371–411.
- Calfee, John E. and Clifford Winston (1993), 'The Consumer Welfare Effects of Liability for Pain and Suffering: An Exploratory Analysis', in *Brookings Papers on Economic Activity: Microeconomics*, pp. 133–74.
- Caragonne, Penelope (1993), 'The Use of the Berla Scale in Quantifying Hedonic Damages: A Case Management Perspective', *Journal of Forensic Economics*, 7 (1), 47–67.
- Carter, Richard A.L. and John P. Palmer (1991), 'Real Rates, Expected Rates, and Damage Awards', *Journal of Legal Studies*, 20, 439–62.
- Chapman, Bruce (1987), 'Pensions, Sex Discrimination, and the Value of Life after Death', *International Review of Law and Economics*, 7, 193–214.

- Choi, Albert and Chris W. Sanchirico (2004), 'Should Plaintiffs Win What Defendants Lose? Litigation Stakes, Litigation Effort, and the Benefits of Decoupling', *Journal of Legal Studies*, 33, 323–54.
- Ciecka, James E. (1994), 'A Survey of the Structure and Duration of Time Periods for Lost Earnings Calculations', *Journal of Forensic Economics*, 4 (2), 39–50.
- Clarke, Karen A. and Anthony I. Ogus (1978), 'What is a Wife Worth?', *British Journal of Law and Society*, 5, 1–25.
- Clermont, Kevin and Theodore Eisenberg (1992), 'Trial by Jury or Judge: Transcending Empiricism', *Cornell Law Review*, 77, 1124 ff.
- Cohen, Lloyd (1985), 'Toward an Economic Theory of the Measurement of Damages in a Wrongful Death Action', *Emory Law Journal*, 34, 295–340.
- Cohen, Mark (1987), 'Optimal Enforcement Strategy to Prevent Oil Spills: An Application of a Principal-Agent Model with Moral Hazard', *Journal of Law and Economics*, 30, 23–52.
- Conley, Brian C. (1976), 'The Value of Life in the Demand for Safety', *American Economic Review*, 66, 45–65.
- Conley, Brian C. (1978), 'The Value of Human Life in the Demand for Safety: Extension and Reply', *American Economic Review*, 68, 717–20.
- Cook, Philip J. (1978), 'The Value of Human Life in the Demand for Safety: Comment', *American Economic Review*, 68, 710–11.
- Cook, Phillip and Daniel Graham (1977), 'The Demand for Insurance and Protection: The Case of Irreplaceable Commodities', *Quarterly Journal of Economics*, 91, 143–56.
- Cooper, Russell and Thomas Ross (1985), 'Product Warranties and Double Moral Hazard', *RAND Journal of Economics*, 16, 103–13.
- Cooter, Robert D. (1982), 'Economic Analysis of Punitive Damages', *Southern California Law Review*, 56, 79–101.
- Cooter, Robert D. (1984), 'Prices and Sanctions', *Columbia Law Review*, 84, 1523–60.
- Cooter, Robert D. (1989a), 'Towards a Market in Unmatured Tort Claims', *Virginia Law Review*, 75, 383–412.
- Cooter, Robert D. (1989b), 'Punitive Damages for Deterrence: When and How Much?', *Alabama Law Review*, 40, 1143 ff.
- Cooter, Robert D. and Ariel Porat (2001), 'Should Courts Deduct Nonlegal Sanctions from Damages?', *Journal of Legal Studies*, 30, 401–22.
- Cooter, Robert D. and Ariel Porat (2006), 'Liability Externalities and Mandatory Choices: Should Doctors Pay Less?', *Journal of Tort Law*, 1 (1), Article 2.
- Cooter, Robert D. and Ariel Porat (2007), 'Total Liability for Excessive Harm', *Journal of Legal Studies*, 36, 63–80.
- Cooter, Robert D. and Stephen D. Sugarman (1988), 'A Regulated Market in Unmatured Tort Claims: Tort Reform by Contract', in Walter Olson (ed.), *New Directions in Liability Law*, New York, NY: The Academy of Political Science.
- Cooter, Robert D. and Thomas S. Ulen (2004), *Law and Economics*, Boston: Pearson Addison Wesley, 4th edition.
- Coyne, Thomas Joseph (1982), 'Present Value of Future Earnings: A Sensible Alternative to Simplistic Methodologies', *Insurance Counsel Journal*, 49 (1), 25–31.
- Craswell, Richard (1996), 'Damage Multipliers in Market Relationships', *Journal of Legal Studies*, 25, 463–92.
- Craswell, Richard and John E. Calfee (1986), 'Deterrence and Uncertain Legal Standards', *Journal of Law, Economics and Organization*, 2, 279–303.
- Creedy, John (1988), 'Taxation and Compensation to Dependents of Accident Victims', *International Review of Law and Economics*, 8, 85–95.
- Croley, Stephen P. and John D. Hanson (1991), 'What Liability Crisis? An Alternative Explanation for Recent Events in Products Liability', *Yale Journal on Regulation*, 8, 1–111.
- Croley, Stephen P. and John D. Hanson (1995), 'The Nonpecuniary Costs of Accidents: Pain-and-Suffering Damages in Tort Law', *Harvard Law Review*, 108, 1785–1917.

- Danzon, Patricia Munch (1984), 'Tort Reform and the Role of Government in Private Insurance Markets', *Journal of Legal Studies*, 13, 517–49.
- Danzon, Patricia Munch (1985), *Medical Malpractice: Theory, Evidence, and Public Policy*, Cambridge, MA: Harvard University Press.
- Darbis, Rachael (1980), 'The Value of Life: New Evidence from the Marketplace', *American Economic Review*, 70, 1077–82.
- Dari-Mattiacci, Giuseppe (2004), 'The Economics of Pure Economic Loss and the Internalisation of Multiple Externalities', in W. van Boom, H. Koziol and C. Witting (eds), *Pure Economic Loss*, New York, NY: Springer, pp. 167–90.
- Dari-Mattiacci, Giuseppe and Gerrit De Geest (2005), 'Judgment Proofness under Four Different Precaution Technologies', *Journal of Institutional and Theoretical Economics*, 161, 38–56.
- Dari-Mattiacci, Giuseppe and Hans-Bernd Schäfer (2007), 'The Core of Pure Economic Loss', *International Review of Law and Economics*, 27, 8–28.
- Depperschmidt, Thomas O. (1994), 'Unintended Consequences and Perverse Effects in Forensic Economic Award Calculations', *Journal of Legal Economics*, 4, 65–72.
- Devlin, Nancy and David Parkin (2004), 'Does NICE have a Cost Effectiveness Threshold and What other Factors Influence its Decisions? A Binary Choice Analysis', *Health Economics*, 13, 437–52.
- Deweese, Don, David Duff and Michael Trebilcock (1996), *Exploring the Domain of Accident Law. Taking the Facts Seriously*, New York: Oxford University Press.
- Diamond, Peter (1974), 'Single Activity Accidents', *Journal of Legal Studies*, 3, 107–64.
- Dickens, William T. (1990), 'Assuming the Can Opener: Hedonic Estimates and the Value of Life', *Journal of Forensic Economics*, 3 (3), 51–60.
- Dodge, Joseph M. (1992), 'Taxes and Torts', *Cornell Law Review*, 77, 143–88.
- Duggan, Anthony (2006), 'Exemplary Damages in Equity: A Law and Economics Perspective', *Oxford Journal of Legal Studies*, 26, 303–26.
- Dulaney, Ronald A. (July 1991), 'Estimating Decedents' Consumption Expenditures in Wrongful Death Actions: Some Refinements', *Journal of Legal Economics*, 1 (2), 94–8.
- Durham, Stephan E. (1993), 'The Correct Value of Social Security Contributions in Personal Injury and Wrongful Death Settlements: A Comment', *Journal of Forensic Economics*, 6 (2), 151–2.
- Dijkstra, Robert J. and Louis T. Visscher (2007), 'Een pleidooi voor beperkte aansprakelijkheid van financieel toezichhouders wegens falend toezicht (A Plea for Limited Liability of Financial Supervisors for Failing Supervision)', *Tijdschrift voor Financieel Recht*, 9, 140–7.
- Easterbrook, Frank, William Landes and Richard Posner (1982), 'Contribution among Antitrust Defendants: A Legal and Economic Analysis', *Journal of Law and Economics*, 23, 331–67.
- Eaton, Thomas A., David B. Mustard and Susette M. Talarico (2005), 'The Effects of Seeking Punitive Damages on the Processing of Tort Claims', *Journal of Legal Studies*, 34, 343–69.
- Eide, Erling (1982), 'Kapitaliseringsrente ved Personskadeerstatning. Kritikk av en Dom i Høyesterett (Capitalization Interest Rates in Personal Injury Compensation. A Critique of a Supreme Court Verdict)', *Lov og Rett. Norsk Juridisk Tidsskrift*, 30–42.
- Eide, Erling (1984), 'Renter og Verdisikring av Pengekrav (Interest Rates and Security against Inflation in Monetary Claims)', *Tidsskrift for Rettsvitenskap*, 97, 477–533.
- Eide, Erling (1987), 'Ekspropriasjonerstatning i en Inflasjonstid: Valg av Kapitaliseringsrente (Compensation for Expropriation in Inflationary Times: The Choice of Capitalization Interest Rates)', *Lov og Rett. Norsk Juridisk Tidsskrift*, 165–77.
- Eisenberg, Theodore, John Goerd, Brian Ostrom, David Rottman and Martin T. Wells (1997), 'The Predictability of Punitive Damages', *Journal of Legal Studies*, 26, 623–61.
- Ellis, Dorsey D. (1982), 'Fairness and Efficiency in the Law of Punitive Damages', *Southern California Law Review*, 56, 1–78.
- Epstein, Richard A. (1984), 'The Legal and Insurance Dynamics of Mass Tort Litigation', *Journal of Legal Studies*, 13, 475–506.

- Epstein, Richard A. (1985), 'Products Liability as an Insurance Market', *Journal of Legal Studies*, 14, 645–70.
- Epstein, Richard A. (1994), 'The Ubiquity of the Benefit Principle', *Southern California Law Review*, 67, 1369–410.
- Evans, William and W. Kip Viscusi (1991a), 'Estimation of State Dependent Utility Functions Using Survey Data', *Review of Economics and Statistics*, 73 (1), 94–104.
- Evans, William and W. Kip Viscusi (1991b), 'Utility-Based Measures of Health', *American Journal of Agricultural Economics*, 73, 1422–7.
- Faure, Michael G. (2000a), 'Compensation of Non-pecuniary Loss: An Economic Perspective', in Ulrich Magnus, and Jaap Spier (eds), *European Tort Law, Liber Amicorum for Helmut Koziol*, Frankfurt am Main: Peter Lang GmbH, pp. 117–30.
- Faure, Michael G. (2000b), 'Vergoeding van immateriële schade vanuit rechtseconomisch perspectief (Compensation of Immaterial Losses from a Law and Economics Perspective)', in Pepita Kottenhagen-Edzes (ed.), *Immateriële schade: tendensen en wensen*, Groningen: Intersentia, pp. 107–26.
- Faure, Michael G. (2002), 'Economic Analysis', in Bernhard A. Koch and Helmut Koziol (eds), *Unification of Tort Law: Strict Liability*, The Hague: Kluwer Law International, pp. 361–94.
- Faure, Michael G. (2003a), 'Vergoeding van persoonlijk leed: een rechtseconomische benadering (Compensation of Personal Grief, a Law and Economics Approach)', in Gerrit E. Van Maanen (ed.), *De rol van het aansprakelijkheidsrecht bij de verwerking van persoonlijk leed*, The Hague: Boom Juridische uitgevers, pp. 85–101.
- Faure, Michael G. (2003b), 'Causal Uncertainty, Joint and Several Liability and Insurance', in Helmut Koziol and Jaap Spier (eds), *Liber Amicorum Pierre Widmer*, Vienna: Springer, pp. 79–98.
- Faure, Michael G. (2005), 'The View from Law and Economics', in Gerhard Wagner (ed.), *Tort Law and Liability Insurance*, Vienna: Springer, pp. 239–73.
- Faure, Michael G. and Roger J. Van den Bergh (1989), *Objectieve aansprakelijkheid, verplichte verzekering en veiligheidsregulering* (Objective Liability, Mandatory Insurance and Safety Regulation), Apeldoorn: MAKLU Uitgevers N.V.
- Fenn, Paul (1987), 'Evaluating Irreplaceable Loss: Some Implications for Insurance and Liability Rules', *Geneva Papers on Risk and Insurance*, 12, 158–67.
- Finkelstein, M.O., P.A. Pickrel and G.J. Glooser (1974), 'The Death of Children: A Nonparametric Statistical Analysis of Compensation for Anguish', *Columbia Law Review*, 74, 884–93.
- Fischer, Charles C. (1994), 'The Valuation of Household Production: Divorce, Wrongful Injury and Death Litigation', *American Journal of Economics and Sociology*, 53, 187–201.
- Fischer, David A. (2001), 'Tort Recovery for Loss of Chance', *Wake Forest Law Review*, 36, 606–55.
- Fisher, Ann, Lauraine G. Chestnut and Daniel M. Violette (1989), 'The Value of Reducing Risks of Death: A Note on New Evidence', *Journal of Policy Analysis and Management*, 8, 88–100.
- Fisher, Franklin and R. Craig Romaine (1990), 'Janis Joplin's Yearbook and the Theory of Damages', *Journal of Accounting, Auditing and Finance*, 145–57.
- Frankel, Marcin and Charles M. Linke (1992), 'The Value of Life and Hedonic Damages: Some Unresolved Issues', *Journal of Forensic Economics*, 5 (3), 233–47.
- Franklin, Talcott (1995), 'Calculating Damages for Loss of Parental Nurture through Multiple Regression Analysis', *Washington and Lee Law Review*, 52, 271–320.
- Frasca, Ralph R. (1992), 'The Inclusion of Fringe Benefits in Estimates of Earnings Loss: A Comparative Analysis', *Journal of Forensic Economics*, 5 (2), 127–36.
- Frasca, Ralph R. (2005), 'Loss of Chance Rules and the Valuation of Loss of Chance Damages', Working Paper University of Dayton.
- Fraser, Clive D. (1984a), 'What is "Fair Compensation" for Death or Injury? A Note', *International Review of Law and Economics*, 4, 83–8.

- Fraser, Clive D. (1984b), 'Optimal Compensation for Potential Fatality', *Journal of Public Economics*, 23, 307–32.
- Fraser, Clive (1996), 'On Tort as an Implicit Insurance System with State-dependent Utility: The Case of Child Mortality Risk', *International Review of Law and Economics*, 16, 449–60.
- Frech, Harry E., III (1994), 'State-dependent Utility and the Tort System as Insurance: Strict Liability versus Negligence', *International Review of Law and Economics*, 14, 261–71.
- Fried, Charles (1969), 'The Value of Life', *Harvard Law Review*, 82, 1415–37.
- Friedman, David (1982), 'What is "Fair Compensation" for Death or Injury?', *International Review of Law and Economics*, 2, 81–93.
- Friedman, David D. (2000), *Law's Order. What Economics Has to Do with Law and Why it Matters*, Princeton, NJ: Princeton University Press.
- Fuchs, Victor R. and Richard Zeckhauser (1987), 'Valuing Health—A "Priceless Commodity"', *American Economic Review Papers and Proceedings*, 77, 263–8.
- Galanter, Mark (1996), 'Real World Torts: An Antidote to Anecdote', *Maryland Law Review*, 55, 1093–160.
- Geistfeld, Mark (1988), 'Imperfect Information, the Pricing Mechanism, and Products Liability', *Columbia Law Review*, 88, 1057–72.
- Geistfeld, Mark (1995), 'Placing a Price on Pain and Suffering: A Method for Helping Juries Determine Tort Damages for Nonmonetary Injuries', *California Law Review*, 83, 773–852.
- Ghosh, Debapriya, Dennis Lees and William Seal (1976), *The Economics of Personal Injury*, Lexington, MA: Lexington Books.
- Gilbert, Roy F. (1994), 'The Application of Hedonic Models to Personal Injury Litigation', *Journal of Legal Economics*, 4(3), 13–26.
- Gilbert, Roy F. (1995a), 'A Review of the Monte Carlo Evidence Concerning Hedonic Value of Life Estimates', *Journal of Forensic Economics*, 8(2), 125 ff.
- Gilbert, Roy F. (1995b), 'In Defense of the Application of Hedonic Models to Wrongful Death and Personal Injury Litigation', *Journal of Forensic Economics*, 8(1), 25–39.
- Goetz, Charles J. (1989), 'Commentary on "Towards a Market in Unmatured Tort Claims": Collateral Implications', *Virginia Law Review*, 75, 413–40.
- Goldberg, John P.C. (2003), 'What Clients are Owed: Cautionary Observations on Lawyers and Loss of a Chance', *Emory Law Journal*, 52, 1201–14.
- Goldberg, Victor (1994), 'Recovery for Economic Loss Following the Exxon Valdez Oil Spill', *Journal of Legal Studies*, 23, 1–40.
- Gómez, Fernando and Juan A. Ruiz (2004), 'The Plural – and Misleading – Notion of Economic Loss in Tort: A Law and Economics Perspective', *Zeitschrift für Europäisches Privatrecht*, 908–31.
- Goodman, Jane, Elizabeth F. Loftus, Marian Miller and Edith Green (1991), 'Money, Sex, and Death: Gender Bias in Wrongful Death Damage Awards', *Law and Society Review*, 25, 263–85.
- Grady, Mark F. (1983), 'A New Positive Economic Theory of Negligence', *Yale Law Journal*, 92, 799–829.
- Grady, Mark F. (1984), 'Proximate Cause and the Law of Negligence', *Iowa Law Review*, 69, 363–449.
- Grady, Mark F. (1989), 'Untaken Precautions', *Journal of Legal Studies*, 18, 139–56.
- Graham, Daniel A. and Ellen R. Peirce (1984), 'Contingent Damages for Products Liability', *Journal of Legal Studies*, 13, 441–68.
- Gronau, Reuben (1980), 'Home Production – A Forgotten Industry', *Review of Economics and Statistics*, 62, 408–16.
- Grossman, Sanford (1981), 'The Informational Role of Warranties and Private Disclosure about Product Quality', *Journal of Law and Economics*, 24, 461–83.
- Haddock, David D., Fred S. McChesney and Menahem Spiegel (1990), 'An Ordinary Economic Rationale for Extraordinary Legal Sanctions', *California Law Review*, 78, 1–51.

- Hanson, John D. and Kyle D. Logue (1990), 'The First-Party Insurance Externality: An Economic Justification for Enterprise Liability', *Cornell Law Review*, 76, 129–96.
- Havrilesky, Thomas (1990), 'Valuing Life in the Courts: An Overview', *Journal of Forensic Economics*, 3, 71 ff.
- Havrilesky, Thomas (1993), 'The Misapplication of the Hedonic Damages Concept to Wrongful Death and Personal Injury Litigation', *Journal of Forensic Economics*, 6 (2), 93–8.
- Havrilesky, Thomas (1995), 'The Persistent Misapplication of the "Hedonic Damages" Concept to Wrongful Death and Personal Injury Litigation', *Journal of Forensic Economics*, 8 (1), 49–54.
- Helland, Eric and Alexander Tabarrok (2003), 'Race, Poverty, and American Tort Awards: Evidence from Three Data Sets', *Journal of Legal Studies*, 32, 27–58.
- Hensler, Deborah R., M. Susan Marquis, Allan Abrahamse, Sandra Berry, Patricia Ebener, Elizabeth Lewis, E. Allen Lind, Robert MacCoun, Willard Manning, Jeannette Rogowski and Mary Vaiana (1991), *Compensation for Accidental Injuries in the United States*, Santa Monica, CA: Rand Institute for Civil Justice.
- Hersch, Joni and W. Kip Viscusi (2007), 'Tort Liability Litigation Costs', Vanderbilt University Law School Law and Economics Working Paper No. 07-16.
- Hindley, Brian and William Bishop (1983), 'Accident Liability Rules and Externality', *International Review of Law and Economics*, 3, 59–68.
- Hoffman, Elizabeth and Matthew Spitzer (1993), 'Willingness to Pay vs. Willingness to Accept: Legal and Economic Implications', *Washington University Law Quarterly*, 71, 59–114.
- Hylton, Keith N. (2002), 'Welfare Implications of Costly Litigation under Strict Liability', *American Law and Economics Review*, 4 (1), 18–43.
- Hylton, Keith N. and Thomas J. Miceli (2005), 'Should Tort Damages be Multiplied?', *Journal of Law, Economics and Organization*, 21 (2), 388–416.
- Ireland, Thomas R. (1993), 'The Meaning of "Hedonic Damages" in Tort Litigation', *Journal of Forensic Economics*, 4 (2), 99–104.
- Ireland, Thomas R. (1995), 'The Application of the Hedonic Damages Concept to Wrongful Death and Personal Injury Litigation: A Comment', *Journal of Forensic Economics*, 8 (1), 93–4.
- Ireland, Thomas R. and James D. Rodgers (1993), 'Hedonic Damages in Wrongful Death/Survival Actions: Equitable Compensation or Optimal Life Protection?', *Journal of Forensic Economics*, 3, 43 ff.
- Ireland, Thomas R. and John O. Ward (1994), 'Valuing the Life of a Child: Broadening the Investment Approach', *Journal of Forensic Economics*, 7 (2), 179–91.
- Jennings, William P. and Michael G. Phillips (1989), 'Risk as a Discount Rate Determinant in Wrongful Death and Injury Cases', *Journal of Risk and Insurance*, 56 (1), 122–7.
- Johnson, Larry J. and John R. Phelps (1985), 'The Development and Solution of a Tax-Adjusted Model for Personal Injury Awards: A Clarification', *Journal of Risk and Insurance*, September, 52 (3), 518–19.
- Jolls, Christine (1998), 'Behavioral Analysis of Redistributive Legal Rules', *Vanderbilt Law Review*, 51 (6), 1653–79.
- Jones, David D. (1989), 'Rejoinder to Brown's Comment and a Reaction to Schilling's "Estimating the Present Value . . ." Inflation Rates Implicit in Discounting Personal Injury Economic Losses', *Journal of Risk and Insurance*, 53 (3), 165–79.
- Jones, David D. (1990), 'Choosing a Discount Rate for Future Losses in Wrongful Death and Injury Cases', *Journal of Risk and Insurance*, 57 (1), 137–40.
- Jones, David D. (1994), 'Hedonic Damages and the Index Number Problem', *Journal of Forensic Economics*, 7 (2), 193–6.
- Jones-Lee, Michael W. (1974), 'The Value of Changes in the Probability of Death or Injury', *Journal of Political Economy*, 82, 835–49.
- Jones-Lee, Michael W. (1976), *The Value of Life: An Economic Analysis*, Chicago, IL: University of Chicago Press.

- Jones-Lee Michael W. (1978), 'The Value of Human Life in the Demand for Safety: A Comment', *American Economic Review*, 68, 712–16.
- Jones-Lee, Michael W. (1979), 'Trying to Value a Life: Why Broome Does Not Sweep Clean', *Journal of Public Economics*, 12, 249–56.
- Jones-Lee, Michael W. (1980), 'Maximum Acceptable Physical Risk and a New Measure of Financial Risk Aversion', *Economic Journal*, 90, 550–68.
- Jones-Lee, Michael W. (1989), *The Economics of Safety and Physical Risks*, Oxford, UK: Basil Blackwell.
- Jones-Lee, Michael W., M. Hammerton and P.R. Philips (1985), 'The Value of Safety: Results of a National Sample Survey', *Economic Journal*, 95, 49–72.
- Jost, Peter J. (1996), 'Limited Liability and the Requirement to Purchase Insurance', *International Review of Law and Economics*, 16, 259–76.
- Kahan, Marcel (1989), 'Causation and the Incentives to Take Care under the Negligence Rule', *Journal of Legal Studies*, 18, 427–47.
- Kahan, Marcel and Bruce Tuckman (1995), 'Special Levies on Punitive Damages: Decoupling, Agency Problems, and Litigation Expenditures', *International Review of Law and Economics*, 15, 175–85.
- Kakalik, James S. and Nicholas M. Pace (1986), *Costs and Compensation Paid in Tort Litigation*, Santa Monica, CA: Rand Institute for Civil Justice.
- Kalss, Susanne (2007), 'Recent Developments in Liability for Nondisclosure of Capital Market Information', *International Review of Law and Economics*, 27, 70–95.
- Kaplow, Louis (1992), 'The Optimal Probability and Magnitude of Fines for Acts that Definitely Are Undesirable', *International Review of Law and Economics*, 12, 3–11.
- Kaplow, Louis (1993), 'Shifting Plaintiffs' Fees versus Increasing Damage Awards', *RAND Journal of Economics*, 24, 625 ff.
- Kaplow, Louis and Steven Shavell (1994), 'Why the Legal System is Less Efficient than the Income Tax in Redistributing Income', *Journal of Legal Studies*, 23, 667–81.
- Kaplow, Louis and Steven Shavell (1996), 'Accuracy in the Assessment of Damages', *Journal of Law and Economics*, 39, 191–210.
- Kaplow, Louis and Steven Shavell (2000), 'Should Legal Rules Favor the Poor? Clarifying the Role of Legal Rules and the Income Tax in Redistributing Income', *Journal of Legal Studies*, 29, 821–35.
- Kaplow, Louis and Steven Shavell (2002), *Fairness versus Welfare*, Cambridge, MA: Harvard University Press.
- Karpoff, Jonathan M. and John R. Lott Jr (1999), 'On the Determinants and Importance of Punitive Damage Awards', *Journal of Law and Economics*, 42, 527–73.
- Kerkmeester, Heico (1998a), 'De terugkeer van het bemiddelend vonnis: de doctrine van het kansverlies bij medische aansprakelijkheid (The Return of Court Imposed Compromises: the Doctrine of Loss of a Chance in Medical Liability)', *Nederlands Juristenblad*, 73, 435–41.
- Kerkmeester, Heico (1998b), 'Punitive damages ter compensatie van een lage veroordelingskans (Punitive Damages as Compensation for a Low Probability of Conviction)', *Nederlands Juristenblad*, 73, 1807–13.
- Kerkmeester, Heico and Louis T. Visscher (1999), 'Causaal verband tussen onrechtmatige daad en schade: een nieuw pleidooi voor de leer Demogue-Besier (Causal Relationship between Tort and Losses: a New Plea for the doctrine Demogue-Besier)', *Weekblad voor Privaatrecht, Notariaat en Registratie*, 99, 835–40.
- Kidner, R. and K. Richards (1974), 'Compensation to Dependents of Accident Victims', *Economic Journal*, 84, 130–42.
- Kim, Jeonghyun and Allan M. Feldman (2006), 'Victim or Injurer, Small Car or SUV: Tort Liability Rules under Role-type Uncertainty', *International Review of Law and Economics*, 26, 455–77.
- King, Elizabeth M. and James P. Smith (1988a), *Economic Loss and Compensation in Aviation Accidents*, Santa Monica, CA: Rand Institute for Civil Justice.
- King, Elizabeth M. and James P. Smith (1988b), *Computing Economic Loss in Cases of Wrongful Death*, Santa Monica, CA: Rand Institute for Civil Justice.

- King, Joseph H. (1981), 'Causation, Valuation, and Chance in Personal Injury Torts Involving Preexisting Conditions and Future Consequences', *The Yale Law Journal*, 90, 1353–97.
- Klerman, Daniel (1996), 'Settling Multidefendant Lawsuits: The Advantage of Conditional Setoff Rules', *Journal of Legal Studies*, 25, 445–62.
- Knetsch, Jack L. (1984), 'Legal Rules and the Basis for Evaluating Economic Losses', *International Review of Law and Economics*, 4, 5–13.
- Knoll, Michael S. (1996a), 'A Primer on Prejudgment Interest', *Texas Law Review*, 75, 293–374.
- Knoll, Michael S. (1996b), 'Products Liability and Legal Leverage: The Perverse Effects of Stiff Penalties', USC Law School Olin Working Paper Series.
- Komesar, Neil K. (1974), 'Toward a General Theory of Personal Injury Loss', *Journal of Legal Studies*, 3, 457–86.
- Komesar, Neil K. (1990), 'Injuries and Institutions: Tort Reform, Tort Theory, and Beyond', *New York University Law Review*, 65, 23–77.
- Köndgen, Johannes (1977), 'Ökonomische Aspekte des Schadensproblems. Bemerkungen zur Kommerzialisierungsmethode des Bundesgerichtshofes (Economic Aspects of the Damage Problem. Remarks on the "Commercializing Method" of the Bundesgerichtshofes)', *Archiv für Zivilistische Praxis*, 177, 1–34.
- Kornhauser, Lewis A. (1985), 'Theory and Fact in the Law of Accidents', *California Law Review*, 73, 1024–42.
- Kornhauser, Lewis A. (1990), 'The Value of Life', *Cleveland State Law Review*, 38, 209–30.
- Kornhauser, Lewis A. and Richard Revesz (1989), 'Sharing Damages among Multiple Tortfeasors', *Yale Law Journal*, 98, 831–84.
- Kornhauser, Lewis A. and Richard Revesz (1990), 'Apportioning Damages among Potentially Insolvent Actors', *Journal of Legal Studies*, 19, 617–51.
- Kornhauser, Lewis A. and Richard Revesz (1994a), 'Multidefendant Settlements: The Impact of Joint and Several Liability', *Journal of Legal Studies*, 23, 41–76.
- Kornhauser, Lewis A. and Richard Revesz (1994b), 'Multidefendant Settlements under Joint and Several Liability: The Effect of Insolvency', *Journal of Legal Studies*, 23, 517–42.
- Kornhauser, Lewis A. and Richard Revesz (1998), 'Joint and Several Liability', in Peter Martin (ed.), *The New Palgrave Dictionary of Economics and the Law*, London: Macmillan, pp. 371–6.
- Kötz, Hein and Hans-Bernd Schäfer (2003), 'Judex oeconomicus – 12 höchstrichterliche Entscheidungen kommentiert aus ökonomischer Sicht', *German Working Papers in Law and Economics*, paper 12.
- Krier, James E. and Stewart J. Schwab (1995), 'Property Rules and Liability Rules: The Cathedral in Another Light', *New York University Law Review*, 70, 440–83.
- LaCroix, Sumner J. and H. Laurence Miller Jr (1986), 'Lost Earnings Calculations and Tort Law: Reflections on the Pfeifer Decision', *University of Hawaii Law Review*, 8, 31–55.
- Landes, Elizabeth (1982), 'Compensation for Automobile Accident Injuries: Is the Tort System Fair?', *Journal of Legal Studies*, 11, 253–9.
- Landes, William M. and Richard A. Posner (1980), 'Joint and Multiple Torts: An Economic Analysis', *International Review of Law and Economics*, 9, 517–56.
- Landes, William M. and Richard A. Posner (1981), 'An Economic Theory of Intentional Torts', *International Review of Law and Economics*, 1, 127–54.
- Landes, William M. and Richard A. Posner (1984), 'Tort Law as a Regulatory Regime for Catastrophic Personal Injuries', *Journal of Legal Studies*, 13, 417–34.
- Landes, William M. and Richard A. Posner (1987), *The Economic Structure of Tort Law*, Cambridge, MA: Harvard University Press.
- Lassiter, Roy L., Jr (1962), 'Estimating the Monetary Value of Damages in Negligence Cases Involving Death', *University of Florida Law Review*, 15, 384–93.
- Leebron, David W. (1989), 'Final Moments: Damages for Pain and Suffering Prior to Death', *New York University Law Review*, 64, 256–325.

- Lehmann, Michael (1988), 'Juristisch-ökonomische Kriterien zur Berechnung des Verletzergewinns bzw. des entgangenen Gewinns (Legal-economic Criteria for the Calculation of the Profit of the Injurer Respectively the Lost Profit)', *Der Betriebs-Berater*, 25, 1680–87.
- Levmore, Saul (1994), 'Obligation or Restitution for Best Efforts', *Southern California Law Review*, 67, 1411–64.
- Lewis, Richard (2001), 'Increasing the Price of Pain: Damages, the Law Commission and *Heil v Rankin*', *Modern Law Review*, 64, 100–11.
- Lewis, Richard, Robert McNabb, Helen Robinson and Victoria Wass (2002), 'Court Awards of Damages for Loss of Future Earnings: An Empirical Study and an Alternative Method of Calculation', *Journal of Law and Society*, 20, 406–35.
- Lewis, Tracey R. and David E.M. Sappington (1999), 'Using Decoupling and Deep Pockets to Mitigate Judgment-Proof Problems', *International Review of Law and Economics*, 19, 275–93.
- Lewis, W. Cris (1992), 'The Rationale and Quantitative Evidence for the Personal Consumption Offset in Wrongful Death Actions', *Journal of Legal Economics*, 2 (2), 1–18.
- Linnerooth, Joanne (1979), 'The Value of Human Life: A Review of the Models', *Economic Inquiry*, 17, 52–74.
- Lipnowski, Irwin F. (1979), 'The Economist's Approach to Assessing Compensation for Accident Victims', *Manitoba Law Journal*, 9, 319–33.
- Lott, John R. Jr. and Richard L. Manning (2000), 'Have Changing Liability Rules Compensated Workers Twice for Occupational Hazards? Earnings Premiums and Cancer Risks', *Journal of Legal Studies*, 29, 99–130.
- Magnus, Ulrich (ed.) (2001), *Unification of Tort Law: Damages*, The Hague: Kluwer Law International.
- Markowski, Edward P. and Edward M. Cross (1991a), 'Determination of Tax-adjusted Lost Income Awards', *Journal of Legal Economics*, 1 (1), 11–18.
- Markowski, Edward P. and Edward M. Cross (1991b), 'Determination of Tax-adjusted Lost Income Awards: Reply', *Journal Legal Economics*, 1 (3), 103–4.
- Marshall, Jennings B. and John T. Lee (1991), 'Achieving Optimality in Wrongful Death Awards', *Journal of Legal Economics*, 1 (2), 31–7.
- McCaffery, Edward J., Daniel J. Kahneman and Matthew L. Spitzer (1995), 'Framing the Jury: Cognitive Perspectives on Pain and Suffering Awards', *Virginia Law Review*, 81, 1341–420.
- Metcalf, Robert (1992), 'Loss of Enjoyment, Rehabilitation and Hedonic Damages: A Comment', *Journal of Forensic Economics*, 5 (3), 249 ff.
- Miceli, Thomas J. (1996), 'Cause in Fact, Proximate Cause, and the Hand Rule: Extending Grady's Positive Economic Theory of Negligence', *International Review of Law and Economics*, 16, 473–82.
- Miceli, Thomas J. and Kathleen Segerson (1995), 'Defining Efficient Care: The Role of Income Distribution', *Journal of Legal Studies*, 24, 189–208.
- Miceli, Thomas J. and Kathleen Segerson (2003), 'A Note on Optimal Care by Wealth-constrained Injurers', *International Review of Law and Economics*, 23, 273–84.
- Miller, Ted R. (1989), 'Willingness to Pay Comes of Age: Will the System Survive?', *Northwestern University Law Review*, 83, 876–907.
- Miller, Ted R. (1990), 'The Plausible Range for the Value of Life – Red Herrings among the Mackerel', *Journal of Forensic Economics*, 3 (3), 17–40.
- Mishan, E.J. (1971), 'Evaluation of Life and Limb: A Theoretical Approach', *Journal of Political Economy*, 79, 687–705.
- Mishan, E.J. (1981), 'The Value of Trying to Value Life', *Journal of Public Economics*, 15, 133–7.
- Mishan, E.J. (1982), 'Recent Contributions to the Literature of Life Valuation: A Critical Assessment', in M.W. Jones-Lee (ed.), *The Value of Life and Safety*, Chicago, IL: University of Chicago Press, pp. 81–94.
- Moller, Eric (1996), *Trends in Civil Jury Verdicts since 1985*, RAND Institute for Civil Justice.

- Mooney, Gavin H. (1977), *The Valuation of Human Life*, London: Macmillan.
- Moore, Michael J. and W. Kip Viscusi (1988), 'Doubling the Estimated Value of Life: Results Using New Occupational Fatality Data', *Journal of Policy Analysis and Management*, 7, 476–90.
- Nussim, Jacob and Avraham Tabbach (2006), 'A Revised Model of Unilateral Accidents', Tel Aviv University Law Faculty Papers 2006, paper 37.
- Olson, Craig A. (1981), 'An Analysis of Wage Differentials Received by Workers on Dangerous Jobs', *Journal of Human Resources*, 16, 167–85.
- Oswald, Andrew J. and Nattavudh Powdthavee (2007), 'Death and the Calculation of Hedonic Damages', Working Paper June 2007.
- Ott, Claus and Hans-Bernd Schäfer (1986), 'Begründung und Bemessung des Schadensersatzes wegen entgangener Sachnutzung (Foundation and Rating of the Compensation for Damage Because of Lost Utility of Property)', *Zeitschrift für Wirtschaftsrecht*, 7, 613–24.
- Owen, David G. (1982), 'Civil Punishment and the Public Good', *Southern California Law Review*, 56, 103–21.
- Pacey, Patricia L. (1985), 'Measures of Economic Loss in the Wrongful Death of a Child', *Colorado Lawyer*, 14, 392–402.
- Parisi, Francesco, Vernon V. Palmer and Mauro Bussani (2007), 'The Comparative Law and Economics of Pure Economic Loss', *International Review of Law and Economics*, 27, 29–48.
- Patell, James, Roman Weil and Mark A. Wolfson (1982), 'Accumulating Damages in Litigation: The Roles of Uncertainty and Interest Rates', *Journal of Legal Studies*, 3, 341–64.
- Piette, Michael J. and Janet R. Thornton (1994), 'Using New Labor Force Participation Rates When Computing Economic Damage and Loss: A Methodological Note', *Journal of Legal Economics*, 4 (2), 81–8.
- Plummer, James L. (1995), 'The Cost of Substitute Consumption Activities: A Better Alternative than Hedonic Damages', *Journal of Forensic Economics*, 8 (2), 159–65.
- P'ng, Ivan P.L. and Eric Zolt (1989), 'Efficient Deterrence and the Tax Treatment of Monetary Sanctions', *International Review of Law and Economics*, 9, 209–18.
- Pogarsky, Greg and Linda Babcock (2001), 'Damage Caps, Motivated Anchoring, and Bargaining Impasse', *Journal of Legal Studies*, 30, 143–59.
- Polinsky, A. Mitchell (1980a), 'Resolving Nuisance Disputes: The Simple Economics of Injunctive and Damages Remedies', *Stanford Law Review*, 32, 1075–112.
- Polinsky, A. Mitchell (1980b), 'Strict Liability versus Negligence in a Market Setting', *American Economic Review*, 70, 363–70.
- Polinsky, A. Mitchell (1989), *An Introduction to Law and Economics*, Boston, MA: Little, Brown and Company, 2nd edition.
- Polinsky, A. Mitchell (1997), 'Are Punitive Damages Really Insignificant, Predictable and Rational? A Comment on Eisenberg et al.', *Journal of Legal Studies*, 26, 663–77.
- Polinsky, A. Mitchell and Yeon-Koo Che (1991), 'Decoupling Liability: Optimal Incentives for Care and Litigation', *Rand Journal of Economics*, 22, 562–70.
- Polinsky, A. Mitchell and William Rogerson (1983), 'Product Liability, Consumer Misperception, and Market Power', *Bell Journal of Economics*, 14, 581–9.
- Polinsky, A. Mitchell and Daniel Rubinfeld (1988), 'The Welfare Implications of Costly Litigation for the Level of Liability', *Journal of Legal Studies*, 17, 151–64.
- Polinsky, A. Mitchell and Daniel Rubinfeld (1993), 'Sanctioning Frivolous Suits: An Economics Analysis', *Georgetown Law Journal*, 82, 397–435.
- Polinsky, A. Mitchell and Daniel Rubinfeld (1996), 'Optimal Awards and Penalties When the Probability of Prevailing Varies among Plaintiffs', *RAND Journal of Economics*, 27, 269–80.
- Polinsky, A. Mitchell and Steven Shavell (1994), 'Should Liability be Based on the Harm to the Victim or the Gain to the Injurer', *Journal of Law, Economics, and Organization*, 10, 427–37.

- Polinsky, A. Mitchell and Steven Shavell (1998), 'Punitive Damages: An Economic Analysis', *Harvard Law Review*, 111, 869–962.
- Posner, Eric A. and Cass R. Sunstein (2005), 'Dollars and Death', *University of Chicago Law Review*, 72, 537–89.
- Posner, Richard A. (1972), 'A Theory of Negligence', *Journal of Legal Studies*, 1, 29–96.
- Posner, Richard A. (2003), *Economic Analysis of Law*, New York: NY, Aspen Publishers, 6th edition.
- Priest, George L. (1981), 'A Theory of Consumer Product Warranty', *Yale Law Journal*, 90, 1297–352.
- Priest, George L. (1987), 'The Current Insurance Crisis and Modern Tort Law', *Yale Law Journal*, 96, 1521–90.
- Priest, George L. (1988), 'Understanding the Liability Crisis', in W. Olson (ed.), *New Directions in Liability Law*, 196, New York, NY: The Academy of Political Science.
- Priest, George L. (1992), 'Can Absolute Manufacturer Liability be Defended?', *Yale Journal on Regulation*, 9, 237–63.
- Prinzinger, Joseph M. (1993), 'A Valuation of a Generic Child: The Investment Approach', *Journal of Forensic Economics*, 6, 121–34.
- Pryor, Ellen Smith (1993), 'The Tort Law Debate, Efficiency, and the Kingdom of Ill: A Critique of the Insurance Theory of Compensation', *Virginia Law Review*, 79, 91–152.
- Quah, Euston and William Rieber (1989), 'Value of Children in Compensation for Wrongful Death', *International Review of Law and Economics*, 9, 165–80.
- Rabin, Robert (1985), 'Tort Recovery for Negligently Inflicted Economic Loss: A Reassessment', *Stanford Law Review*, 37, 1513–38.
- Raes, Koen (1988), 'Onrechtmatige Daad en de Markt van Pijn en Smart (Tort and the Market for Pain and Sorrow)', *Recht en Kritiek*, 102–25.
- Rea, Samuel A. (1980), 'Inflation, Taxation and Damage Assessment', *Canadian Bar Review*, 58, 280–98.
- Rea, Samuel A. (1981), 'Lump Sum versus Periodic Damage Awards', *Journal of Legal Studies*, 10, 131–54.
- Rea, Samuel A. (1990), 'Taxation, the Standard of Care and Damage Awards', *International Review of Law and Economics*, 10, 285–92.
- Rizzo, Mario J. (1982a), 'A Theory of Economic Loss in the Law of Torts', *Journal of Legal Studies*, 11, 281–310.
- Rizzo, Mario J. (1982b), 'The Economic Loss Problem: A Comment on Bishop', *Oxford Journal of Legal Studies*, 2, 197–206.
- Rodgers, Gregory B. (1993), 'Estimating Jury Compensation for Pain and Suffering in Product Liability Cases Involving Nonfatal Personal Injury', *Journal of Forensic Economics*, 6 (3), 251 ff.
- Rogers, Walter B., Bichaka Fayissa and B.W. Balch (1991), 'Variations in the Economic Estimation of Personal Injury and Wrongful Death Claims', *Journal of Legal Economics*, 1(1), 81–8.
- Rossello, Carlo (1990), 'Il Danno Evitabile. La Misura della Responsabilità tra Diligenza ed Efficienza (Avoidable Damage: The Measure of Liability between Due Care and Efficiency)', Padova: CEDAM, 320 ff.
- Rubin, Paul H. (1993), *Tort Reform By Contract*, Washington, DC: American Enterprise Institute.
- Rubin, Paul H. (1996), 'The Pitfalls of Hedonic Value Use', *National Law Journal*, 15–16.
- Rubin, Paul H. and John E. Calfee (1992), 'Consequences of Damage Awards for Hedonic and Other Nonpecuniary Losses', *Journal of Forensic Economics*, 5, 249–60.
- Rubinfeld, Daniel L. (1984), 'On Determining the Optimal Magnitude and Length of Liability in Torts', *Journal of Legal Studies*, 13, 551–63.
- Salop, Steven (1977), 'The Noisy Monopolist: Imperfect Information, Price Dispersion, and Price Discrimination', *Review of Economic Studies*, 44, 393 ff.
- Sanchirico, Chris W. (2000), 'Taxes versus Legal Rules as Instruments for Equity: A More Equitable View', *Journal of Legal Studies*, 29, 797–820.

- Sanchirico, Chris W. (2001), 'Deconstructing the New Efficiency Rationale', *Cornell Law Review*, 86, 1003–89.
- Schäfer, Hans-Bernd (2000), 'The Bundling of Similar Interests in Litigation. The Incentives for Class Actions and Legal Actions taken by Associations', *European Journal of Law and Economics*, 9, 183–213.
- Schäfer, Hans-Bernd (2001a), 'Stromkabelfall: Anmerkungen zum Ersatz reiner Vermögensschäden (Power Cable Case: Comments to Compensation of Pure Economic Loss)', *German Working Papers in Law and Economics*, paper 5.
- Schäfer, Hans-Bernd (2001b), 'Haftung für fehlerhafte Wertgutachten aus wirtschaftswissenschaftlicher Perspektive (Liability for Negligent Value Assessments from an Economic Perspective)', *German Working Papers in Law and Economics*, paper 6.
- Schäfer, Hans-Bernd and Claus Ott (1990), 'Schmerzensgeld bei Körperverletzungen. Eine Ökonomische Analyse (Damages for Pain and Suffering)', *Juristenzeitung*, 563–73.
- Schäfer, Hans-Bernd and Claus Ott (2005), *Lehrbuch der ökonomischen Analyse des Zivilrechts* (Textbook Economic Analysis of Private Law), 4th revised edition, Berlin: Springer.
- Schelling, Thomas (1968), 'The Life You Save May Be Your Own', in S. Chase (ed.), *Problems in Public Expenditure Analysis*, Washington, DC: Brookings Institution.
- Schenk, David J. (1995), 'Contingent Valuation: A Critical Assessment', *Journal of Economic Literature*, 33, 236–7.
- Schieren, George A. (1994a), 'Taxes and Present Value Awards for Wrongful Death', *Journal of Forensic Economics*, 7 (3), 293–304.
- Schieren, George A. (1994b), 'On Using Minimum-Cost Portfolios to Determine Present Value', *Journal of Legal Economics*, 4 (1), 47–59.
- Schuck, Peter (1990), 'Scheduled Damages and Insurance Contracts for Future Services: A Comment on Blumstein, Bovbjerg and Sloan', *Yale Journal on Regulation*, 8, 213–21.
- Schwartz, Alan (1985), 'Product Liability, Corporate Structure, and Bankruptcy: Toxic Substances and the Remote Risk Relationship', *Journal of Legal Studies*, 14, 689–736.
- Schwartz, Alan (1988), 'Proposals for Products Liability Reform: A Theoretical Synthesis', *Yale Law Journal*, 97, 353–415.
- Schwartz, Alan (1989), 'Commentary on "Towards a Market in Unmatured Tort Claims": A Long Way Yet to Go', *Virginia Law Review*, 75, 423–30.
- Schwartz, Alan and Louis Wilde (1983), 'Imperfect Information in Markets for Contract Terms: The Examples of Warranties and Security Interests', *Virginia Law Review*, 69, 1387–485.
- Schwartz, Alan and Louis Wilde (1985), 'Product Quality and Imperfect μ Information', *Review of Economic Studies*, 52, 251–62.
- Schwartz, Gary T. (1982), 'Deterrence and Punishment in the Common Law of Punitive Damages: A Comment', *Southern California Law Review*, 56, 133–53.
- Schwartz, Gary (1986), 'Economic Loss in American Tort Law: The Examples of J Aire and of Products Liability', *San Diego Law Review*, 23, 37–78.
- Schwartz, Gary (1996), 'The Economic Loss Doctrine in American Tort Law: Assessing the Recent Experience', in E. Banakas (ed.), *Civic Liability for Pure Economic Loss*, London: Kluwer Law International, pp. 103–30.
- Schweizer, Urs (2007), 'Tortious Acts Affecting Markets', *International Review of Law and Economics*, 27, 49–69.
- Shavell, Steven (1979), 'On Moral Hazard and Insurance', *Quarterly Journal of Economics*, 93, 541–62.
- Shavell, Steven (1980), 'Strict Liability versus Negligence', *Journal of Legal Studies*, 9, 463–516.
- Shavell, Steven (1981), 'A Note on Efficiency vs. Distributional Equity in Legal Rulemaking: Should Distributional Equity Matter Given Optimal Income Taxation?', *American Economic Review*, 71, 414–18.
- Shavell, Steven (1982), 'On Liability and Insurance', *Bell Journal of Economics*, 13, 120–32.
- Shavell, Steven (1986), 'The Judgment Proof Problem', *International Review of Law and Economics*, 6, 45–58.

- Shavell, Steven (1987), *Economic Analysis of Accident Law*, Cambridge, MA: Harvard University Press.
- Shavell, Steven (1996), 'The Level of Litigation: Private versus Social Optimality', Harvard University Working Paper.
- Shavell, Steven (1997), 'The Fundamental Divergence between the Private and the Social Motive to Use the Legal System', *Journal of Legal Studies*, 26, 575–612.
- Shavell, Steven (2004), *Foundations of Economic Analysis of Law*, Cambridge, MA: The Belknap Press of Harvard University Press.
- Shogren, Jason F. et al. (1994), 'Resolving Differences in Willingness to Pay and Willingness to Accept', *American Economic Review*, 84, 255–70.
- Shukaitis, Marc J. (1987), 'A Market in Personal Injury Tort Claims', *Journal of Legal Studies*, 16, 329–49.
- Singh, Ram (2003), 'Efficiency of "Simple" Liability Rules When Courts Make Erroneous Estimation of the Damage', *European Journal of Law and Economics*, 16 (1), 39–58.
- Singh, Ram (2004), '"Full" Compensation Criteria: An Enquiry into Relative Merits', *European Journal of Law and Economics*, 18 (2), 223–37.
- Smith, Stan V. (1990), 'Hedonic Damages in the Courtroom Setting – A Bridge over Troubled Waters', *Journal of Forensic Economics*, 3, 41–9.
- Smith, V. Kerry (1990), 'Can We Measure the Economic Value of Environmental Amenities?', *Southern Economic Journal*, 56, 856–78.
- Spence, Michael (1977), 'Consumer Misperceptions, Product Failure and Product Liability', *Review of Economic Studies*, 64, 561–72.
- Staller, Jerome M., Brian P. Sullivan and Edward Friedman (1995), 'A Reply to Professor Gilbert', *Journal of Forensic Economics*, 8, 293–4.
- Sugarman, Stephen D. (1985), 'Doing Away With Tort Law', *California Law Review*, 73, 555–664.
- Summers, John (1983), 'The Case of the Disappearing Defendant: An Economic Analysis', *University of Pennsylvania Law Review*, 132, 145–85.
- Sunstein, Cass R. (1994), 'Incommensurability and Valuation in Law', *Michigan Law Review*, 92, 779–861.
- Sunstein, Cass R. (2004), 'Lives, Life-Years, and Willingness to Pay', *Columbia Law Review*, 104, 205–52.
- Sunstein, Cass R. (2007), 'Illusory Losses', Chicago John M. Olin Law & Economics Working Paper No. 340 (2nd series).
- Sunstein, Cass R., Daniel Kahneman and David Schkade (1998), 'Assessing Punitive Damages (with Notes on Cognition and Valuation in Law)', *Yale Law Journal*, 107, 2071–153.
- Sykes, Alan O. (1984), 'The Economics of Vicarious Liability', *Yale Law Journal*, 93, 1231–80.
- Sykes, Alan O. (2001), 'Subrogation and Insolvency', *Journal of Legal Studies*, 30, 383–99.
- Thaler, Richard and Sherwin Rosen (1975), 'The Value of Saving a Life: Evidence from the Labor Market', in Nestor Terleckj (ed.), *Household Production and Consumption*, New York, NY: NBER, 265 ff.
- Tietenberg, Tom H. (1989), 'Indivisible Toxic Torts: The Economics of Joint and Several Liability', *Land Economics*, 65, 305–19.
- Torre, Andrew and Adrian Clifford (2005), 'Is the Treatment of Economic Loss by the Australian Courts in Torts Cases Anomalous?', *European Journal of Law and Economics*, 20 (2), 145–64.
- Trout, Robert R. and Carroll B. Foster (1993), 'Estimating a Decedent's Consumption in Wrongful Death Cases', *Journal of Forensic Economics*, 6 (2), 135–50.
- Ulph, Alistair (1982), 'The Role of Ex ante and Ex post Decisions in the Valuation of Life', *Journal of Public Economics*, 18, 265–76.
- Van Aaken, Anne (2003) 'Massenklagen im öffentlichen Recht aus institutionenökonomischer Sicht: Eine Art der direkten Volksrechte (Collective Actions in Public Law from an Institutional Economics Perspective: A Form of Direct Democratic Rights)', *Kritische Vierteljahresschrift für Gesetzgebung und Rechtswissenschaft*, 86, 44–75.

- Van den Bergh, Roger J. and Michael G. Faure (1990), 'De invloed van verzekering op de civiele aansprakelijkheid: een rechtseconomische analyse (The Influence of Insurance on Civil Liability: A Law and Economics Analysis)', in *De invloed van verzekering op de civiele aansprakelijkheid (preadviezen, uitgebracht voor de Vereniging voor Burgerlijk Recht)*, Lelystad: Koninklijke Vermande bv.
- Van den Bergh, Roger J. and Louis T. Visscher (2006), 'The Principles of European Tort Law: The Right Path to Harmonization?', *European Review of Private Law*, 14, 511–42.
- Van Velthoven, Ben C.J. (2000), 'Veiliger verkeer in Nederland? (Safer Traffic in the Netherlands?)', *Verkeersrecht*, 48, 313–22.
- Van Wijck, Peter and Jan Kees Winters (2001), 'The Principle of Full Compensation in Tort Law', *European Journal of Law and Economics*, 11 (3), 319–32.
- Vidmar, Neil (1993), 'Empirical Evidence on the Deep Pockets Hypothesis: Jury Awards for Pain and Suffering in Medical Malpractice Cases', *Duke Law Journal*, 43, 217–66.
- Vidmar, Neil and Jeffrey J. Rice (1993), 'Assessments of Noneconomic Damage Awards in Medical Negligence: Comparison of Jurors with Legal Professionals', *Iowa Law Review*, 78, 883–911.
- Viscusi, W. Kip (1978), 'Labor Market Valuations of Life and Limb: Empirical Evidence and Policy Implications', *Public Policy*, 26, 359–86.
- Viscusi, W. Kip (1983a), 'Alternative Approaches to Valuing the Health Impacts of Accidents: Liability Law and Prospective Evaluation', *Law and Contemporary Problems*, 46, 49–68.
- Viscusi, W. Kip (1983b), *Risk by Choice: Regulating Health and Safety in the Workplace*, Cambridge, MA: Harvard University Press.
- Viscusi, W. Kip (1985), 'Consumer Behavior and the Safety Effects of Product Safety Regulation', *Journal of Law and Economics*, 28, 527–54.
- Viscusi, W. Kip (1986), 'The Determinants of the Disposition of Product Liability Claims and Compensation for Bodily Injury', *Journal of Legal Studies*, 15, 321–46.
- Viscusi, W. Kip (1988), 'Pain and Suffering in Product Liability Cases: Systematic Compensation or Capricious Awards?', *International Review of Law and Economics*, 8, 203–20.
- Viscusi, W. Kip (1990), 'The Value of Life: Has Voodoo Economics Come to the Courts?', *Journal of Forensic Economics*, 3 (1), 1–15.
- Viscusi, W. Kip (1991), *Reforming Products Liability*, Cambridge, MA: Harvard University Press.
- Viscusi, W. Kip (1992), *Fatal Tradeoffs: Public and Private Responsibilities for Risk*, New York, NY: Oxford University Press.
- Viscusi, W. Kip and Joseph E. Aldy (2003), 'The Value of a Statistical Life: A Critical Review of Market Estimates throughout the World', *The Journal of Risk and Uncertainty*, 27 (1), 5–76.
- Viscusi, W. Kip and William N. Evans (1990), 'Utility Functions that Depend on Health Status: Estimates and Economic Implications', *American Economic Review*, 80, 353–74.
- Viscusi, W. Kip and W.A. Magat (1987), *Learning and Risk: Consumer and Worker Responses to Hazard Information*, Cambridge, MA: Harvard University Press.
- Visscher, Louis T. (1998), 'The Problem of Uncompensated Losses. The Case of Dutch Traffic Liability', in Claus Ott and Georg Von Wangenheim (eds), *Essays in Law and Economics IV*, Antwerpen: Maklu, pp. 203–21.
- Visscher, Louis T. (2006), *Een rechtseconomische analyse van het Nederlandse onrechtmatigedaadsrecht (A Law and Economics Analysis of Dutch Tort Law)*, The Hague: Boom Juridische uitgevers.
- Visscher, Louis T. and Roger J. Van den Bergh (1998), 'Over fietsende juristen en autorijdende rechtseconomen of een nieuwe fase in het debat over verkeersaansprakelijkheid (On Cycling Lawyers and Car Driving Law and Economists, or a New Phase in the Debate on Traffic Safety)', *Nederlands Juristenblad*, 73, 122–7.
- Von Randow, Philipp (1989), 'Kommentar (Comment) (On Adams, Warum kein Ersatz von Nichtvermögensschäden)', in Claus Ott and Hans-Bernd Schäfer (eds), *Allokationseffizienz in der Rechtsordnung*, Berlin: Springer, pp. 218–25.

- Waldrop, Alexander M. (1983), 'Accounting for Inflation and Other Productivity Factors When Calculating Lost Future Earning Capacity', *Kentucky Law Journal*, 72, 951–69.
- Weiler, Paul (1993a), *A Measure of Malpractice*, Cambridge, MA: Harvard University Press.
- Weiler, Paul (1993b), 'The Case for No-Fault Medical Liability', *Maryland Law Review*, 52, 908–50.
- Weinstein, Milton C. (2005), 'Spending Health Care Dollars Wisely: Can Cost-effectiveness Analysis Help?', Sixteenth Annual Herbert Lourie Memorial Lecture of Health Policy.
- Weisbach, David A. (2002), 'Taxes and Torts in the Redistribution of Income', The Coase Lecture Winter 2002, John M. Olin Program in Law & Economics Working Paper No. 148 (2nd series).
- Weterings, Wim C.T. (2004), *Efficiëntere en effectievere afwikkeling van letselschadeclaims. Een studie naar schikkingsonderhandelingen in de letselschadepraktijk, normering en geschiloplossing door derden* (More Efficient and Effective Handling of Personal Injury Claims. A Study of Settlement Negotiations in the Personal Injury Loss Practice, Standards and Conflict Resolution by Third Parties), The Hague: Boom Juridische uitgevers.
- Williams, Alan (1979), 'A Note on "Trying to Value a Life"', *Journal of Public Economics*, 12, 257–58.
- Williams, Stephen F. (1993), 'Second Best: The Soft Underbelly of Deterrence Theory in Tort', *Harvard Law Review*, 106, 932–44.
- Wittman, Donald (1981), 'Optimal Pricing of Sequential Inputs: Last Clear Chance, Mitigation of Damages, and Related Doctrines in the Law', *Journal of Legal Studies*, 10, 65–92.
- Wittman, Donald (1984), 'Liability for Harm or Restitution of Benefit?', *Journal of Legal Studies*, 13, 57–80.
- Wittman, Donald (1985), 'Should Compensation be Based on Costs or Benefits?', *International Review of Law and Economics*, 5, 173–85.
- Wittman, Donald, Daniel Friedman, Stephanie Crevier and Aaron Braskin (1997), 'Learning Liability Rules', *Journal of Legal Studies*, 26, 145–64.
- Yandell, Dirk (1991), 'The Value of Lost Future Earnings: Methodology, the Discount Rate, and Economic Theory', *Journal of Legal Economics*, December, 1 (3), 54–67.
- Yoon, Albert (2001), 'Damage Caps and Civil Litigation: An Empirical Study of Medical Malpractice Litigation in the South', *American Law and Economics Review*, 3 (2), 199–227.
- Yun, John M. (2004), 'Publicity and the Optimal Punitive Damage Multiplier', *International Review of Law and Economics*, 24, 15–27.
- Yunker, Katherine K. (1994), 'Addressing the Real Problems for Law and Economics of Factoring Interest Rates, Earnings Growth and Inflation into Awards for Lost Future Earnings', *University of Pittsburgh Law Review*, 56, 1–106.
- Zeckhauser, Richard J. (1973), 'Coverage for Catastrophic Illness', *Public Policy*, 21, 149–72.
- Zeckhauser, Richard J. (1975), 'Procedures for Valuing Lives', *Public Policy*, 23, 419–64.
- Zeckhauser, Richard J. and Albert L. Nichols (1978), 'Lessons from the Economics of Safety', in Simon Rottenberg (ed.), *The Economics of Medical Malpractice*, Washington, DC: American Enterprise Institute for Public Policy Research, 19 ff.
- Zervogianni, Eleni (2004), 'Remedies for Damage to Property: Money Damages or Restitution in Natura?', *International Review of Law and Economics*, 24, 525–41.

7 Pure economic loss

*Jef De Mot**

7.1 Introduction

Pure economic loss usually refers to foregone profits or earnings without antecedent harm to plaintiff's person or property. In contrast to consequential (or parasitic) economic loss, that is, the financial loss that is connected with (even the slightest) damage to the person or property of the plaintiff, there is great variance across legal systems in the recoverability of pure economic loss in tort. In the United States, the economic loss rule states that a plaintiff cannot recover for negligence that causes pure economic loss (the 'exclusionary rule'). In some cases, however, courts ignore the rule and make their decisions based on an assessment of the particular policy considerations of the case (Schwartz, 2003). For Europe, a distinction can be made between liberal regimes (such as Belgium, France, Greece, Italy and Spain), conservative regimes (such as Austria, Finland, Germany, Portugal and Sweden) and pragmatic regimes (such as England, the Netherlands and Scotland) (Bussani and Palmer, 2003b). Liberal regimes are characterized by the absence of an in-principle objection to allowing compensation for stand-alone economic harm. On the contrary, in conservative regimes, pure economic loss does not figure among the 'absolute rights' which receive protection under tort law. If a remedy is available, it is based on a specific tort provision or on an expansive application of contract principles. In pragmatic regimes, results are not driven by the dictates of a wide tort principle, nor by a checklist of absolute rights. These systems are characterized by a case-by-case approach which studies the socio-economic implications of allowing compensation for pure economic loss (principally through the 'duty of care' concept). Two conclusions follow. First, the contrasting approaches do not follow the familiar common law/civil law divide since civil law is divided itself. Second, the radically opposed starting points of the different legal systems often conceal a more complex theoretical substructure. When taken into account, this may lead to more uniformity (Bussani and Palmer, 2003e).

* University of Ghent – Center for Advanced Studies in Law and Economics.

7.2 A taxonomy of pure economic loss cases

There is a wide range of problems that come under the heading of pure economic loss. Such loss may arise from a varied collection of contexts, ranging from cable cases to oil spill cases to wrong audit cases. However, the following four categories have been proven to be functionally and relationally distinct (see Bussani and Palmer, 2003a; Bussani, Palmer and Parisi, 2003): ricochet loss cases, transferred loss cases, closure of public service and infrastructures cases and flawed professional advice cases. In ricochet loss cases, a physical damage is done to the property or person of one party, which impairs the contract rights of the plaintiff. In these cases, there is a direct victim who incurs physical damage to his property or person, while the plaintiff is a secondary victim who suffers only economic harm. One example is the case in which someone negligently cuts a cable belonging to a public utility, which delivers telephone services to a company which suffers damage caused by the loss of production ('cable cases'). Another example is the case in which a football star is injured in a car accident, causing the team to drop in the rankings ('loss of a star cases').

Transferred loss cases are those cases in which a tortfeasor causes damage to a victim's property or person, but a contract or the law transfers the loss to a third party. In such cases, a loss that would normally be sustained by the primary victim alone is passed on to a secondary victim, who has a contractual obligation to insure the loss or who only has a contractual interest in the property. Such a transfer may occur when the damaged property is subject to a lease, an insurance agreement, a pending sales contract or when a pay continuation statute requires an employer to pay the salary of an injured employee who can no longer perform his contractual obligations.

In closure of public service and infrastructures cases, an economic loss arises without a previous injury to anyone's property or person. Any physical damage is to 'unowned resources' that lie in the public domain (Goldberg, 1994). Textbook examples of this type of case include the situation in which a negligent act causes the closure of a public highway, resulting in an economic loss to individuals whose production depends on using the highway.

Finally, cases of flawed professional advice deal with the liability of those who provide professional advice, prepare data or render services concerning financial matters. When third parties rely on advice, data or services that are carelessly compiled or executed, they may suffer a pure economic loss. One example is the case of an investor who buys shares in a company at more than its current value because he relies on the audit of an accountant who has carelessly overstated the net financial worth of

the company. Another example is the case of a will that is deemed invalid due to the careless preparation of a lawyer, causing an economic loss to a non-client.

7.3 The insufficiency of explanations not based on efficiency

Traditional explanations seeking to justify the frequent denial of compensation for pure economic loss that are not based on notions of efficiency all lead to practical inconsistencies (see Bussani, Palmer and Parisi, 2003; Dari-Mattiacci and Schäfer, 2007; Parisi, Palmer and Bussani, 2007). A first explanation is grounded in the belief that pure economic losses are more difficult to foresee than physical damage. Applying the traditional foreseeability test to cases of pure economic loss would lead to disastrous levels of liability (Feldthusen, 2000). However, this argument proves too little because not all pure economic losses are difficult to foresee and proves too much because some instances of physical losses seem to cause foreseeability problems that are at least as great, and yet their compensation is not questioned.

A second set of arguments maintains that intangible wealth should not be treated on the same level as bodily integrity or physical property. Not all interests are equally good. Greater protection should be given to tangible property than to intangible wealth (Weir, 2000). However, it's easy to see that barring recovery for pure economic loss cannot simply be the consequence of an ordering of interests. How could this be reconciled with the fact that intentionally inflicted pure economic losses and consequential economic losses are generally recoverable?

A third frequently invoked explanation concerns the problems of open-ended liability and derivative litigation. In a world of economic networking, pure economic losses are likely to be serially linked to one another. Permitting recovery of pure economic loss would (in some cases) overwhelm the courts, place an excessive burden upon the defendant (producing overdeterrence) and reinforce the general trend toward expansion of tort liability (Spier, 1998). The empirical foundation for this argument however is weak. In the liberal regimes in Europe, where this argument has not been a restraint, no dire consequences have resulted. Moreover, the pattern of adjudication in Europe in ricochet loss cases is not in accordance with an explanation based on concerns for open-ended litigation. The risk of open-ended litigation is far greater in 'cable cases' than in 'loss of a star cases', and yet many more jurisdictions grant compensation in the former type of cases.

A final argument refers to the need to reduce the costs of litigation by allowing recovery in tort only to those plaintiffs who suffered physical loss (for example, the telephone company in 'cable cases') and thus to induce

plaintiffs who suffered pure economic loss (for example, customers of the telephone company who suffered a blackout) to seek protection through contractual arrangements with the first type of plaintiffs, who then recover from the tortfeasor (Rizzo, 1982b). However, this solution does not work when no plaintiff suffers physical harm (Gomez and Ruiz, 2004). Also, this solution carries the risk that plaintiffs will be induced to exaggerate the magnitude of the loss channeled through the contract. It reduces the involvement of the courts in tort liability, but may increase their role in contract cases (as guarantor of the reasonableness of contractual arrangements) (Rizzo, 1982b). Whether litigation costs would rise or fall with this solution is questionable (Bishop, 1986).

7.4 Private versus social loss

Bishop (1982a) presented the first economically oriented analysis of economic losses caused by accidents. He noticed that in many cases in which the law is reluctant to award compensation to the victim for economic loss, there is a divergence between the private loss of the victim and the social loss (the loss that the accident inflicts upon society at large). There is an important difference between cases of physical harm and cases of pure economic loss. Physical harm always implies the destruction of a societal resource. There is a one-to-one relationship between the private loss of the victim and the resulting social loss. The case of pure economic harm is different. Such harm may or may not amount to a social loss because the tortfeasor may cause by a single act an economic damage to a victim *and* a gain to a third party. Pure economic harm may, to a certain extent, simply mean a redistribution of wealth from one subject to another. For example, if a firm loses profits due to an accident, a competing firm may benefit from an increase in profits as a consequence of that accident (see also Shavell, 1987). Compensation should only be based on the existence of a social loss. If injurers are made liable for more than the harm they cause to society, they will take levels of precaution that are excessive from society's point of view. Many subsequent analyses of the pure economic loss problem have been based on these theoretical foundations (see for example Shavell, 1987; Landes and Posner, 1987; Goldberg, 1994).

Dari-Mattiacci and Schäfer (2007) have stressed the limitations of Bishop's transfer argument by arguing that even when the victim's private loss and the third-party earnings are the same, there may be a social loss deriving from the impairment of socially valuable resources. Impairment and destruction are social losses of the same nature; the difference between them is only quantitative. The value of a resource corresponds to the utility that individuals derive from its use. While destruction means the impossibility of deriving utility from a resource *ad infinitum*, impairment

is the impossibility of deriving utility from a resource for a limited period of time. The objection that another resource may be used as a substitute is not a convincing reason for accepting that impairment does not amount to a social loss. This objection would still hold when resources are destroyed. The only difference is that a destroyed resource ought to be substituted permanently, while an impaired resource need only be substituted for a limited period of time.

Rizzo (1982a) has objected to Bishop's transfer argument by remarking that it is based on the assumption that substitutes are readily available on the market at no cost. In reality, third parties will only make gains when they have excess capacity. According to Rizzo, such excess capacity is inefficient because it diverts resources from alternative valuable uses. If economic loss is not compensated, incentives to increase capacity will increase since there will be more accidents. Due to excess capacity, any private loss should be considered a social loss in the real world (Rizzo, 1982a). However, it can be argued that increased capacity by the victim and the gainer is a form of precaution (Schäfer and Ott, 2004, Dari-Mattiacci, 2004; Dari-Mattiacci and Schäfer, 2007). Such precaution leads to a reduction in the social loss. The optimal solution can thus be a combination of some levels of precaution by the injurer, the victim and the gainer. Overcapacity is thus not inefficient *per se*. The real question is what the optimal level of capacity is. In many cases, the optimal level will be higher than in a world without accidents.

Even when the third-party gain comes at no impairment or increased-capacity cost, the loss is purely economic, the social loss is smaller than the private loss and there is no explicit contract between the injurer and the victim, some cases should lead to compensation (see for example Dari-Mattiacci and Schäfer, 2007). The reason is that someone else besides the victim may have paid for protection against an involuntary wealth transfer. An example is the case in which the seller of a house hires an expert to value the house with the explicit purpose of facilitating the sales transaction. Another example concerns the liability of an auditor who approves a financial statement for the initial public offering of a corporation. The purpose of hiring the expertise of the auditor (at least in this case) is to reduce the asymmetry of information between the management, the inside investors and the public.

According to Dari-Mattiacci (2004), the private versus social loss antinomy does not furnish a general economic explanation for the legal doctrines concerning pure economic loss. He argues that the pure economic loss problem originates from the use of the tort law system for a hybrid task: the simultaneous internalization of negative and positive externalities. However, tort law is a mechanism primarily conceived to deal with

the internalization of accidental harm and not the internalization of accidental benefits. In an ideal world in which both negative liability and positive liability could be used, legal remedies could provide all parties with optimal incentives. However, no traditional tort rule is compatible with such a framework of decoupled (positive and negative) liability. A liability system that merely links liability to the measure of the net social loss provides optimal incentives for the injurer but not for the victim (see further at Section 7.6). One of the conclusions of Dari-Mattiacci is that the economic explanation of the seemingly disparate treatment that the pure economic loss problem receives in different legal systems may be improved by taking into account additional factors that influence the incentive effects of liability rules (the determination of negligence, the presence of incentives provided by taxes, subsidies or regulation, the way the socially relevant loss depends on the precautions taken by the injurer, the victim and the gainer). From a different perspective, Kalss (2007) argues that the issue of liability for misleading information in capital markets cannot be fully understood without taking into account the global picture of enforcement of informational duties.

7.5 Private loss, social loss and market structure

Some authors have pointed out that the discrepancy between the primary victim's private loss and the social loss depends on the structure of the affected market. The most extensive analysis comes from Schweizer (2007). He examines the case in which an injurer causes a temporary blackout to a firm (the primary victim) which also affects customers (secondary victims) and competitors of the firm (gainers). When the primary victim serves the market as a monopolist, by definition there are no competitors that could benefit from the monopolist's blackout. The customers, however, lose their surplus. The social loss thus exceeds the private loss of the primary victim by the amount of the customer's surplus. In the case of a market governed by perfect (short-run) competition, prices equal marginal costs due to competitive pressure. If an accident happens, the competitors will make up for part of the reduction in supply but the price will rise, given increasing marginal costs. Once again, the social loss exceeds the private loss of the primary victim. In the case of perfect competition with constant marginal costs, the accident would cause neither a private nor a social loss. In the case of imperfect competition with free entry, the primary victim's private loss exceeds the social loss. Schweizer relies on an earlier finding on free entry under imperfect competition to find this result: when competition is less than perfect, free entry leads to a range where social welfare is decreasing (von Weizsäcker, 1980, Mankiw and Whinston, 1986). As a result, social welfare in the case of an accident, net of the victim's fixed costs, exceeds

social welfare without accident. In addition, without the accident, the primary victim would earn revenues covering both fixed and variable costs. It follows that the social loss is smaller than the primary victim's private loss. Note, however, that the social loss is not zero but positive. The intuition goes as follows. The social loss does not depend on the level of fixed costs, since fixed costs arise with and without accidents. In addition, fixed costs are not relevant for quantity choice (although they may affect the entry decision). As a result, the social loss from an accident in a setting with fixed costs would be the same as in the absence of fixed costs. And we know that in the absence of fixed costs, an accident will lead to higher prices since competition is lessened. It follows that the social loss will be positive since higher prices imply a lower sum of producer's and consumer's surplus.

7.6 Strict liability versus negligence

Several authors have examined the efficiency properties of the rules of strict liability and negligence when the victim is entitled to full compensation of his economic loss and when he is only entitled to compensation of the (smaller) socially relevant loss (Dari-Mattiacci, 2004; Dari-Mattiacci and Schäfer, 2007; Schweizer, 2007). The most elaborate analysis comes from Dari-Mattiacci (2004), who considers three general cases: unilateral precaution accidents (only the injurer can take precautions), bilateral precaution accidents (either the injurer and the victim or the injurer and the gainer can take precautions) and trilateral precaution accidents (injurer, victim and gainer can take precautions). When the victim and the gainer are not passive, they are only able to mitigate the magnitude of the loss by increasing their capacity. The injurer is able to reduce the probability of the accident. Further, the gainer is never asked to pay compensation for the gain received. Under the 'recovery rule', the victim is entitled to full compensation for his loss. Under the 'exclusionary rule', he is only entitled to compensation for the socially relevant loss (note the difference with the standard definition of the 'exclusionary rule').

7.6.1 Unilateral precaution accidents

When only the injurer can take precautions, the exclusionary rule is optimal under strict liability, while both the exclusionary rule and the recovery rule are optimal under simple negligence. In general, if we want to induce efficient precaution under a rule of strict liability, the injurer should face damages equal to the social loss. This is the case only under the exclusionary rule. If damages are lower than the social loss, a suboptimal amount of precaution will be taken. If damages are larger than the social loss (as under the recovery rule), too many precautions will be taken. A negligence rule provides incentives for efficient precaution if the standard of conduct

is equal to efficient precaution and a negligent injurer owes damages not below the social loss. This last condition is fulfilled under the recovery rule as well as under the exclusionary rule.

7.6.2 *Bilateral and trilateral precaution accidents*

When the injurer and the victim can take precautions (and the gainer cannot), neither the recovery rule nor the exclusionary rule is generally optimal under strict liability or under simple negligence. Under strict liability, the injurer will choose the optimal amount of precaution if compensation is equal to the pure social loss (exclusionary rule) and if the victim takes optimal precautions. Consequently, the victim bears the remaining private loss. This is not efficient because the victim should also bear the social loss in order to have incentives to take the optimal level of precaution. In general, it is impossible to set a level of compensation so that both the victim and the injurer take optimal precautions. Under simple negligence, both the exclusionary rule and the recovery rule optimally incentivize the injurer when due care is set at the optimal level and the victim also takes optimal precautions. Consequently, the non-negligent injurer pays no compensation to the victim, who bears his full loss. The victim will take too many precautions as he bears a higher cost than the social cost.

When the injurer and the gainer can take precautions (and the victim cannot), the exclusionary rule is optimal under strict liability, while both rules are optimal under simple negligence. Under strict liability, the gainer will act so as to maximize his expected gain minus his gain-enhancing costs. Since he bears the full gain, he will take the optimal level of gain-enhancing precaution if the injurer takes an optimal level of precaution. The injurer will take an optimal level of precaution if he faces damages equal to the social loss (exclusionary rule) and if the gainer takes optimal care. Consequently, only the exclusionary rule gives both the injurer and the gainer incentives to take optimal levels of precaution. Under simple negligence, the injurer's minimization problem is the same as in the unilateral precaution case and the gainer's maximization problem is the same as under strict liability. Both rules are efficient if the required level of precaution is set at the optimal level.

When the injurer, the victim and the gainer can take precautions, neither the recovery rule nor the exclusionary rule is generally optimal under strict liability or under simple negligence. Under strict liability, the gainer bears the full gain and will take the optimal level of precaution if the other parties take their optimal levels. This is not the case. As in the case in which only the injurer and the victim can take precautions, it is impossible to set a level of compensation so that both the victim and the injurer take optimal precautions. Under simple negligence, the gainer's maximization problem is

the same as under strict liability. Thus the gainer will take optimal precautions if both the injurer and the victim take optimal precautions. However, this is generally impossible (once again we can refer to the case in which only the injurer and the victim can take precautions).

7.7 Intentional versus negligent torts

The US exclusionary rule does not apply to economic loss caused by intentional wrongdoing. Intentionally inflicted pure economic loss is recoverable in all European legal systems as well. The economic rationale for recovery in such cases is straightforward. A rule of no recovery would enable an intentional tortfeasor to impose a pure economic loss on a victim, creating an economic benefit for a third party, without having to face any tortious liability. These zero-sum transfers would generate the potential for a spiral of reciprocal takings with extensive rent dissipation for society as a whole (Bussani, Palmer and Parisi, 2003; Parisi, Palmer and Bussani, 2007).

7.8 Economic analysis of the various types of cases

Bussani, Palmer and Parisi (2003) have argued that the substantive applications of the economic loss rule in European jurisdictions are consistent with the predicates of economic analysis (see also Parisi, Palmer and Bussani, 2007).

7.8.1 Ricochet loss cases

A very large majority of European jurisdictions refuses recovery of pure economic loss in 'loss of a star cases', while about half grant compensation in 'cable cases'. This difference can be explained in economic terms. In 'loss of a star cases', any liability of the tortfeasor toward the team would probably amount to duplicate compensation for the same loss. Given the position of star players as monopolistic sellers of non-fungible services, star players already capture most of the surplus that the team expects to earn from the player. If compensation received by the victim already includes his lost wages, the duplicate compensation could cause overdeterrence. The situation is different for 'cable cases'. In these cases, the asset's market price cannot be assumed to capture the full surplus that third parties obtain from its use. For example, it's unlikely that the price of telephone services captures the full consumer benefit of using these services. If liability would be limited to the losses of the telephone company, compensation would be lower than the social losses of the accident.

7.8.2 Transferred loss cases

A split among European legal systems can be observed in the treatment of transferred loss cases. This is not unexplainable from an efficiency

perspective. As long as the full social cost of the accident is borne by the tortfeasor and there is no duplication of the tortfeasor's liability for the same loss, both solutions (recovery or not by the third party) lead to efficient precautions. Whether compensation is paid to the primary victim, to the secondary victim or split among the two, is irrelevant from a deterrence point of view. Criteria of efficiency are thus neutral on the question whether compensation for pure economic loss should be granted in transferred loss cases.

7.8.3 Closure of public service and infrastructures cases

Almost all European courts deny compensation for pure economic loss in closure of public service and infrastructure cases. Once again, this seems consistent with efficiency considerations. First, in many of these cases, the pure economic loss may be much larger than the social loss. The social loss is maximally equal to the difference between the foregone profit and the profit of the second-best opportunity available to the plaintiff. Also, some of the lost profit for the plaintiff may result in a windfall gain for other suppliers. With perfect market elasticity, there will be no net social loss. Second, in those instances in which the private loss might generate a social loss due to inelastic market conditions, the efficiency gains may not justify the large administrative costs necessary to implement a full liability system. Indeed, it is this category (perhaps together with the next one) that raises the greatest concerns for open-ended liability and litigation.

7.8.4 Flawed professional advice cases

While virtually all European jurisdictions allow recovery of pure economic loss in case of flawed services provided by lawyers and notaries, they are less enthusiastic about doing so in the case of auditors and accountants. This dichotomous approach is consistent with the economic model of optimal liability. There is an important qualitative difference between services provided by lawyers and notaries and services provided by auditors and accountants. The services of lawyers and notaries usually benefit exclusively the client or a limited group of third parties. These third parties are likely to be intended beneficiaries of the client who is paying for the services. The price of services incorporates the expected cost of professional liability. The client is thus paying for an implicit warranty of quality. In the case of accountants and auditors, due to the intrinsic nature of the services provided, many more individuals may rely upon the information provided by these professionals (for example, third-party investors and other financial institutions). If third parties other than intended beneficiaries can rely on the information and claim compensation in case of flawed information without contributing to the cost of the service (directly or

indirectly), those who acquire the professional services would pay for the larger potential cost of liability in the form of higher fees. In turn, this would lead to a suboptimal demand for professional services.

7.9 Conclusion

Traditional legal theories are unable to explain the observed boundaries between compensable and non-compensable pure economic losses. The economic approach has proven to be rather successful in explaining some large trends in the treatment of pure economic loss cases, but is less advanced when it comes to explaining the variety of legal solutions to the problem of pure economic loss. One possibility is that we need to look at a broader picture that includes other legal elements which differ among various legal systems and which also provide incentives for the parties involved. Another possibility is that attitudes toward pure economic loss are still evolving and changing (and this at a different pace in different countries). In the past 40 years for example, England and Italy have become much more resilient to the recoverability of pure economic loss (see Bussani and Palmer, 2003e). Still another possibility is that the different patterns reflect an element of randomness in rulemaking.

Bibliography

- Arlen, Jennifer (2000), 'Tort damages', in Boudewijn Bouckaert and Gerrit De Geest (eds), *Encyclopedia of Law and Economics*, Vol. II, Cheltenham, UK and Northampton, MA: Edward Elgar, pp. 682–734.
- Backhaus, Jurgen (2003), 'Pure Economic Loss: An economic analysis', in Mauro Bussani and Vernon Palmer (eds), *Pure Economic Loss in Europe*, Cambridge: Cambridge University Press, pp. 57–74.
- Banakas, Efstathios (1996), *Civil Liability for Pure Economic Loss*, London: Kluwer.
- Banakas, Efstathios (1999), 'Liability for incorrect financial information: Theory and practice in a General Clause System and in a Protected Interests System', *European Review of Private Law*, 7, 261.
- Bishop, William (1982a), 'Economic loss in tort', *Oxford Journal of Legal Studies*, 2, 1–29.
- Bishop, William (1982b), 'Economic loss: a reply to Professor Rizzo', *Oxford Journal of Legal Studies*, 2, 207–10.
- Bishop, William (1986), 'Economic loss: Economic theory and emerging doctrine', in Michael Furmston (ed.), *The Law of Tort: Policies and Trends in Liability for Damage to Property and Economic Loss*, London: Duckworth.
- Bishop, William and John Sutton (1986), 'Efficiency and justice in tort damages: The shortcomings of the pecuniary loss rule', *Journal of Legal Studies*, 15, 347–570.
- Bussani, Mauro and Vernon Palmer (2003a), 'The notion of pure economic loss and its setting', in Mauro Bussani and Vernon Palmer (eds), *Pure Economic Loss in Europe*, Cambridge: Cambridge University Press, pp. 3–24.
- Bussani, Mauro and Vernon Palmer (2003b), 'The liability regimes in Europe – their façades and interiors', in Mauro Bussani and Vernon Palmer (eds), *Pure Economic Loss in Europe*, Cambridge: Cambridge University Press, pp. 120–62.
- Bussani, Mauro and Vernon Palmer (2003c), 'Preliminary remarks and methodology', in Mauro Bussani and Vernon Palmer (eds), *Pure Economic Loss in Europe*, Cambridge: Cambridge University Press, pp. 163–70.

- Bussani, Mauro and Vernon Palmer (2003d), 'Summary and survey of the cases and results', in Mauro Bussani and Vernon Palmer (eds), *Pure Economic Loss in Europe*, Cambridge: Cambridge University Press, pp. 523–9.
- Bussani, Mauro and Vernon Palmer (2003e), 'General conclusions of the study', in Mauro Bussani and Vernon Palmer (eds), *Pure Economic Loss in Europe*, Cambridge: Cambridge University Press, pp. 530–36.
- Bussani, Mauro and Vernon Palmer (2003f), 'The recoverability of pure economic loss within the perspective of a European codification', in Mauro Bussani and Vernon Palmer (eds), *Pure Economic Loss in Europe*, Cambridge: Cambridge University Press, pp. 537–48.
- Bussani, Mauro, Vernon Palmer and Francesco Parisi (2003), 'Liability for pure financial loss in Europe: An economic restatement', *American Journal of Comparative Law*, 51, 113–62.
- Calabresi, Guido (1970), *The Costs of Accidents: A Legal and Economic Analysis*, New Haven: Yale University Press.
- Calfee, John and Richard Craswell (1984), 'Some effects of uncertainty on compliance with legal standards', *Virginia Law Review*, 70, 965–1003.
- Canaris, Claus-Wilhelm (1971), *Die Vertrauenshaftung im deutschen Privatrecht*, München: Beck Verlag.
- Canaris, Claus-Wilhelm (1983), 'Schutzgesetze-Verkehrspflichten-Schutzpflichten', in Claus-Wilhelm Canaris and Uwe Diederichsen (eds), *Festschrift für Karl Larenz zum 80. Geburtstag am 23. München*: Beck Verlag, pp. 27–110.
- Canaris, Claus-Wilhelm (1995), 'Schutzwirkungen zugunsten Dritter bei "Gegenläufigkeit" der Interessen', *Juristen Zeitung*, 441–46.
- Cooter, Robert and Thomas Ulen (2003), *Law and Economics*, 4th edition, Reading, MA: Addison Wesley.
- Craswell, Richard (2000), 'Contract law: General theories', in Boudewijn Bouckaert and Gerrit De Geest (eds), *Encyclopedia of Law and Economics*, (Vol. III), Cheltenham, UK and Northampton, MA: Edward Elgar, pp. 1–24.
- Craswell, Richard and John Calfee (1986), 'Deterrence and uncertain legal standards', *Journal of Law, Economics and Organisation*, 2, 279–303.
- Cross, Frank (1989), 'Natural resource damage valuation', *Vanderbilt Law Review*, 42, 269–341.
- Dari-Mattiacci, Giuseppe (2004), 'The economics of pure economic loss and the internalization of multiple externalities', in Willem van Boom, Helmut Koziol and Christian Witting (eds), *Pure Economic Loss: Vol. 9. Tort and Insurance Law*, New York/Vienna: Springer, pp. 167–90.
- Dari-Mattiacci, Giuseppe (2007), 'Tort law and economics', in Hatzis Aritides (ed.), *Economic Analysis of Law: A European Perspective*, Cheltenham, UK and Northampton, MA: Edward Elgar.
- Dari-Mattiacci, Giuseppe and Hans-Bernd Schäfer (2007), 'The core of pure economic loss', *International Review of Law and Economics*, 27, 8–28.
- De Meza, David (1998), 'Coase theorem', in Peter Newman (ed.), *The New Palgrave Dictionary of Economics and the Law*, New York: Macmillan, pp. 270–81.
- Diamond, Peter (1974), 'Single activity accidents', *Journal of Legal Studies*, 3, 107–64.
- Ewert, Ralf (1999), 'Auditor liability and the precision of auditing standards', *Journal of Institutional and Theoretical Economics*, 155, 181–206.
- Feldthusen, Bruce (2000), *Economic Negligence: The Recovery of Pure Economic Loss*, 4th edition, Canada: Carswell.
- Fleming, John (1972), 'Limitations on liability for economic loss caused by negligence: a pragmatic appraisal', *Vanderbilt Law Review*, 25, 43–58.
- Ganuzza, Juan-José and Fernando Gomez (2007), 'Should we trust the gatekeepers?: Auditors' and lawyers' liability for clients' misconduct', *International Review of Law and Economics*, 27, 96–109.
- Gilead, Israel (1997), 'Tort law and internalization: The gap between private loss and social cost', *International Review of Law and Economics*, 17, 589–608.
- Gilead, Israel (2002), 'Non-consensual liability of a contractual party: Contract, negligence, both or in-between?', *Theoretical Inquiries in Law*, 3, 511–44.

- Goldberg, Victor (1988), 'Accountable accountants: Is third-party liability necessary?', *Journal of Legal Studies*, 17, 295–312.
- Goldberg, Victor (1991), 'Recovery for pure economic loss in tort: Another look at Robins Dry Dock v. Flint', *Journal of Legal Studies*, 20, 249–75.
- Goldberg, Victor (1994), 'Recovery for economic loss following the ExxonValdez oil spill', *Journal of Legal Studies*, 23, 1–40.
- Gomez, Fernando and Juan Antonio Ruiz (2004), 'The plural and misleading notion of economic loss in tort: A law and economics perspective', *Zeitschrift für Europäisches Privatrecht*, 4, 908–931.
- Gomez, Fernando and Hans-Bernd Schäfer (2007), 'The law and economics of pure economic loss: Introduction to the special issue of the International Review of Law and Economics', *International Review of Law and Economics*, 27, 1–7.
- Gordley, James, 'The rule against recovery in negligence for pure economic loss: an historical accident', in: Mauro Bussani and Vernon Palmer (eds), *Pure Economic Loss in Europe*, Cambridge: Cambridge University Press, pp. 25–56.
- Gottwald, Peter (2003), 'Schuldrecht. Allgemeiner Teil', in *Münchener Kommentar zum BGB*, Vol. 2a, 4th edition, München: Verlag Mohr Siebeck, pp. 328–45.
- Grady, Mark (1983), 'A new positive economic theory of negligence', *Yale Law Journal*, 92, 799–829.
- Harris, D. and C. Veljanovsky (1986), 'Liability for economic loss in tort', in Michael Furmston (ed.), *The Law of Tort: Policies and Trends in Liability for Damage to Property and Economic Loss*, London: Duckworth.
- Kalss, Susanne (2007), 'Recent developments in liability for nondisclosure of capital market information', *International Review of Law and Economics*, 27, 70–95.
- Katz, Avery (1998), 'Contract formation and interpretation', in Peter Newman (ed.), *The New Palgrave Dictionary of Economics and the Law*, New York: Macmillan, pp. 425–32.
- Kötz, Hein and Hans-Bernd Schäfer (2003), *Judex Oeconomicus*, Tübingen: Verlag Mohr Siebeck.
- Koziol, Helmut (1998), *Unification of Tort Law: Wrongfulness*, The Hague: Kluwer.
- Landes, William and Richard Posner (1987), *The Economic Structure of Tort Law*, Cambridge, MA: Harvard University Press.
- Lipstein, Kurt (1962–3), 'Protected interests in the law of torts', *Cambridge Law Journal*, 85.
- Magnus, Ulrich (2001), *Unification of Tort Law: Damages*, The Hague: Kluwer.
- Mankiw, N. Gregory and Michael Whinston (1986), 'Free entry and social inefficiency', *RAND Journal of Economics*, 17, 48–58.
- Miceli, Thomas (2004), *The Economic Approach to Law*, Stanford, CA: Stanford University Press.
- Parisi, Francesco (2003), 'Recovery for pure financial loss: Economic foundations of a legal doctrine', in Mauro Bussani and Vernon Palmer (eds), *Pure Economic Loss in Europe*, Cambridge: Cambridge University Press, pp. 75–93.
- Parisi, Francesco, Vernon Palmer and Mauro Bussani (2007), 'The comparative law and economics of pure economic loss', *International Review of Law and Economics*, 27, 29–48.
- Perry, Ronen (2004), 'Relational economic loss: An integrated economic justification for the exclusionary rule', *Rutgers Law Review*, 56, 711–89.
- Rabin, Robert (1985), 'Tort recovery for negligently inflicted economic loss: A reassessment', *Stanford Law Review*, 37, 1513–38.
- Rizzo, Mario (1982a), 'The economic loss problem: A comment on Bishop', *Oxford Journal of Legal Studies*, 2, 197–206.
- Rizzo, Mario (1982b), 'A theory of economic loss in the law of torts', *Journal of Legal Studies*, 11, 281–310.
- Schäfer, Hans-Bernd (2002), 'Liability of experts and the boundary between tort and contract', *Theoretical Inquiries in Law*, 3, 453–73.
- Schäfer, Hans-Bernd (2004), 'Efficient third party liability of auditors in tort law and in contract law', *Supreme Court Economic Review*, 12, 181–208.

- Schäfer, Hans-Bernd and Claus Ott (2004), *The Economic Analysis of Civil Law*, Cheltenham, UK and Northampton, MA: Edward Elgar.
- Schwartz, Gary (1986), 'Economic loss in American tort law: The examples of J'Aire and products liability', in M. Furmston (ed.), *The Law of Tort: Policies and Trends in Liability for Damage to Property and Economic Loss*, London: Duckworth.
- Schwartz, Gary (1995), 'The economic loss doctrine in American tort law: Assessing the recent experience', in E. Banakas (ed.), *Civil Liability for Pure Economic Loss*, pp. 103–30.
- Schwartz, Gary (2003), 'American tort law and the (supposed) economic loss rule', in Mauro Bussani and Vernon Palmer (eds), *Pure Economic Loss in Europe*, Cambridge: Cambridge University Press, pp. 94–119.
- Schwartz, R. (1998), 'Auditors' liability, vague due care, and auditing standards', *Review of Quantitative Finance and Accounting*, 11, 183–207.
- Schweizer, Urs (2007), 'Tortious acts affecting markets', *International Review of Law and Economics*, 27, 49–69.
- Shavell, Steven (1987), *Economic Analysis of Accident Law*, Cambridge, MA: Harvard University Press.
- Spier, Jaap (1998), *The Limits of Expanding Liability*, The Hague: Kluwer.
- Spier, Jaap (2000), *Unification of Tort Law: Causation*, The Hague: Kluwer.
- Van Dunné, Jan (1999), 'Liability for pure economic loss: Rule or exception? A comparatist's view of the civil law – Common law split on compensation of non-physical damage in tort law', *European Review of Private Law*, 4, 397–428.
- van Gerven, Walter, Jeremy Lever and Pierre Larouche (2000), *Cases, Materials and Text on National, Supranational and International Tort Law*, Oxford: Hart Publishing.
- von Bar, Christian (1998), *The Common European Law of Torts*, vol. 1, Oxford: Clarendon Press.
- von Weizsäcker, Carl (1980), 'A welfare analysis of barriers to entry', *Bell Journal of Economics*, 11, 399–420.
- Weir, Tony (2000), *A Casebook on Tort*, 9th edition, London: Sweet & Maxwell.
- Werro, Frank and Vernon Palmer (2004), *The Boundaries of Strict Liability in European Tort Law, the Common Core of European Private Law*, Brussels: Carolina Academic Press.

8 Non pecuniary losses

Siewert D. Lindenberg and
Peter P.M. van Kippersluis***

8.1 Introduction

Non pecuniary losses can be characterized as losses that are suffered by damaging goods or interests which have in themselves no economic price or value on a financial market. Examples are damage to goods with a primarily sentimental value, such as an album of wedding photos, pain and suffering as a result of physical injury, damage to personal reputation, or even the death of a person. Due to the fact that these goods or interests have no substantial or direct market value, non pecuniary losses are often characterized as losses that cannot be undone with money. Rogers (2001, p. 246) defines non pecuniary losses as ‘losses which are not damage to a person’s assets or wealth or income and which are therefore incapable of being quantified in objective financial manner by reference to a market’. Tort law, however, generally recognizes non pecuniary losses to some extent as losses that should be compensated with money.

The paradox described above gives rise to several questions that have attracted attention in the field of law and economics. To address these questions we will first pay attention to some aspects of tort law and economics in general (Section 8.2). Then we will deal with views on the question of why non pecuniary losses should be compensated (Section 8.3), with aspects of valuation of non pecuniary losses (Section 8.4) and with risks of high awards (Section 8.5). In Section 8.6 we will come to some conclusions.

As a preliminary remark, it should be noted that most of the literature on law and economics that is relevant for the issue of non pecuniary losses is not strictly limited to this type of loss. Authors often, for instance, pay attention to physical injury in general, which may also include financial losses as a result of this injury. Likewise, the aspect of prevention of accidents is usually discussed with regard to all costs of accidents, thus is not limited to non pecuniary losses. For this reason the scope of this overview

* Prof Dr. Siewert Lindenberg holds tenure in private law at the Erasmus University of Rotterdam.

** Peter van Kippersluis MSc is a research assistant in the Department of Private Law at the Erasmus University of Rotterdam.

is not strictly limited to law and economics literature on non pecuniary losses. A first conclusion may be that there are in fact very few authors who isolate questions that consider the economic aspects of non pecuniary losses as such (exceptions are Adams, 1989; Croley and Hanson, 1995; Faure, 2000).

8.2 Tort law and economics

To consider the economic aspects of non pecuniary losses, the broader perspective of economic aspects of tort law in general must be taken into account.

Economic theory analyzes legal rules on the basis of efficiency, which generally means maximizing total benefit and minimizing total cost. The founding fathers of economic theories of law, Ronald Coase and Guido Calabresi, have, independently of each other, greatly contributed to the law and economics approach (Landes and Posner, 1981, pp. 852–64).

Coase developed the theorem that given the conditions of rationally behaving actors, perfect information and zero transaction costs, an optimal allocation of resources will always be reached, irrespective of the legal system (Coase, 1960). The Coase theorem can also be applied to torts. If parties could negotiate under the above-mentioned conditions, they could reach an optimal level of precaution at which the total cost of accidents is minimized. However, since we do not live in such a reality, the optimal allocation is not automatically reached. Yet, the Coase theorem can be helpful in identifying the optimal allocation of resources. Then tort law comes into play. In a world with transaction costs and other imperfections, tort law is necessary to determine people's rights and to influence people's behavior such that an optimal allocation is reached (Cooter and Ulen, 2004, pp. 95–8) and the total expected costs of accidents are minimized. Note, however, that the studies of Dewees, Duff and Trebilcock (1996) doubt the influence of tort law on behavior. In a slightly different setting Landes and Posner (1981) state that – although judges might not act consciously – common law is best explained as if judges are trying to maximize efficiency.

Calabresi identified two principal goals of tort law: it should be fair and it should reduce the costs of accidents. Calabresi mentions fairness as the most important objective of tort law. This is, however, not an independent objective in an economic sense. That is why Calabresi considers fairness rather as a constraint on measures to lower costs (Calabresi, 1970, p. 25). Calabresi's most important contribution to the economic approach of tort law is the division of total costs of accidents into three categories: primary, secondary and tertiary costs. Primary costs are the costs of the accidents themselves and can be reduced by lowering the number and severity of

accidents. Secondary costs are the costs due to an inefficient distribution of the losses over the population and can be reduced by spreading the risk of accidents or by averting the risks to people that 'are best able to pay, [. . .], regardless of whether this involves spreading' (Calabresi, 1970, p. 21). This leads to demand for insurance against losses. Tertiary costs are the costs of administering the treatment of accidents and are, in fact, made to reduce primary and secondary accident costs.

Non pecuniary losses can be related to both theories. By recognizing these losses, they can be seen as (primary) costs of accidents. Allocating the burden of compensation of non pecuniary losses provides these losses with a role in spreading the risks of accidents. A preliminary question is, however, why non pecuniary losses should be recognized as compensable losses.

8.3 Why should non pecuniary losses be compensated?

8.3.1 Why compensation?

Compensation of non pecuniary losses is – to varying extents – recognized in at least all Western jurisdictions (Rogers, 2001). Non pecuniary losses are also considered to form an important aspect of tort liability (for an explanation of this see Comandé, 2005, pp. 250–55, who states that an increase in resources in a society enhances the recognition and protection by law of 'new' personal interests. Compensation of non pecuniary losses can be seen as a relatively new personal interest). Viscusi (1991, p. 102) uses an International Organization for Standardization (ISO) data set to show that share of awards paid for non pecuniary losses in 1977 ranges between 30 percent and 57 percent of total awards paid. A study by Towers Perrin Tillinghast (2003, p. 17) shows that in 2001 the shares of tort costs that went to pecuniary and non pecuniary losses were equal. But it is not only empirical data that show the importance of the topic, the quantity of studies and criticism already indicates its importance.

The paradox presented earlier of monetary compensation for losses that have no financial origin gives, at least from an economic point of view, rise to the fundamental question as to why this type of loss should be compensated at all. At this point, different aims can be recognized. From an economic point of view, usually the aim of prevention is put forward as the main reason to award compensation for non pecuniary loss. From a more traditional legal point of view, usually compensation of the victim and vindication of his rights as such are seen as the main objectives of the compensation of non pecuniary loss.

In order to explore the economic relevance of non pecuniary losses they are often related to the demand for insurance. Given that non pecuniary

losses cannot be undone with money *ex post*, the conclusion is drawn that these losses do not generate a demand for insurance *ex ante*. It would be to no avail to insure oneself and pay premiums, if the (*ex post*) cash benefit does not lead to a higher utility level (Adams, 1989, pp. 215–16). Support for this opinion is said to be found in the absence of demand for insurance against non pecuniary losses. Yet, although by definition non pecuniary losses cannot be undone with money, these losses are considered to be compensable with money. Therefore, the statement that non pecuniary losses do not generate an extra demand for money after an accident is questionable. Croley and Hanson (1995) disagree with this statement and try to make the apparent absence of demand for these kinds of insurance plausible with other explanations. There is no consensus on this point in the literature, and empirical studies will have to answer this question (Faure, 2000, p. 158).

There have been several empirical and theoretical studies with proposals to change the system or to withhold from awarding for non pecuniary losses altogether (for an overview of some of these, see Croley and Hanson, 1995, pp. 1787–93). However, from an economic point of view (partially) awarding for those losses is considered to be desirable to provide individuals with the right incentives for their behavior (Adams, 1989).

8.3.2 *Prevention*

In an economically perfect society, individuals know exactly the benefits and costs of every action they are going to undertake. They will weigh up carefully whether the intended action is beneficial for their utility and act according to this deliberation (Shavell, 1980). Tort law could prevent accidents, or at least enforce precautionary measures, using this line of reasoning. Individuals that have to compensate for losses they cause will weigh these losses against the benefits the intended action brings. Consequently, they will make a decision on whether or not to undertake the action and, if undertaken, how many precautionary measures are to be taken.

To make the outcome of the individual deliberation the socially desirable one, all costs of accidents should be charged to those who could avoid them by taking precautionary measures (Adams, 1989, p. 213). An individual faced with all the costs and benefits of its action, will make an optimal decision for himself and consequently (as Adam Smith stated in his ‘Invisible Hand theory’) for society as a whole. As non pecuniary losses are real losses for the victims, these costs should for deterrence purposes be fully compensated as well (Adams, 1989, p. 213). However, charging total accident costs to injurers does not automatically mean that injurers incur total accident costs. Income taxes mean that injurers only incur a certain (tax rate-dependent) percentage of the total accident costs. This

means that injurers do not include total accident costs in their deliberations before undertaking preventive measures. A less than 100 percent likelihood of a successful claim has the same distorting influence (Shavell, 2004, pp. 274–5). Injurers do not incur total accident costs, but only expected costs, which are a percentage (dependent on the likelihood of a successful claim) of total accident costs.

It is argued that compensating victims for total accident costs should only take place in certain accident situations. Unilateral accidents should be distinguished from bilateral accidents (for example, Shavell, 1980, 1987; Adams, 1989). Unilateral accidents are accidents in which the victim itself cannot do anything to avoid the accident. Bilateral accidents are accidents where both the victim and the injurer can take measures to avoid them. This distinction is decisive for the (share of the) losses that should be charged to the injurer.

In unilateral accidents, all losses (non pecuniary and pecuniary) should be charged to the injurer, for he is the only one that can take precautionary measures to avoid the accident. If he does not have to compensate for all the losses he causes, he will take too few precautionary measures from a social point of view (Adams, 1989, p. 214).

In the case of bilateral accidents the situation is different. As stated, both parties involved in an accident can take precautionary measures to avoid it. To force the injurer to take precautionary measures, he should be charged the losses he causes. However, if the victim is compensated fully for the accident (as in the unilateral situation), he is – from an economic point of view – indifferent between the situation in which he gets involved in an accident or and one where he does not. As a result, a victim will not take the precautions he would have taken in the case where he would not be compensated for the losses he suffers (Shavell, 1987, pp. 247–54).

Many jurisdictions use one of the systems of contributory or comparative negligence defense in deciding on the amount of compensation. These systems will enforce some precautionary measures by the victim. However, there might be many other precautionary measures that do not affect his liability position and which are therefore not enforced by this system (Posner, 2007). Consequently a victim will not take these measures. In contrast, Von Randow (1989, p. 219) thinks that this fault position is enough to enforce all the precautionary measures. Cooter and Ulen (2004, p. 337) mention the problems of proving negligence. This will make potential injurers act with fewer precautions. Shavell (1987, pp. 79–83) shows how errors by judges can influence the precautionary measures potential injurers and victims take.

Hence, on the one hand, the injurer should be charged with all the losses he causes to provide him with the right prevention incentives. On the

other hand, the victim should not always be compensated fully in order to provide him with the right prevention incentives. How much the victim should be compensated depends on which of the two parties is better able to take precautionary measures (Calabresi, 1970, p. 135).

A possible solution to this conflict of interests is to make the injurer pay a fine to a third party. Then all costs of the accident are charged to the injurer and the victim is not compensated fully, so that he will take precautionary measures as well (Shavell, 2004, pp. 272–5).

Calabresi denominates the mechanism of prevention described in this paragraph, by which all accident costs are internalized and individuals decide individually on the amount of precaution to take, general deterrence (Calabresi, 1970, p. 68). This is in contrast to specific deterrence, where a political process leads to the regulation of dangerous behaviour (Calabresi, 1970, p. 95). This is of course the well-known standard-setting through safety regulation; the literature has developed criteria to indicate under which circumstances safety regulation may be better suited than liability rules in order to provide optimal deterrence (Shavell, 1984a, 1984b).

8.3.3 *Efficient distribution and insurance*

Inevitably people will face pecuniary and non pecuniary losses in their lives. Not everybody is equally able and willing to bear these losses. An efficient distribution of losses among the population is very important to reduce total accident costs. Calabresi expects that by taking measures in this field total accident costs ‘can be reduced as significantly as by taking measures to avoid accidents in the first place’.(Calabresi, 1970, p. 27).

An efficient way to distribute losses is insurance. The demand for insurance can be seen as a desire to distribute resources across different states of the world (Croley and Hanson, 1995, p. 1822). People move resources from the non-accident state of the world to the accident state of the world. In this way all the insured cooperate to compensate victims for the losses that would result from a possible accident. Every individual can decide exactly how much he wants to insure for, in other words, how much he is willing to bear of the losses he will possibly face. Thus the losses will be distributed among society in an efficient way. From this point of view, tort law should compensate a victim only for the suffered losses that he would have liked to insure himself for (Croley and Hanson, 1995, pp. 1797–8; Cook and Graham, 1977, pp. 10–14).

With pecuniary losses this is not too problematic. Assuming risk aversion of individuals, it is likely that individuals will take out insurance coverage against pecuniary losses. Besides this, the magnitude of pecuniary losses is relatively easily determined. Given that risk-averse individuals will insure themselves against pecuniary losses, the fact that these losses are

easy to determine and the fact that the preferences regarding these losses do not vary as much as those regarding non pecuniary losses, a law-based tort system could fulfill the role of individual insurances. Such a system will not cause as much inefficiency in the redistribution of resources among the population, as would a law-based tort system for non pecuniary losses. However, Kaplow and Shavell (2002, p. 151) and Posner (2007) point out that a tort system is a much more expensive insurance system than a system in which every individual insures himself.

The situation is different for non pecuniary losses. Since non pecuniary losses are real losses, these losses lead to a decrease in utility. Besides this, non pecuniary losses also seem to influence the marginal utility an individual derives from money (Friedman, 1982, p. 82; Shavell, 2004, pp. 269–71). It is not too hard to imagine that the loss of a child would influence the pleasure of going on a holiday for a family or that the loss of a leg would influence the pleasure of going to a swimming pool. In principle, a non pecuniary loss could increase or decrease the marginal utility of money. Empirical studies tend to show that the marginal utility decreases when faced with a loss of personal health (Viscusi and Evans, 1990).

However, authors disagree about the demand for insurance against non pecuniary losses. It should be noted that the relevance of the demand for insurance against non pecuniary losses is related to the aim of compensation for non pecuniary loss, because it is assumed that this demand reveals something about the needs and perceptions of the victim.

No demand for insurance Adams (1989) draws the conclusion that since, by definition, non pecuniary losses cannot be undone with money, there will not exist extra demand for money after an accident that causes non pecuniary losses. As there is no demand for money *ex post*, the assumption is that people will not insure themselves for non pecuniary losses *ex ante*. The payment of an insurance premium *ex ante* would lead to a decrease in utility for something that does not generate extra demand for money *ex post*.

Moreover, if the marginal utility of money were lower after an accident, this would lead to an inverse insurance desire. People would want to transfer money from the state of the world after the accident to the state of the world before the accident, since they enjoy money more there (Shavell, 1987, pp. 228–31).

Suurmond and van Velthoven (2005, p. 1935) develop an economic model that shows that – even if non pecuniary losses could be fully compensated – a risk averse individual would never insure himself against non pecuniary losses.

Using this line of reasoning, applying tort law to compensate for non pecuniary losses does not seem appropriate. Since there is no demand for

insurance of these losses *ex ante*, compensating for them would be inefficient. This would lead to an increase in prices for everybody (the extra liability has to be charged somewhere), for something that nobody would want to insure himself for (Adams, 1989, pp. 216–17).

A potential problem is the subjectivity of non pecuniary losses. Cook and Graham (1977, p. 144) state that non pecuniary losses can only be valued personally and that their valuation will change with one's wealth. Schwartz (1988, p. 411) even speculates about the possibility that the size of non pecuniary losses might be determined partly by the tort system itself.

As a consequence, even if non pecuniary losses were to generate demand for money, it is undesirable to use tort law for compensation. These losses are different for every individual. This means that prices would increase for everybody, whereas only those who experience large non pecuniary losses are compensated for this. Individual first-party insurance would solve this problem (Priest, 1987, p. 1543).

Support for the opinion that there is no demand for insurance against non pecuniary losses is said to be empirically based (for example, Shavell, 1987, p. 231). However, Zelizer (1981) tries to explain the demand for insurance on the death of a child. It might be true that insurances solely for non pecuniary losses rarely exist, but there do exist some integrated insurances that include a non pecuniary component. Empirical studies do not seem to provide unambiguous evidence.

Demand for insurance Schwartz (1988, p. 365) and Croley and Hanson (1995) disagree with the idea that there is no demand for insurance for non pecuniary losses. Croley and Hanson try to invalidate extensively both theoretical and empirical evidence for the idea that there does not exist a demand for insurance.

In deciding whether or not to take out insurance, individuals try to equalize the marginal utility of money in the accident state of the world and the marginal utility in the non-accident state of the world. If the marginal utilities in both states of the world differed, people could make themselves better off by transferring money from one state of the world to another (by taking out more or less insurance). If it is assumed that a non pecuniary loss does not influence the marginal utility of money, the marginal utility in both states of the world is not affected by the non pecuniary loss and consequently there will be no demand for insurance. As stated before, it is assumed that the marginal utility of money decreases after suffering a non pecuniary loss. This would mean that people will not take out insurance against non pecuniary losses and even that people will not fully insure themselves against pecuniary losses (Shavell, 1987, p. 230).

Croley and Hanson use another way of studying marginal utility. They state in accordance with, for instance, Schwartz (1988, p. 362) that marginal utility partly depends on an individual's total level of utility, the so-called baseline utility. They postulate that baseline independent utility (the concept of utility referred to by Shavell) is appropriate for explaining choices within a certain state of the world. It is less reliable in predicting choices of individuals among different states of the world, each with its own utility level (Croley and Hanson, 1995, p. 1816).

Croley and Hanson present the example of going to the opera: only one of two friends can go to the opera, with one of them being an opera lover and the other not. Normally, it would be best to give the opera lover the ticket, since he derives more utility from the opera. However, if the other friend is in a bad mood, the opera might give him more pleasure than it would give the opera lover. Taking into account the baseline utility, the marginal utilities of the friends might change with respect to each other (Croley and Hanson, 1995, p. 1815).

Inevitably, after an accident with non pecuniary losses, an individual faces a new state of the world with a lower level of utility (Croley and Hanson, 1995, p. 1818). Given this, Croley and Hanson argue that it is plausible (in order to find support for this statement Croley and Hanson cite scholars such as Rawls, Sen, Dworkin and Nagel) to assume that individuals aim to equalize baseline utilities among the two states and maximize total expected baseline-independent utility. In striving for this joint objective, individuals will demand partial insurance against non pecuniary losses (Croley and Hanson, 1995, pp. 1816–20).

Besides this, Croley and Hanson also state that empirical data show that individuals do demand insurance against non pecuniary losses and that these insurances in fact exist. But due to a lack of information, for instance, it is difficult to offer these insurances on a large-scale basis. Tort law could play a role here to overcome some of these obstacles (Croley and Hanson, 1995, pp. 1896–917).

8.4 Valuation of non pecuniary loss

The paradox that non pecuniary losses should be valued in terms of money raises the fundamental question of valuation of this type of loss.

Several studies consider the valuation of non pecuniary losses (for an overview, see Viscusi and Aldy, 2003). This valuation is often derived from the 'willingness to pay' approach (Viscusi and Aldy, 2003, p. 2). The approach uses the implicit tradeoff between money and risk in many market choices to value non pecuniary losses. This may be rather useful in cases of the loss of, for instance, a family photo album, but is more complex when the approach attempts to value the loss of an arm or even loss of a life.

Viscusi (1998, pp. 660–61), however, presents some options to value the loss of a human life. He distinguishes three methods and shows that the method of valuation depends on the economic objective of tort law. The first method is the *compensation of the victim ex post*, which seeks the amount needed to compensate for the loss. This value approaches infinity. That is why the Value of a Statistical Life (VSL) is derived from decisions made by individuals. The VSL is the value that people attach to their lives *ex ante*. A widely used method is to look at the implicit tradeoff between the risk of death associated with a job and the wage in the choice of a job. Schelling (1968) introduced this method. Revesz (1999) stressed the difference between the risk of instantaneous death and latent harms that cause death later in a person's lifetime. The VSL derived from data from the US labor market varies between \$4 million and \$9 million. Results from product markets and housing markets show similar results (Viscusi and Aldy, 2003, p. 4). The second method focuses on *the amount needed for deterrence*. This value is meant to set incentives for those who can take measures to avoid an accident. The third approach relates the value to *the amount of insurance one would prefer*. People try to equalize marginal utilities before and after the accident. Since an accident changes the utility function, it is likely that the preferred income after an accident will be different from the preferred income before an accident (Croley and Hanson, 1995, pp. 1797–804).

The valuation of a human life, therefore, depends on the objective of tort law. Law and economics authors mostly concentrate on the second and third objectives (Calabresi, 1970; Shavell, 1987; Adams, 1989; Faure, 2000), because they strive to maximize the total utility of society. Their view is that compensation of the victim will only increase the total utility of society if the victim enjoys a higher marginal utility from the transferred money than the injurer. People with a higher marginal utility of money are usually poorer people. So only if poor people had a higher probability of becoming a victim in an accident than rich people, would compensation serve a utility-increasing goal (Kaplow and Shavell, 2002, p. 33).

The concentration on deterrence and insurance as an important viewpoint for the valuation of non pecuniary losses differs substantially from the regular approach in tort law (Rogers, 2001), which usually concentrates on compensation of the victim *ex post*. It must be noted that loss of a human life can – as is shown above – not only be seen as a matter of non pecuniary loss, but also or even primarily, as a financial loss.

8.5 Risks of high awards

The lack of a market price for non pecuniary losses and of other specific tools for valuation creates the risk of high awards (Viscusi, 1991, pp. 99–101). The increase of awards for non pecuniary losses in federal

products liability lawsuits involving personal injury in the United States is considered to have been an important cause of increases in insurance premiums (American Law Institute, 1991, p. 199). The increase in awards also causes other economic effects, such as higher prices for consumer products and altering product innovation (for a broader overview, see Croley and Hanson, 1995, pp. 1787–8). These effects are considered to have caused a liability crisis. Recently a new increase in insurance premiums has been signaled. To keep the insurance market functioning, tort law is being reformed (Viscusi, 2003, pp. 1–2).

An often proposed remedy is imposing caps on awards for non pecuniary damages. These caps have been criticized by Viscusi. Rather than solely imposing caps, having stable and predictable awards for all categories of non pecuniary losses should be the objective (Viscusi, 2003, pp.10–11). Rubin and Shepherd (2007, p. 225) conclude that imposing caps does in fact lead to more predictable situations and therefore to a decrease in the amount of accidents (Rubin and Shepherd, 2007, p. 235).

8.6 Conclusions

In the literature, non pecuniary losses are defined as losses that do not have a value on a financial market. For individuals that face non pecuniary losses, these losses are, however, real. Economic theory aims at efficiency. From this point of view, tort law should minimize total accident costs. This should be done by decreasing primary and secondary accident costs as long as the decrease outweighs the increase in tertiary costs it causes.

A decrease in primary costs is reached by the prevention of accidents. In order to encourage precautionary measures, injurers should be charged all the costs of the damage they cause. This means that they should also be charged for the non pecuniary costs of the damage. However, if the victim is better able to take precautionary measures to prevent the accident than the injurer, the victim should not be fully compensated for the damage he has suffered.

A decrease in secondary costs is reached by distributing the costs of accidents over society in such a way that those who are more willing to bear the costs do bear them. The value for which individuals insure themselves is a good way of identifying the willingness to bear these costs. There is no consensus about the question of whether individuals demand insurance against non pecuniary losses. If they were to demand such insurance, the valuation of non pecuniary losses is different for every individual. This implies that from an economic viewpoint, tort law is not appropriate to compensate for non pecuniary losses. This would lead to a negative redistribution, in which everybody paid the same increase in prices for awards that not everybody values equally.

The valuation of non pecuniary losses is subjective and therefore difficult. Various methods to value these losses have been developed, of which the Value of a Statistical Life method is the one most often used. In spite of the methods available, awards for non pecuniary losses are substantial and regarded as one of the main problems leading to high insurance premiums in the United States. The search for a proper solution to these problems has not yet been completed.

Bibliography

- Adams, Michael (1989), 'Warum kein Ersatz von Nichtvermogensschaden?', in Claus Ott and Hans-Bernd Schäfer (eds), *Allokationseffizienz in der Rechtsordnung*, Berlin: Springer-Verlag, pp. 210–17.
- American Law Institute (1991), *Enterprise Responsibility for Personal Injury, Volume II: Approaches to Legal and Institutional Change*.
- Calabresi, Guido (1970), *The Costs of Accidents*, New Haven: Yale University Press.
- Coase, Ronald C. (1960), 'The Problem of Social Costs', *Journal of Law and Economics*, 3, 1–44.
- Comandè, Giovanni (2005), 'Towards a Global Model for Adjudicating Personal Injury Damages', *Temple International and Comparative Law Journal*, 19, 241–349.
- Cook, Philip J. and Daniel A. Graham (1977), 'The Demand for Insurance and Protection: The Case of Irreplaceable Commodities', *The Quarterly Journal of Economics*, 91, 143–56.
- Cooter, Robert D. and Thomas Ulen (2004), *Law and Economics: International Edition*, Boston: Pearson Addison-Wesley.
- Croley, Stephen P. and John D. Hanson (1995), 'The Non Pecuniary Costs of Accidents: Pain-and-suffering Damages in Tort Law', *Harvard Law Review*, 108, 1785–917.
- Deweese, Donald N., David Duff and Michael J. Trebilcock (1996), *Exploring the Domain of Accident Law*, Oxford: Oxford University Press.
- Faure, Michael G. (2000), 'Compensation of Non-pecuniary Loss: An Economic Perspective', in Ulrich Magnus and Jaap Spier (eds), *European Tort Law, Liber Amicorum for Helmut Koziol*, Frankfurt am Main: Peter Lang, pp. 143–59.
- Fraser, Clive D. (1984), 'What is "Fair Compensation" for Death or Injury?', *International Review of Law and Economics*, 4, 83–8.
- Friedman, David (1982), 'What is "Fair Compensation" for Death or Injury?', *International Review of Law and Economics*, 2, 81–93.
- Kaplow, Louis and Steven Shavell (2002), *Fairness versus Welfare*, Cambridge, MA: Harvard University Press.
- Landes, William M. and Richard A. Posner (1981), 'The Positive Economic Theory of Tort Law', *Georgia Law Review*, 15, 851–924.
- Mishan, Edward J. (1971), 'Evaluation of Life and Limb: A Theoretical Approach', *Journal of Political Economy*, 79, 687–705.
- Poletiek, Fenna H. and Carel J.J.M. Stolker (2004), 'Who Decides the Worth of an Arm and a Leg?', in Elke Kurz-Milcke and Gerd Gigerenzer (eds), *Experts in Science and Society*, New York: Kluwer Academic/Plenum, pp. 201–15.
- Posner, Richard A. (2007), *Economic Analysis of Law*, New York: Aspen.
- Priest, George L. (1987), 'The Current Insurance Crisis and Modern Tort Law', *Yale Law Journal*, 96, 1521–90.
- Revesz, Richard L. (1999), 'Environmental Regulation, Cost-benefit Analysis, and the Discounting of Human Lives', *Columbia Law Review*, 99, 941–1017.
- Rogers, W.V. Horton (ed.) (2001), *Damages for Non-pecuniary Loss in a Comparative Perspective*, Vienna and New York: Springer.
- Rubin, Paul H. and Joanna M. Shepherd (2007), 'Tort Reform and Accidental Deaths', *Journal of Law and Economics*, 50, 221–38.

- Schäfer, Hans-Bernd and Claus Ott (2004), *The Economic Analysis of Civil Law*, Cheltenham, UK and Northampton, MA: Edward Elgar.
- Schelling, Thomas C. (1968), 'The Life you Save May be Your Own', in S.B. Chase (ed.), *Problems in Public Expenditure Analysis*, Washington, DC: The Brookings Institution, pp. 127–62.
- Schwartz, Alan (1988), 'Proposals for Products Liability Reform: A Theoretical Synthesis', *The Yale Law Journal*, 97, 353–415.
- Shavell, Steven (1980), 'Strict Liability versus Negligence', *The Journal of Legal Studies*, 9, 1–25.
- Shavell, Steven (1984a), 'Liability for Harm versus Regulation of Safety', *The Journal of Legal Studies*, 13, 357–74.
- Shavell, Steven (1984b), 'A Model of the Optimal Use of Liability and Safety Regulation', *RAND Journal of Economics*, 15, 271–80.
- Shavell, Steven (1987), *Economic Analysis of Accident Law*, Cambridge, MA: Harvard University Press.
- Shavell, Steven (2004), *Foundations of Economic Analysis of Law*, Cambridge, MA: Harvard University Press.
- Shukaitis, Marc J. (1987), 'A Market in Personal Injury Tort Claims', *The Journal of Legal Studies*, 16, 329–49.
- Suurmond, Guido and Ben Van Velthoven (2005), 'Vergoeding van affectieschade: te weinig met het oog op de daders en te veel met het oog op de slachtoffers', *Nederlands Juristenblad*, 80, 1934–6.
- Towers Perrin Tillinghast (2003), *U.S. Tort Costs: 2002 Update*, New York: Tillinghast-Towers Perrin.
- Viscusi, W. Kip (1991), *Reforming Products Liability*, Cambridge, MA: Harvard University Press.
- Viscusi, W. Kip (1998), 'Valuing Life and Risks to Life', in Peter Newman (ed.), *New Palgrave Dictionary of Economics and Law*, 3rd edition, London: Macmillan, pp. 660–69.
- Viscusi, W. Kip (2003), 'Tort Reform and Insurance Market', Discussion paper, No. 440, Harvard John M. Olin Center for Law, Economics and Business.
- Viscusi, W. Kip and Joseph E. Aldy (2003), 'The Value of a Statistical Life: A Critical Review of Market Estimates throughout the World', Cambridge, MA: NBER Working Paper 9487.
- Viscusi, W. Kip and William N. Evans (1990), 'Utility Functions that Depend on Health Status: Estimates and Economic Implications', *American Economic Review*, 80, 353–74.
- Visscher, Louis T. (2005), *Een rechtseconomische analyse van het Nederlandse onrechtmatige daadsrecht*, Rotterdam: Erasmus University.
- Von Randow, Philipp (1989), 'Kommentar', in Claus Ott and Hans-Bernd Schäfer (eds), *Allokationseffizienz in der Rechtsordnung*, Berlin: Springer-Verlag, pp. 218–25.
- Zelizer, Viviana A. (1981), 'The Price and Value of Children: The Case of Children's Insurance', *American Journal of Sociology*, 86, 1036–56.

9 Punitive damages

A. Mitchell Polinsky and Steven Shavell

9.1 Introduction

This chapter concerns *punitive damages*, an important form of damages that sometimes are awarded to plaintiffs in addition to compensatory damages. (The term ‘punitive damages’ is somewhat inapt because the purpose of such damages is only partly, and perhaps not even mainly, to punish; we nevertheless use the term because it is conventional.) In the United States, punitive damages are awarded in approximately 6 percent of all cases in which plaintiffs prevail. While punitive damages are granted mainly in tort cases, they are increasingly employed in contract disputes and other areas of litigation; see Eisenberg et al. (1997) for an evaluation of the empirical significance of punitive damages. Outside of the United States, punitive damages and other forms of extra-compensatory damages are of lesser, though growing, importance; see Stoll (1983, pp. 99–106) and Gotanda (2004). (Much of what we have to say, however, is relevant to publicly imposed penalties that exceed harm, which are common in all countries.)

In considering the justification for awarding punitive damages, we will refer to two broad social goals: deterrence and punishment. By deterrence, we mean the use of sanctions to influence behavior, so as to maximize the following measure of social welfare: the benefits parties obtain from their actions, less the costs of precautions, the harm done, and the expenses due to use of the legal system. By punishment, we mean the imposition of sanctions to satisfy a desire for retribution against wrongdoers. We generally do not consider compensation and the reduction of risk as social goals; this simplification is not of great consequence because punitive damages are extra-compensatory; thus, there is no need to insure victims (although the bearing of liability risk by injurers remains an issue, as will be noted).

The remainder of this chapter is organized as follows. In Section 9.2, we review the basic theory of deterrence, and in Sections 9.3 through 9.6, we discuss the main deterrence-related justifications for punitive damages: the possibility of escaping sanctions; underestimation of harm; socially illicit gains; and inducing parties to bargain rather than acting unilaterally to cause harm. Then in Section 9.7 we examine the punishment goal and how it is served by punitive damages, and in Section 9.8 we consider how

the punishment and deterrence goals should jointly determine damages. Finally, in Section 9.9 we address a variety of extensions to the analysis and certain legal doctrines that bear on the award of punitive damages.

9.2 Optimal damages when injurers are found liable for sure: the basic theory of deterrence

We summarize here the basic principles of the economic theory of deterrence and liability assuming that, whenever a party causes harm, he will be sanctioned for sure. (For integrated treatments of the standard theory of liability and deterrence, see Landes and Posner (1987) and Shavell (1987).) In this setting, the point on which we want to focus is that *the proper magnitude of damages is the harm that the party has caused*. (The term ‘damages’ means the magnitude of liability payments.) We first discuss this point when liability is strict – when injurers are liable for harm regardless of the care they took – and then when liability is based on the negligence rule – when injurers are liable for harm only if they were at fault. Readers familiar with the basic theory of deterrence and liability may want to proceed directly to Section 9.3.

There are two basic reasons why it is best for damages to equal harm under strict liability. The first concerns the *level of precautions* taken by parties, where the term ‘precautions’ is to be interpreted generally (including, for example, the use of safety devices, attention to hazards, and the monitoring of employees by firms). If damages equal harm, parties will have socially correct incentives to take precautions; they will be induced to invest in precautions if and only if the cost is less than the resulting reduction in expected harm. If, however, damages are less than harm, precautions will tend to be inadequate, and if damages exceed harm, precautions will tend to be excessive.

The second reason why it is desirable for damages to equal harm involves parties’ *level of activity* – the extent to which individuals and firms participate in risky activities. A party’s level of activity affects the magnitude of expected harm, whatever precautions are taken by the party when engaging in the activity. For example, the more miles a person drives (his level of activity), the greater the number of accidents that he is likely to cause, whatever is his level of care when he drives. Similarly, the more units of a product produced and sold by a firm (its level of activity), the greater the number of accidents that will be caused by the product, whatever are the safety features of the product (which affect the expected harm per unit sold).

If damages equal harm, parties will have socially correct incentives to engage in risky activities. In particular, because an individual’s expected damages will equal the expected harm he causes by participating in an

activity (such as driving), he will participate in the activity if and only if the benefit he obtains from the activity exceeds the resulting expected harm. Likewise, a firm will produce a product if and only if its value, as reflected in the willingness of customers to pay for it, exceeds the full cost of its production, including the expected harm that it causes. (This is because the price of the product will equal its full cost of production, assuming for simplicity that the firm produces in a competitive environment.) However, if damages are less than harm, levels of activity will tend to be socially excessive, and if damages exceed harm, levels of activity will tend to be too low.

Let us turn now to the negligence rule, under which a party whose level of precautions is below a specified standard is said to be negligent and must pay damages. Assume that the negligence standard is set equal to the optimal level of precautions (the level that minimizes the sum of precaution costs and expected harm). Then, if damages for negligence equal harm, parties will decide to comply with the negligence standard and thus will take appropriate precautions. However, if damages are less than harm, parties might not meet the standard. If damages exceed harm, parties will have a more-than-adequate incentive to meet the standard, and no reason to exceed it, assuming that the negligence determination is accurate.

Realistically, however, there will be errors in the negligence determination. For example, courts may err in determining the negligence standard or in assessing parties' behavior. Because of the risk of such mistakes, parties may have an incentive to take greater precautions than they would otherwise, in order to reduce the chance that they will incorrectly be found negligent. If the chance of mistake leads parties to take excessive precautions, raising the level of damages will exacerbate this problem.

Next consider the relationship between damages and the level of activity under the negligence rule. In the absence of mistakes, the negligence rule will tend to cause parties to participate in risky activities to a socially excessive extent. This is because, once a party takes the precautions required by the negligence standard, he will not be found liable for any harms that he causes. For example, a person who drives with reasonable care will not be found negligent, and therefore will not have to pay for any harm caused by his driving; consequently, he will drive more than is socially desirable. However, because non-negligent parties sometimes will be found liable by mistake, they will sometimes bear damages. In principle, this could ameliorate the problem of excessive participation in risky activities under the negligence rule. It also is possible, however, that finding parties negligent by mistake will result in their bearing damages in excess of the harm they have caused, and thereby overly discourage their participation in activities. This effect, if it occurs, will be exacerbated by raising the level of damages.

The preceding discussion shows that there is not a simple, theoretically correct answer to the question of what level of damages is optimal under the negligence rule. We will assume for simplicity that optimal damages under the negligence rule are equal to the harm, as under the rule of strict liability. Accordingly, we generally will not distinguish between the two rules in our subsequent discussion.

In passing, we want to note that the conclusion that damages should equal harm depends on our implicit assumption that parties are risk neutral. If injurers are risk averse and cannot purchase liability insurance, the optimal level of damages tends to be lower than harm, both to reduce the imposition of risk on injurers and because damages do not need to be as high to induce injurers to behave appropriately. But if, as is realistic, liability insurance is available (even if only partially available due to moral hazard), the optimal level of damages remains equal to the harm. Also, publicly held firms should be treated as approximately risk neutral – implying that damages should equal harm – if their shareholders have well-diversified portfolios, which often, if not usually, will be the case.

We next turn to various deterrence-based rationales for setting damages in excess of harm – that is, for imposing punitive damages. The first and most important of these arises when injurers might escape liability.

9.3 Optimal damages when injurers might escape liability

There are several reasons why injurers sometimes escape liability for harms for which they should be liable under a liability rule. First, it may be difficult for the victim to determine that the harm was the result of some party's act – as opposed to simply being the result of nature, of bad luck. This might be the case, for instance, if an individual develops a form of cancer that could have been caused by exposure to a naturally occurring carcinogen but which was in fact caused by exposure to a man-made carcinogen. Second, even if the victim knows that he was injured by a person's conduct and not by nature, it might be difficult for him to prove who caused the harm. The owner of a parked car that was damaged might know that it had been struck by another vehicle but not be able to identify the injurer or be able to establish his identity in court. Third, even if the victim knows both that he was wrongfully injured and who injured him, he might not sue the injurer because of the effort and expense a suit would entail.

The consequences of the possibility that injurers can escape liability are clear. If damages merely equal harm, injurers' motivations to take precautions will be inadequate and their incentive to participate in risky activities will be excessive. To remedy these problems, the damages that are imposed in those instances when injurers *are* found liable should be raised sufficiently so that injurers' expected damages will equal the harm they cause.

This implies that total damages should equal the harm multiplied by the reciprocal of the probability that the injurer will be found liable when he ought to be. Formally, if h is harm and p is the probability of being found liable, the injurer should pay $h \times (1/p) = h/p$ when he is found liable; his expected damages therefore will be $p \times (h/p) = h$. We will refer to $1/p$ as the *total damages multiplier*. For example, if the probability of being found liable is 0.25, the total damages multiplier is 4 ($= 1/0.25$), so the injurer should pay, in total, four times the level of harm if he is found liable.

The excess of total damages over compensatory damages can be labeled *punitive damages*. Thus, the *optimal* level of punitive damages is the optimal level of total damages less compensatory damages. If the harm is \$100,000 and the probability of being found liable is 0.25, implying a total damages multiplier of 4, total damages should be \$400,000; since \$100,000 of this total represents compensatory damages, the \$300,000 remainder is the optimal punitive damages amount. This amount also can be described as a multiple of harm or, equivalently, of compensatory damages. Since optimal total damages are h/p , optimal punitive damages are $h/p - h$, which can be rewritten as $[(1 - p)/p]h$. The term in brackets – the ratio of the injurers' chance of escaping liability to the injurer's chance of being found liable – is the *punitive damages multiplier*. In the preceding example, the punitive damages multiplier is 3 ($= 0.75/0.25$), which, when multiplied by the harm of \$100,000, yields the \$300,000 punitive damages amount.

Note that the award of punitive damages may itself raise the probability of suit, and therefore the probability that an injurer will be found liable. This effect, when applicable, should be taken into account. In general, there will be a level of damages that, given the resulting probability of suit, will lead to optimal deterrence. Basing punitive damages on the relatively low probability of suit that would occur if just compensatory damages were awarded would tend to lead to excessive damages.

The general point that, to achieve proper deterrence, sanctions must be inflated if injurers can escape liability, dates back at least to Bentham ([1838–43] 1962, pp. 401–2) and has been applied to the subject of punitive damages by many commentators. The first explicit references to the factor of escaping liability as a justification for punitive damages apparently are Posner (1972, pp. 77–8) and Ellis (1982, pp. 25–6); this justification has been developed most thoroughly by Cooter (1989) and Polinsky and Shavell (1998). See also Craswell (1999).

9.4 Optimal damages when harm is underestimated

Even if injurers are always found liable when they are responsible for harm, if the magnitude of harm is underestimated, compensatory damages will be less than harm and deterrence will be inadequate. This possibility is

realistic because hard-to-measure components of harm (such as nonpecuniary losses) often are excluded from damages. Such missing components of harm are commonly mentioned as a reason to impose punitive damages; see especially Ellis (1982, pp. 26–31) and Galligan (1990).

However, as emphasized in Polinsky and Shavell (1998, pp. 939–41), there is a problem with employing punitive damages as a substitute for missing components of compensatory damages. Namely, a component of harm might be excluded from compensatory damages because of the difficulties and expense that would be encountered in its estimation. For example, were the pain and suffering experienced by the friends of a person who dies included in compensatory awards, the number of claimants in cases of wrongful death could become quite large, and the cost of litigation would also increase as parties contested the degree of their psychological losses. It may well be best, then, for the law to exclude from compensatory damages many such speculative, difficult-to-determine elements of harm, even though these elements are real and their omission does undesirably dilute deterrence. If a component of loss is excluded from compensatory damages for such reasons, arguably it should be excluded from punitive damages for the same reasons.

Conversely, if a component of loss should have been included in compensatory damages, despite the costs of doing so, this mistake in legal policy should be rectified by incorporating the component in such damages. Including the component only in punitive damages would still result in underdeterrence, for the component would remain omitted in the large majority of cases in which only compensatory damages are awarded. Moreover, the component of loss would probably be more poorly measured as a form of punitive damages because the calculation of such damages is not disciplined by the procedures and evidentiary requirements common to the determination of compensatory damages.

9.5 Optimal damages when injurers' gains are socially illicit

We have implicitly assumed to this point that the gains that parties obtain from committing harmful acts count in social welfare, whereas here we consider the situation when their gains are not counted in social welfare because they are treated as *socially illicit*. Suppose that a person, out of spite, punches another individual. Society might well deem the pleasure the injurer obtains from this act to be socially illicit. This view of an injurer's gains would seem especially plausible when the injurer's utility derives solely from causing harm (that is, when the injurer's act is malicious). However, certain conduct that is not intended to cause harm might also be treated as socially illicit, for instance, driving at high speed for the fun of it.

If an injurer's utility from an act is considered socially illicit (whatever the

explanation for this), it is desirable for the act to be deterred completely. To accomplish this, damages must exceed the injurer's utility from committing the act. And since the injurer's utility could be greater than the harm, the required level of damages might exceed the harm. For instance, if the illicit gain from an act is equivalent to \$500 to the injurer and the harm is \$100, damages of at least \$500 are necessary to deter the act. This justification for punitive damages was first noted by Ellis (1982, pp. 31–3) and Cooter (1982, pp. 86–9); for a more formal treatment, see Shavell (1987, pp. 159–61).

It should be noted, though, that the present justification for punitive damages is limited in scope. Many, if not most, socially undesirable acts committed by individuals, including some very reprehensible ones, do not seem to be associated with socially illicit utility; often this is because such acts are not committed with the intention of causing harm. Similarly, most conduct of firms is unlikely to be associated with socially illicit utility, since the goal of firms is to make profit, not cause harm.

9.6 Optimal damages when parties can bargain and transact in the marketplace

In some circumstances it is possible for a party to communicate with a potential victim before causing harm. This would usually be so, for example, when a firm contemplates infringing on another's copyright. When prior communication is possible, a potential injurer could negotiate in advance with the potential victim to purchase the right to engage in the harm-creating conduct. The firm deliberating about the copyright violation could secure a license to use the copyrighted material.

In such circumstances, it may be socially desirable to induce a potential injurer to bargain and purchase the right to engage in harm-creating conduct – by threatening to impose punitive damages if the injurer acts unilaterally to cause harm. This point apparently originated with Calabresi and Melamed (1972) and was further developed by Landes and Posner (1981), Haddock, McChesney and Spiegel (1990), Biggar (1995), and Kaplow and Shavell (1996).

To amplify on this rationale for punitive damages, suppose that compensatory damages alone are employed and that they are underestimated. A potential injurer then might cause harm when doing so is socially undesirable – because the benefit to the injurer might be less than the harm done, but greater than the low estimate of compensatory damages.

There may be additional undesirable repercussions from underestimating compensatory damages. If injurers can take property from victims without having to pay its full value, injurers will devote effort to identifying and taking such property (copyright violators will seek out material to copy), and victims will expend effort to protect their property (copyright

owners will invest resources in preventing duplication of their material). Such efforts are socially wasteful; they are similar to those associated with the theft of property.

The foregoing problems can be avoided if punitive damages are imposed for unilaterally causing harm. If the level of such damages is set so that total damages substantially exceed the value of the property at issue, a potential injurer will be induced to bargain with the property owner – it will be cheaper to pay an agreed upon price than to pay damages. Consequently, property will be exchanged only if the injurer's benefit exceeds the property owner's loss, and the wasteful incentives to take and to protect property will be eliminated.

Another possible reason to employ punitive damages to encourage bargaining and market transactions concerns administrative costs. If compensatory damages are used alone, harm and the taking of property will tend to be mediated through the legal system by the bringing of lawsuits. But if punitive damages are used as a threat, harm and the shifting of property interests will be much more likely to occur through voluntary transactions, the costs of which are likely to be lower than those associated with litigation.

The preceding arguments favoring the use of punitive damages to promote negotiation and market transactions obviously do not apply if bargaining between parties is not possible or if there are substantial impediments to it. Suppose, for instance, that a hiker lost in the mountains discovers an unoccupied cabin. The benefit he would obtain from using the cabin and consuming the food in it presumably would exceed the loss borne by the cabin's owner. But because there is no opportunity for the hiker to bargain with the owner, the threat of punitive damages might discourage the hiker from using the cabin, which would be undesirable. Hence, when parties cannot bargain, it may be better just to employ compensatory damages (despite the possibility of errors in estimation). Additionally, even if bargaining is feasible, there may be other impediments to efficient exchange – such as bargaining failures due to strategic behaviour – that could justify relying solely on compensatory damages.

Because many harms cannot, as a practical matter, be resolved beforehand by bargaining – including most harms due to accidents between strangers, such as automobile accidents – and because bargaining failures are important, the present justification for punitive damages often will not be relevant.

9.7 Optimal damages and punishment

Having discussed the use of punitive damages to accomplish proper deterrence, let us now turn to the punishment objective. We treat this objective as deriving from the desire of individuals to have blameworthy parties

appropriately punished. We equate blameworthiness with the reprehensibility of a party's conduct, that is, with its maliciousness or the extent to which it reflects disregard for the safety of others. Given the degree of a party's blameworthiness, we assume that there is a correct level of punishment, and that either higher or lower punishment detracts from satisfaction of the punishment objective.

When the defendant is an individual, the connection between imposition of punitive damages and accomplishment of the punishment objective is conceptually straightforward: if, after assessing the blameworthiness of an individual's act, appropriate punitive damages are imposed, the punishment objective is achieved.

However, when the defendant is a firm, the role of punitive damages in relation to the punishment objective involves a number of complexities; these have been considered, for example, in Polinsky and Shavell (1998, pp. 948–54). One is that there are different ways of viewing the objective of punishment: the goal may be to punish firms as *entities*, that is, without reference to whether anyone within a firm behaved inappropriately or was punished as a consequence; or the goal may be to punish firms only as a means of punishing culpable *individuals* in the firms. We find the former conception of the punishment goal unappealing both because it requires a definition of blameworthiness of a firm that is divorced from the behavior of any individuals who are affiliated with it, and because it necessitates believing that people would, after reflecting about the matter, want to impose a penalty on what ultimately is an artificial legal construct. Notwithstanding these reservations, it is possible that people do want to personify firms and punish them as entities, and the reader can make up his or her mind about the importance of this way of defining the punishment objective.

Now consider the alternative reason for punishing firms – as a means of punishing blameworthy individuals within them. Supposing that this is the purpose of punishment, we turn to the question of the extent to which the imposition of punitive damages on firms will in fact result in the punishment of blameworthy employees. Because firms clearly have an interest in discouraging culpable conduct by their employees that could give rise to punitive damages, firms can be expected to seek to control such conduct through the use of internal sanctions (such as demotion or dismissal). However, several considerations suggest that the imposition of punitive damages on firms will have a smaller effect on the punishment of blameworthy employees than might at first be supposed.

First, culpable employees may not be punished by firms because firms may have difficulty identifying them. Second, even if culpable individuals within a firm can be identified and punished by the firm, imposing punitive damages on firms often will have little or no marginal effect on their

punishment. That is, the internal sanction imposed on such employees may not be much (if at all) greater as a result of the firm's bearing both punitive and compensatory damages than if the firm had borne compensatory damages alone, because the latter may result in the firm imposing the maximum internal sanction on the employee. Additionally, there may not even exist culpable employees in the firm to punish: responsibility for a decision may be so dispersed that no one person would be considered blameworthy with respect to it; and even if there are such persons, they may have changed jobs, retired, or died by the time a judgment is rendered.

A further point is that imposing punitive damages on firms often penalizes the firms' shareholders and customers, who ordinarily would not be thought to deserve punishment. This adverse consequence of punitive damages must be weighed against the beneficial effects of such damages in furthering the punishment goal.

To amplify, shareholders, as residual claimants on a firm's profits, obviously will be made worse off when punitive damages are imposed on a firm. The question, however, is whether they should be punished. If a shareholder owns a significant share of a firm's stock, participated actively in the firm's decisions and acted egregiously, then his position would be much the same as that of a blameworthy employee with decisionmaking power; each would be morally culpable. But if a shareholder owns a minuscule fraction of the stock of the firm, and was a passive investor with no direct involvement in the firm's decisionmaking processes, then his degree of blameworthiness is small, if it exists at all.

A firm's customers also will suffer from the imposition of punitive damages on the firm if such damages cause the prices of the firm's products or services to rise. This can occur because firms may regard punitive damages as an additional cost of doing business – a cost that, with a positive probability, will be borne by them beyond their ordinary costs. To cover the added cost of punitive damages, therefore, firms will have to raise their prices, which will cause the welfare of their customers to decline. It seems clear, however, that customers would not ordinarily be considered blameworthy, because they do not exert direct control over the actions of firms that pose risks to other persons.

Thus, assuming that the punishment objective with respect to firms is to ensure that blameworthy individuals are penalized, punitive damages do not accomplish this objective in a direct way and also tend to penalize parties who are not blameworthy.

9.8 Optimal damages in the light of both objectives

The levels of damages that are optimal from the perspective of the two separate objectives of deterrence and of punishment generally will be different.

Notably, the level that is best for deterrence is likely to exceed that which is best for punishment if the chance of being found liable is low and the magnitude of punitive damages necessary for deterrence therefore is high. Conversely, the level that is best for punishment is likely to be higher if the chance of being found liable is high, because then optimal damages for purposes of deterrence are approximately equal to harm, but the reprehensibility of the defendant's act presumably calls for extra-compensatory damages to serve the punishment objective.

It is evident that the optimal level of damages overall – that which maximizes a measure of social welfare combining both objectives – is a compromise between the levels that are optimal when each objective is considered independently, as noted in Polinsky and Shavell (1998, pp. 955–6) and developed in Diamond (2002).

9.9 Extensions of the analysis

In this section, we will consider a variety of additional topics, focusing on the deterrence objective and usually restricting attention to the rationale for punitive damages stemming from the chance that the injurer can escape liability. We will, however, mention the punishment objective when it seems of particular importance.

Reprehensibility of conduct The law requires that a defendant be found to have acted in a reprehensible manner before punitive damages can be imposed on him. However, as emphasized in Galligan (1990, pp. 62–4) and Polinsky and Shavell (1998, pp. 905–10), this legal policy often is inconsistent with the deterrence objective. On the one hand, emphasis on reprehensibility may lead to imposition of punitive damages when such damages are not needed to achieve deterrence because the injurer is virtually certain to be found liable (as when a surgeon fails to remove a surgical tool from his patient). On the other hand, the converse problem may arise: an individual's harmful conduct may not be reprehensible but nevertheless may be unlikely to result in his liability (as when a truck inadvertently spills toxic wastes onto a highway at night).

Notwithstanding the preceding observations, basing the level of punitive damages on the reprehensibility of the defendant's conduct may be proper with respect to the deterrence objective for acts leading to gains that are socially illicit: such acts usually are considered reprehensible and, as observed in Section 9.3, punitive damages may be necessary to deter them.

From the perspective of the punishment objective, the focus on reprehensibility clearly is sensible, because reprehensibility of conduct is essentially synonymous with the actor's blameworthiness and thus with the need for punishment.

Wealth of injurers The courts often state that a defendant's financial condition is a relevant factor in setting a punitive damages award, with the understanding that higher punitive damages may be appropriate for defendants with higher wealth.

With regard to deterrence, however, damages usually should not depend on the injurer's wealth; see, for example, Abraham and Jeffries (1989), Cooter (1989, pp. 1176–7), and Polinsky and Shavell (1998, pp. 910–14). The reason, in essence, is that if parties make decisions about precautions and choice of activity based on the expected value of their liability – that is, if they act in a risk-neutral way – their decisions will not depend on their wealth, and thus there is no reason to link damages to wealth. This point generally applies to corporations since, for the reason discussed at the end of Section 9.2, they can be treated as risk neutral. It also applies to individuals if they are risk neutral or have access to liability insurance.

A qualification is that if individuals are risk averse and cannot obtain liability insurance, then optimal damages may depend on their wealth. To elaborate, the optimal level of damages for such individuals tends to be lower than that indicated by the multiplier formula presented in Section 9.3. (We noted an analogous point at the end of Section 9.2, where we observed that, for uninsured, risk-averse individuals who are found liable for sure, optimal damages are less than harm.) Further, the more risk averse an individual is, the lower the optimal level of damages. Assuming that poor individuals are more risk averse than rich individuals, this implies that the optimal level of punitive damages is lower for poorer individuals. Equivalently, punitive damages should be higher for wealthier individuals.

Another qualification to the conclusion that a defendant's wealth should not bear on the level of damages needed for proper deterrence arises when an injurer's gain is considered socially illicit. An injurer's wealth then may be relevant because the sanction necessary to offset his illicit gain will be higher the higher is his wealth, assuming that his marginal utility of money declines with his wealth.

Similarly, an individual's wealth may be relevant to the level of punitive damages that will achieve appropriate *punishment*. For to impose a given disutility on an individual, he must pay more if he is wealthy than if he is not, assuming that his marginal utility of money declines with his wealth. But if the injurer is a firm and the punishment objective is concerned with punishing culpable employees, the firm's wealth generally would not be relevant to satisfaction of the punishment objective. This is because there is no general reason to believe that the penalties that a firm imposes on its employees for misbehavior will be a function of the firm's wealth, and thus no reason to think that achievement of the punishment objective will be served by linking punitive damages to a firm's wealth.

Whether victims are strangers or customers Although we have so far implicitly assumed that the parties harmed by injurers are ‘strangers’ – parties who have no market or contractual relationship with the injurer – victims of harm often are customers of defendant firms. The status of victims either as strangers or as customers is important to consider, although courts generally do not observe this distinction.

When customers might be harmed by the products (or services) they buy, firms will tend to be concerned that customers may not be willing to pay as much for the products or that they may stop purchasing the products altogether. Given that firms have this market-based incentive to be attentive to the risk of harm to their customers, the need for liability in general, and for punitive damages in particular, to control injurer behavior is diminished. The more knowledgeable customers are about product hazards, the less the need for punitive (or any) damages. Obviously, this market mechanism cannot operate if the victims are strangers to the defendant. On punitive damages and the customer relationship, see Craswell (1996), Polinsky and Shavell (1998, pp. 934–6), and Shavell (2007).

Litigation costs Litigation costs may be relevant to the calculation of punitive damages because they may influence the probability of suit, and therefore the chance of escaping liability. If litigation costs are significant relative to the expected gain from suit, the probability of suit may be small, and this fact may justify imposing punitive damages on the injurer. However, litigation costs often will be insignificant in relation to the expected gain from suit, so that the probability of suit may be presumed to be very high. Then, consideration of litigation costs does not provide a basis for imposing punitive damages.

Note that punitive damages should not be awarded for the *purpose* of spurring suit. The damage multiplier formula is designed to achieve appropriate deterrence when suit does not always occur, so it is not necessary to award damages to increase the probability of suit (provided that the probability of suit is not so low that the implied level of damages exceeds the defendant’s ability to pay). Indeed, encouraging lawsuits would increase social costs and therefore is socially undesirable, other things equal.

The tendency of higher damage awards to increase litigation costs lends appeal to the policy of decoupling punitive damages, that is, awarding the plaintiff only a part of the punitive damages judgment paid by the defendant, with the remainder going to the state. Use of decoupling allows society to discourage excessive spending on litigation (the plaintiff receives less than otherwise) without diluting deterrence (the defendant can still be made to pay an appropriate penalty). On punitive damages and litigation costs generally, see Polinsky and Shavell (1998, pp. 921–3), Eaton, Mustard,

and Talarico (2005), and Hylton and Miceli (2005); see also Kahan and Tuckman (1995), Daughety and Reinganum (2003), and Landeo and Nikitin (2006) for a discussion of punitive damages and decoupling.

Insurability The question whether liability insurance for punitive damages should be permitted is of interest, in part because legal policy on this matter varies among the states. The basic answer to this question is that punitive damages should be insurable when the justification for punitive damages is that injurers might escape liability.

The reasons for allowing liability insurance for punitive damages are essentially the same as those for allowing liability insurance for compensatory damages. These reasons are easiest to explain when liability is strict and harm is solely monetary. In that case, the sale of liability insurance cannot hurt potential victims, since they will be fully compensated for any loss; and the insurance must raise the well-being of injurers if they elect to buy it. The arguments for allowing liability insurance in other contexts are more complicated. A potential qualification to all of these arguments arises if injurers are judgment proof; the availability of insurance could worsen injurers' behavior in these circumstances (although insurance also could improve matters). For discussions of insurance and punitive damages, see Priest (1989), Baker (1998), and Polinsky and Shavell (1998, pp. 931–4).

Tax treatment If punitive damages are imposed on an injurer as a result of his engaging in a business activity, such damages generally are tax deductible, just as are compensatory damages in those circumstances. This policy is socially desirable given the deterrence objective. For if punitive damages were not deductible, their after-tax cost to injurers would be artificially inflated relative to the costs of taking precautions, which are deductible. Consequently, injurers would be induced to take excessive precautions (and, for similar reasons, to be overly deterred from participating in risky activities). The general point that damages should be deductible, given that precaution costs are deductible, originated with Png and Zolt (1989) and carries over to the situation when parties might escape liability and punitive damages might be imposed as a result.

Acknowledgments

Polinsky's research was supported by the John M. Olin Program in Law and Economics at Stanford Law School. Shavell's research was supported by the John M. Olin Center for Law, Economics, and Business at Harvard Law School. An earlier version of this chapter appeared in Boudewijn Bouckaert and Gerrit De Geest (eds.), *Encyclopedia of Law and Economics* (Cheltenham, UK: Edward Elgar, 2000), Volume II, pp. 764–81.

Bibliography

- Abraham, Kenneth S. and John C. Jeffries, Jr (1989), 'Punitive Damages and the Rule of Law: The Role of Defendant's Wealth', *Journal of Legal Studies*, 18, 415–25.
- Baker, Tom (1998), 'Reconsidering Insurance for Punitive Damages', *Wisconsin Law Review*, 101–30.
- Bentham, Jeremy [1838–43] (1962), 'Principles of Penal Law', in John Bowring, (ed.), *The Works of Jeremy Bentham*, Vol. 1, New York: Russell & Russell Inc., pp. 365–580.
- Biggar, Darryl A. (1995), 'A Model of Punitive Damages in Tort', *International Review of Law and Economics*, 15, 1–24.
- Boyd, James and Daniel E. Ingberman (1995), 'Do Punitive Damages Promote Deterrence?', Business Law and Economics Center, Washington University, St Louis, BLE-95-08.
- Calabresi, Guido and A. Douglas Melamed (1972), 'Property Rules, Liability Rules, and Inalienability: One View of the Cathedral', *Harvard Law Review*, 85, 1089–128.
- Chapman, Bruce and Michael Trebilcock (1989), 'Punitive Damages: Divergence in Search of a Rationale', *Alabama Law Review*, 40, 741–829.
- Cooter, Robert D. (1982), 'Economic Analysis of Punitive Damages', *Southern California Law Review*, 56, 79–101.
- Cooter, Robert D. (1989), 'Punitive Damages for Deterrence: When and How Much?', *Alabama Law Review*, 40, 1143–96.
- Craswell, Richard (1996), 'Damage Multipliers in Market Relationships', *Journal of Legal Studies*, 25, 463–92.
- Craswell, Richard (1999), 'Deterrence and Damages: The Multiplier Principle and its Alternatives', *Michigan Law Review*, 97, 2185–238.
- Daniels, Stephen and Joanne Martin (1990), 'Myth and Reality in Punitive Damages', *Minnesota Law Review*, 75, 1–64.
- Daughety, Andrew F. and Jennifer F. Reinganum (1997a), 'Everybody Out of the Pool: Products Liability, Punitive Damages, and Competition', *Journal of Law, Economics, & Organization*, 12, 410–32.
- Daughety, Andrew F. and Jennifer F. Reinganum (1997b), 'Settlement, Deterrence and the Economics of Punitive Damages Reform', Department of Economics and Business Administration, Vanderbilt University Working Paper No. 97-W04.
- Daughety, Andrew F. and Jennifer F. Reinganum (2003), 'Found Money? Split-award Statutes and Settlement of Punitive Damages Cases', *American Law and Economics Review*, 5, 134–64.
- Diamond, Peter (2002), 'Integrating Punishment and Efficiency Concerns in Punitive Damages for Reckless Disregard of Risks to Others', *Journal of Law, Economics, and Organization*, 18, 117–35.
- Dobbs, Dan B. (1989), 'Ending Punishment in "Punitive" Damages: Deterrence-Measured Remedies', *Alabama Law Review*, 40, 831–917.
- Eaton, Thomas A., David B. Mustard and Susette M. Talarico (2005), 'The Effects of Seeking Punitive Damages on the Processing of Tort Claims', *Journal of Legal Studies*, 34, 343–68.
- Eisenberg, Theodore, John Goerd, Brian Ostrom, David Rottman and Martin T. Wells (1997), 'The Predictability of Punitive Damages', *Journal of Legal Studies*, 26, 623–61.
- Ellis, Dorsey D., Jr (1982), 'Fairness and Efficiency in the Law of Punitive Damages', *Southern California Law Review*, 56, 1–78.
- Farber, Daniel A. (1980), 'Reassessing the Economic Efficiency of Compensatory Damages for Breach of Contract', *Virginia Law Review*, 66, 1443–84.
- Friedman, David (1989), 'An Economic Explanation of Punitive Damages', *Alabama Law Review*, 40, 1125–42.
- Galanter, Marc (1996), 'Real World Torts: An Antidote to Anecdote', *Maryland Law Review*, 55, 1093–160.
- Galligan, Thomas C., Jr (1990), 'Augmented Awards: The Efficient Evolution of Punitive Damages', *Louisiana Law Review*, 51, 3–85.

- Gotanda, John Y. (2004), 'Punitive Damages: A Comparative Analysis', *Columbia Journal of Transnational Law*, 42, 391–444.
- Haddock, David D., Fred S. McChesney and Menahem Spiegel (1990), 'An Ordinary Economic Rationale for Extraordinary Legal Sanctions', *California Law Review*, 78, 1–51.
- Hylton, Keith N. (1998), 'Punitive Damages and the Economic Theory of Penalties', *Georgetown Law Review*, 87, 421–71.
- Hylton, Keith N. and Thomas J. Miceli (2005), 'Should Tort Damages be Multiplied?', *Journal of Law, Economics, and Organization*, 21, 388–412.
- Johnston, Jason S. (1987), 'Punitive Liability: A New Paradigm of Efficiency in Tort Law', *Columbia Law Review*, 87, 1385–446.
- Kahan, Marcel and Bruce Tuckman (1995), 'Special Levies on Punitive Damages: Decoupling, Agency Problems, and Litigation Expenditures', *International Review of Law and Economics*, 15, 175–85.
- Kaplow, Louis and Steven Shavell (1996), 'Property Rules versus Liability Rules: An Economic Analysis', *Harvard Law Review*, 109, 713–90.
- Landeo, Claudia M. and Maxim Nikitin (2006), 'Split-Award Tort Reform, Firm's Level of Care, and Litigation Outcomes', *Journal of Institutional and Theoretical Economics*, 162, 571–600.
- Landes, William M. and Richard A. Posner (1981), 'An Economic Theory of Intentional Torts', *International Review of Law and Economics*, 1, 127–54.
- Landes, William M. and Richard A. Posner (1986), 'New Light on Punitive Damages', *Regulation*, 10, 1, 33–6, 54.
- Landes, William M. and Richard A. Posner (1987), *The Economic Structure of Tort Law*, Cambridge, MA: Harvard University Press.
- Moller, Erik, Nicholas M. Pace and Stephen J. Carroll (1997), *Punitive Damages in Financial Injury Verdicts*, Institute for Civil Justice, Rand Corporation, No. MR-888-ICJ.
- Perczek, Jacqueline (1993), Note, 'On Efficiency, Punishment, Deterrence, and Fairness: A Survey of Punitive Damages Law and a Proposed Jury Instruction', *Suffolk University Law Review*, 27, 825–904.
- Perlstein, Barry (1992), 'Crossing the Contract-Tort Boundary: An Economic Argument for the Imposition of Extracompensatory Damages for Opportunistic Breach of Contract', *Brooklyn Law Review*, 58, 877–911.
- Peterson, Mark, Syam Sarma and Michael Shanley (1987), *Punitive Damages: Empirical Findings*, Institute for Civil Justice, Rand Corporation, No. R-3311-ICJ.
- Png, I.P.L. and Eric M. Zolt (1989), 'Efficient Deterrence and the Tax Treatment of Monetary Sanctions', *International Review of Law and Economics*, 9, 209–17.
- Polinsky, A. Mitchell (1997), 'Are Punitive Damages Really Insignificant, Predictable, and Rational? A Comment on Eisenberg et al.', *Journal of Legal Studies*, 26, 663–77.
- Polinsky, A. Mitchell and Yeon-Koo Che (1991), 'Decoupling Liability: Optimal Incentives for Care and Litigation', *RAND Journal of Economics*, 22, 562–70.
- Polinsky, A. Mitchell and Daniel L. Rubinfeld (1988), 'The Welfare Implications of Costly Litigation for the Level of Liability', *Journal of Legal Studies*, 17, 151–64.
- Polinsky, A. Mitchell and Steven Shavell (1998), 'Punitive Damages: An Economic Analysis', *Harvard Law Review*, 111, 869–962.
- Posner, Richard A. (1972), *Economic Analysis of Law*, 1st edition, Boston, MA: Little, Brown and Company.
- Priest, George L. (1982), 'Punitive Damages and Enterprise Liability', *Southern California Law Review*, 56, 123–32.
- Priest, George L. (1989), 'Insurability and Punitive Damages', *Alabama Law Review*, 40, 1009–35.
- Rubin, Paul H., John E. Calfee and Mark F. Grady (1997), '*BMW v Gore*: Mitigating the Punitive Economics of Punitive Damages', *Supreme Court Economic Review*, 5, 179–216.
- Rustad, Michael (1992), 'In Defense of Punitive Damages in Products Liability: Testing Tort Anecdotes with Empirical Data', *Iowa Law Review*, 78, 1–88.

- Schwartz, Alan (1990), 'The Myth that Promisees Prefer Supracompensatory Remedies: An Analysis of Contracting for Damage Measures', *Yale Law Journal*, 100, 369–407.
- Schwartz, Gary T. (1982), 'Deterrence and Punishment in the Common Law of Punitive Damages: A Comment', *Southern California Law Review*, 56, 133–53.
- Shavell, Steven (1987), *Economic Analysis of Accident Law*, Cambridge, MA: Harvard University Press.
- Shavell, Steven (1997), 'The Fundamental Divergence between the Private and the Social Motive to Use the Legal System', *Journal of Legal Studies*, 26, 575–612.
- Shavell, Steven (2007), 'On the Proper Magnitude of Punitive Damages: *Mathias v. Accor Economy Lodging Inc.*', *Harvard Law Review*, 120, 1223–7.
- Stoll, H. (1983), 'Consequences of Liability: Remedies', in André Tunc (ed.), *International Encyclopedia of Comparative Law*, Tübingen, Germany, J.C.B. Mohr (Paul Siebeck) and Dordrecht, The Netherlands: Martinus Nijhoff Publishers.
- Sunstein, Cass R., Daniel Kahneman and David Schkade (1998), 'Assessing Punitive Damages (With Notes on Cognition and Valuation in Law)', *Yale Law Journal*, 107, 2071–153.
- Wheeler, Malcolm E. (1989), 'A Proposal for Further Common Law Development of the Use of Punitive Damages in Modern Product Liability Litigation', *Alabama Law Review*, 40, 919–73.

PART IV

SPECIFIC CASES

10 Environmental liability

Michael Faure

10.1 Introduction

This chapter of the Encyclopedia on tort law and economics will deal with the hot issue of environmental liability. Economic analysis of law has long been applied to environmental problems and also to the area of environmental liability. As such, the application of the general economic principles of accident law to environmental problems does not pose specific difficulties. There are, however, several characteristics of environmental pollution which make it worthwhile to devote a separate chapter to this area. The problems of choosing between negligence and strict liability may have specific features in the area of environmental liability; environmental damage assessment may be even more difficult in this area and causation issues may play a particular role here as well. Moreover, the foreseeability requirement will often not be met in the case of environmental pollution, which raises specific questions when tort law is applied to environmental pollution. In these cases, one often notices tensions between the deterrence objective stressed by economists and notions of distributional justice advanced by lawyers and policy makers who wish to seek relief for victims of environmental pollution. Many of the issues concerning environmental pollution which are dealt with in this chapter therefore closely relate to issues dealt with in other chapters as well. The general theory (for example, concerning the choice between negligence and strict liability) will therefore not be repeated within the scope of this chapter, but some specific features of environmental pollution will be stressed.

Of course, when confronted with a broad notion such as 'environmental liability' the question always arises how one can delineate the subject. I have chosen on the one hand a broad interpretation, by not only discussing liability issues in the strict sense, but also looking at compensation issues. Therefore, some attention will also be paid to insurance issues and to alternative compensation mechanisms. A central question in the economic analysis of environmental liability is indeed how the law can provide incentives for prevention of environmental pollution and how *ex post* compensation may be provided at the lowest cost. On the other hand, it is, of course, not possible to discuss all relevant topics related to the domain of environmental liability. We will therefore not discuss the role of environmental groups which could bring citizen suits (see

on this issue Settle et al., 2001) and moreover an attempt will only be made to focus on the main literature, without being comprehensive. The question of environmental liability was briefly discussed in the chapter on environmental regulation in the previous version of the Encyclopedia (Faure, 2000) and hence this chapter largely builds upon that chapter, of course, by discussing also literature that has been published since that date. In addition to this chapter on environmental liability, included in the volume on tort law and economics, there is also a chapter on environmental crime in the volume of the Encyclopedia on the economics of criminal law and there is a chapter on environmental regulation in the volume of the Encyclopedia on regulation. Therefore, we will not focus on literature which is related to the area of enforcement, compliance or regulation since the reader can be referred to the chapters in those other volumes for information on those issues. Since we cannot discuss all the vast literature related to this broad area of environmental liability, the reader is referred to the list of references provided at the end of this chapter for further reading.

Some general books discuss problems of environmental liability in some detail. The reader interested in an introduction to the area might for example consult Revesz and Stewart (1995) who provide several contributions with a critical analysis of superfund legislation. Many contributions in Heyes (2001) deal with environmental liability from a law and economics perspective. Bergkamp (2001c) meanwhile discusses issues of environmental liability as do the contributions in Faure (2003a) and Faure and Verheij (2007).

This chapter is structured as follows: after this introduction, first the goals of environmental liability from an economic perspective are discussed (Section 10.2) and the importance of the Coase Theorem is stressed (Section 10.3). Then, the classic dichotomy between negligence and strict liability is applied to environmental pollution (Section 10.4) and the question of the consequences of the fact that many polluters are subject to regulation is addressed (Section 10.5). Problems of environmental damage are discussed in (Section 10.6) and limits and extensions of liability to others rather than the polluter are discussed in Section 10.7. The importance of latency and the evolution over time of environmental liability is addressed in Section 10.8. Then, we turn briefly to environmental insurance in Section 10.9 and discuss alternative compensation mechanisms as well in Section 10.10. The literature concerning the application of environmental federalism to environmental liability is discussed in Section 10.11. Finally, two specific areas of environmental liability are discussed, namely, nuclear liability (Section 10.12) and oil pollution (Section 10.13) and a few concluding observations are provided in Section 10.14.

10.2 Goals of environmental liability

The general idea of the economic analysis of law and of accident law more specifically, namely that a legal rule and more particularly a finding of liability will provide incentives for careful behaviour to potential parties in an accident setting has been applied by many to the area of environmental pollution as well (see for example Endres and Staiger, 1996; Wagner, 1999; Monti, 2001; and Gimpel-Hinteregger, 1994). Economists therefore stress, also as far as environmental liability is concerned, the deterrent function of tort law. (Environmental) lawyers on the other hand tend to attach more value to the compensation goal of accident law and also of environmental liability. They see environmental liability rather as an instrument that satisfies the polluter-pays principle and guarantees compensation to victims of pollution. A combination of both approaches, by showing that tort law may serve both the aims of deterrence and corrective justice, has been presented by G. Schwartz (1997).

Without going into these issues in detail, it should be mentioned that many studies have shown that environmental liability does have a deterrent effect in the sense that it influences the behaviour of polluters. For example, Alberini and Frost (2007) found that waste generators do respond to the fact that they can be held liable for the costs of clean-up if the waste disposal site contaminates the environment after closure or abandonment and thus falls under the federal or state superfund legislation. Earlier, Alberini and Austin (2001) also found that the imposition of strict liability in state environmental policies reduced unintended pollution releases. Firms therefore show behavioural responses of avoiding liability when they are strictly liable for releases of hazardous chemicals into the environment. Alberini and Austin also found that in states with strict liability, greater spill severity and frequency, this is also associated with smaller production units (and thus reduced assets) whereas this association is not present in states following negligence-based liability. Much research has also been devoted to the effects of so-called superfund liability under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA). Most of these studies (for example, Sigman, 2001) conclude that liability creates various incentives *inter alia* towards precaution in managing hazardous wastes and to discourage the development of old industrial sites. However, given the high (mostly legal) costs of superfund, the mere fact that the legislation does give incentives for prevention of waste generation does not necessarily mean that the overall judgment is that the system is efficient.

10.3 Coase

In many textbooks on law and economics, pollution is presented as the classic example of an externality. A factory might engage in socially

beneficial activities such as, for example, the production of pharmaceutical products, but this production process may bring about negative side effects, such as the emission of smoke or waste water. Much of the law and economics literature on environmental law is simply concerned with the two fundamental questions, namely:

- What is the optimal level of emissions?
- How can the law provide incentives to comply with this optimal level?

Traditional economists would answer that the right incentives can be given by imposing a tax on the polluting activity. Since this idea builds on the earlier work of Pigou (1951), this is usually referred to as a Pigovian tax. By equating the marginal tax rate to the marginal costs caused by the harmful activity, the factory would get incentives to reduce pollution in an optimal way. However, in his seminal article 'The Problem of Social Cost', Coase showed that if transaction costs are zero, an optimal allocation of resources will always take place irrespective of the content of the governing legal rule (Coase, 1960). Coase stressed the reciprocal nature of harm, meaning in this particular case that the pollution is not just caused by the harmful emissions of the factory but also by the presence of neighbours who are, for example, injured by the smoke emissions. The crucial question therefore is not how the law should provide incentives to force the factory to reduce emissions. First of all, the question should be asked, which of the two actors (factory or victims) should be limited in their activity (and maybe the answer is both, if both can take optimal precautions).

If it is, for example, established that the factory is emitting smoke causing a harm of 200 to each of the three victims living in its neighbourhood, that there is no feasible way in which the victims could prevent this harm from occurring and that all the emissions could be reduced by installing a filter which costs 500, the optimal solution is obviously that the filter should be installed. It follows from the Coase theorem that if the conditions are met, the filter will indeed be installed no matter what the content of the legal rule are. If the law holds the factory liable to pay compensation to the victims, the installation of the filter (which costs less than the compensation payments) is obviously in the interest of the factory. But the same result will hold if the factory is not liable and victims bear their own damage. Given the zero transaction cost assumption, they will get together and negotiate with the factory to convince the owners to install the filter. Also, if the victims pay for the filter, the price they pay may be less than the costs they would incur if the emissions took place.

Obviously, the efficient outcome may not follow if one of the parties behaves strategically or if the zero transaction cost assumption is not met.

In addition, it is clear that the Coase theorem only deals with the efficiency aspect of social problems, not with distributional aspects. Indeed, although the efficient result will hold in both cases (liability or no liability), there is a distributional difference: in the first case the factory pays for the filter; in the second case the victims do. Hence, the contents of the legal rule will matter from the victim's perspective. This may be a reason why, from a policy perspective, the legislator sometimes intervenes to make the polluter liable even in situations where the conditions of the Coase theorem were fulfilled.

This Coase theorem is used by many scholars as a starting point for discussing the role of environmental law and, more generally, the need for legal instruments to control environmental pollution. In this respect, we can refer to Baumol and Oates (1979), Frey (1992), Oates (1983) and to Schulze and D'Arge (1974). A literature overview is presented by Mishan (1971a). The possibilities for Coasean bargaining in the environmental arena have been explored *inter alia* by Rhoads and Shogren (2001). A drawback of the Coase theorem, especially as far as it relates to environmental problems, is that in real life the situation given in the example of one factory emitting smoke that affects just three victims rarely exists. Usually there are cases of multiple victims where transaction costs will be prohibitive. These drawbacks lead to scepticism concerning the importance of the Coase theorem for environmental problems on the part of, for example, Mishan (1971b) and Kapp (1970). In cases where transaction costs are indeed prohibitive, the Coasian negotiations will not take place and some intervention by the legal system will then remain necessary to reach an internalization of the externality.

Since the pioneering work of Calabresi (1961), Brown (1973), Posner (1972) and Shavell (1980b), economists have stressed the steering function of liability rules. The foresight of being held liable *ex post* will induce parties in the accident setting to take optimal care. These basic ideas can also be applied to environmental damage. By using liability law, a potential polluter can be given an incentive not to pollute or to invest in cleaning equipment of which the marginal costs equal the marginal benefits of a reduction in additional environmental damage. Many authors have applied these general notions of the economics of accident law to environmental liability and have shown that in the environmental context too tort rules may have this preventive effect (see Michelman, 1971; Bouckaert, 1991; Endres and Staiger, 1996; Faure, 1996). A nice study on a Swedish environmental liability case has been presented by Skogh and Rehme (1998). Since the details of the economics of tort law are discussed elsewhere, we shall now only focus on a few aspects of particular importance for environmental liability from a law and economics angle.

10.4 Negligence versus strict liability

One crucial question is whether environmental liability should be based on strict liability or on a negligence regime. The economic literature generally accepts (Shavell, 1980b, 1987b, p. 8) that both a negligence rule and a strict liability rule will provide a potential polluter with incentives to adopt an efficient care level. However, if the activity level is also taken into consideration, a negligence rule will not be optimal since the activity level is not incorporated into the due care standard which the courts apply. Hence, it is argued in the literature that in a unilateral accident model (where only the behaviour of the injurer influences the accident risk) strict liability will be efficient since it leads both to efficient care and to an optimal activity level. Hence, it has often been argued in the literature that there seems to be an economic rationale behind the tendency in case law and environmental statutes in many legal systems to introduce strict liability for environmental damage: since the victim cannot influence the accident risk, strict liability will be first-best to give the potential polluter optimal incentives for accident reduction and, hence, for optimal internalization (see, for example, Endres and Staiger, 1996; Faure, 1995a and for nuclear liability Faure, 1995b). However, if risk aversion of the polluter is assumed, strict liability is only efficient if it is insurable (Endres and Schwarze, 1991).

Environmental pollution can in most cases certainly be considered a unilateral accident, that is, an accident whereby only the injurer can influence the accident risk. In that case, the economic model (Shavell, 1980b) predicts that only strict liability will give the injurer an incentive to adopt both an optimal activity level and to take efficient care. In situations where the victim cannot influence the accident risk, strict liability seems to be the first-best solution to give the potential polluter optimal incentives for accident reduction (Pozzo, 1996). The basic model assumes that the judge has accurate information on the amount of the damage. If courts err in assessing damages, strict liability will lead to underdeterrence (so Cooter, 1984). Moreover, strict liability is efficient only if an injurer is always held to fully pay for the consequences of the accident. If the injurer were insolvent or if the judge were to underestimate the amount of the damage, a negligence rule would be preferred if the judge could at least adequately fix the optimal level of care, even if there were uncertainty concerning the precise amount of the damage (Cooter, 1984). A final nuance on the choice between negligence and strict liability is that specific problems may arise if strict liability is combined with other features which may expand the burden of liability on enterprises. This could more particularly be a shift of the burden of proving causation (see Faure and Hartlief, 1998), joint and several liability and high (punitive) damages for (non-pecuniary) losses. Trebilcock (1987) indicated that it was especially because of these last-mentioned features

that strict liability regimes in the US were experienced as ‘crushing’. Hence, the final judgment on the efficiency of strict liability for environmental harm may also depend upon these other issues, such as causation and the magnitude of damages awarded.

In a few recent papers, some of these ideas are either tested, confirmed or further developed. Endres and Bertram (2006) extend the basic Calabresi and Brown model to a dynamic setting where tort law induces progress in care technology. They examine dynamic incentives generated by alternative liability rules. Their general conclusion is that (with nuances) strict liability does not suffer from distortions as a result of changes in a due care standard (resulting from changes in technology) and therefore strict liability is superior to negligence in the intertemporal context. An overview of the literature concerning the incentive impacts of environmental liabilities is also provided by Earnhart (2004). In various papers Van Egteren and Smith examine the difference between negligence and strict liability in a setting where jurisdictions compete for firms that engage in environmentally risky behaviour. They conclude that (in different settings) strict liability (weakly) dominates the negligence rule (Van Egteren and Smith, 2002; Van Egteren, Smith and McAfee, 2004; and Van Egteren, Smith and Eckert, 2006).

10.5 The influence of regulation on liability

10.5.1 Criteria for regulation

Even though in this chapter, we focus on the deterrent effect of environmental liability and hence on the capacity of tort law to internalize environmental costs, the criteria advanced by Wittman (1977), Shavell (1984a, 1984b, 1987a) and by Kolstad, Ulen and Johnson (1990) have to be recalled which indicate when liability rules alone will not provide a sufficient incentive for a firm to take efficient care. In the case of environmental risk, most of these criteria point in the direction of *ex ante* regulation: information can be obtained more easily by the regulator, there is an insolvency risk and a serious risk of underdeterrence since no liability suit will be brought if, for example, the damage is widespread. This literature indicates that there is a strong case for controlling environmental harm through regulation. In legal practice, regulation plays an important role in controlling environmental harm. Similar economic criteria for regulation are advanced in Ogus’s book on regulation (1994, pp. 29–46).

10.5.2 Necessity of the combination

We just stated that according to Shavell’s criteria there is a strong argument to control the environmental risk through *ex ante* regulation (or

taxes). However, in individual cases there can still be damage to the environment. Then again liability under tort comes into the picture and the question has been addressed in the literature as to how regulation influences the liability system and vice versa. These complementarities between tort law and regulation have more particularly been addressed by Rose-Ackerman (1992a, 1992b, 1996), Faure and Ruegg (1994) and Kolstad, Ulen and Johnson (1990). See on these issues also Arcuri (2001), Burrows (1999), Boyer and Porrini (2001, 2002), Faure (2007a), Ogus (2007) and Schmitz (2000). Rose-Ackerman (1995a, 1995b) has also compared US and European experiences in using regulation versus tort law in environmental policy. The first point which is often stressed is that the fact that there are many arguments in favour of *ex ante* regulation of the environment does not mean that the tort system should no longer be used for its deterrent and compensating functions. One reason to still rely on the tort system is that the effectiveness of (environmental) regulation is dependent upon enforcement, which may be weak. In addition, the influence of lobby groups on regulation can to some extent be overcome by combining safety regulation and liability rules. Moreover, safety regulation, for example emission standards in licences, can be quickly out of date, which also merits a combination with tort rules. See also, on the necessity of adding tort law to regulation, Cane (2002) and Hylton (2002).

10.5.3 Violation of regulation and liability

The question then arises whether a violation of a regulatory standard should automatically be considered a fault under tort law and thus lead to liability. Shavell argues that this should not necessarily be the case, so as to avoid some parties who pose lower risks taking wasteful precautions (Shavell, 1984a, pp. 365–6). However, in many legal systems, a breach of a regulatory duty is often considered a fault. This can be understood since the regulation will pass on information to both the parties and to the judge on the efficient standard of care. Thus the statutory standards can be applied to define negligence (Rose-Ackerman, 1992a).

10.5.4 Compliance with regulation and liability

A second question is whether following the conditions of regulation, often laid down in a licence, excludes liability. This point of view is usually rejected in most legal systems (Faure and Ruegg, 1994, pp. 55–6). The economic rationale behind this rule is that if compliance with a regulatory standard were to release the operator from liability, there would be no incentive to invest in more care than the regulation asks for, even if additional care could still reduce the expected accident costs beneficially (Shavell, 1984a, p. 365). A second reason is that exposure to liability even in the case of compliance

with regulatory standards may be an adequate remedy when too lenient standards are set as a result of lobbying. Finally tort law can also be seen as a 'stop gap' for situations not dealt with by statute (Rose-Ackerman, 1992a, p. 123). A problem with this point of view is, however, that it may destroy the uniformity a standard is supposed to bring when judges are allowed in all cases to 'second guess' agency decisions (see Rose-Ackerman, 1992a, p. 124). The issue whether *ex post* liability and *ex ante* safety regulation are substitutes or complements has also been addressed by Kolstad, Ulen and Johnson (1990). They show that where there is uncertainty, there are inefficiencies associated with the exclusive use of negligence liability and that *ex ante* regulation can correct these inefficiencies. In that case, they argue a joint use of *ex ante* and *ex post* regulation will enhance efficiency. See, on the issue whether compliance with federal safety statutes should have a justificative effect in state tort cases, A. Schwartz (2000).

10.5.5 Liability and incentive-based instruments

Finally it should be mentioned that in the literature some attention has been given to the problem of combining tort recovery and effluent fees or tradeable rights. Rose-Ackerman has argued that incentive schemes require a fundamental rethinking of the relationship between tort law and statutory law. She has argued that incentive-based regulatory statutes should preempt tort actions: if fee schedules have been set to reflect the social costs, tort actions would be redundant or even counterproductive (see, for example, Rose-Ackerman, 1992a, p. 128).

10.6 Damage and damages

Classic techniques for the valuation of damage will be hard to apply when, for example, an entire ecosystem is endangered as a consequence of certain emissions. Nevertheless a more or less accurate estimation of the damage seems important for several reasons. First of all, the scope of the environmental harm will have a large influence on the optimal level of care required from the potential polluter. Indeed, there is supposed to be a relationship between the magnitude of the harm and the optimal level of care. Hence, it seems important to have some insight into the amount of the damage to be able to fix the level of care required from a potential polluter in an efficient way. Second, for the same reason, it will be important to fix the magnitude of the harm accurately *ex post*, not only to provide a fair compensation to victims (although it may not always be clear who they are in an environmental case), but also because this fixing of the magnitude of the damage will have an influence on future cases as well.

Economists have established a variety of techniques for valuing environmental damage. One method is the so-called hedonic price technique.

This is based on the analysis of market data from transactions in private goods and services which are related to the characteristics of the public good under consideration. In other words, in the hedonic price technique the value of changes to the natural environment are analysed by the perceived monetary changes this has caused in markets for the affected goods. It is then, for example, assumed that housing values would reflect the variation in the quality of environmental goods. House prices can be a function of natural surroundings such as the presence of parks and forests. On that basis, an evaluation of environmental improvements could be undertaken based on an estimation of the house price function. This approach has, for example, been applied by Hoch and Drake (1974), Harrison and Rubinfeld (1978) and Nelson (1978) (for a critical analysis, see Maler, 1977).

The alternative is to ask individuals to state their willingness to pay for environmental improvement directly, using a survey questionnaire. This is referred to as contingent valuation and is based on a hypothetical allocation procedure for the particular public good. This more direct approach is based on, for example, Davis (1963), Bradford (1970) and Bohm (1971) (for a comparison of both methods of analysis see Pommerehne, 1988). There is a lot of discussion of contingent valuation in the US since it is being used under some environmental laws (see, for a critical analysis, Hausman, 1993). Another option is the use of travel cost studies to estimate environmental benefits. Travel cost studies have been used to measure the benefits of recreational options (see, for example, Krutilla, 1967).

In order to evaluate the effectiveness of restoration of contaminated sites, a concept of Net Environmental Benefit Analysis (NEBA) has been developed. This technique measures the net environmental benefits in gains attained by remediation minus the value of adverse environmental effects caused by those actions (Efroymsen et al., 2004). The damage assessment and valuation under natural resources damages law in the US is extensively discussed by Boyd (2003). An example of how such an economic valuation of ecological losses is performed in practice is presented in a case study by Chapman and Hanemann (2001).

A specific feature of environmental liability regimes, especially under international conventions, is that the compensation due to victims is limited through so-called financial caps. This is usually justified on insurance grounds. Nevertheless, these financial caps have been seriously criticized both in legal and in law and economics literature. Lawyers argue that caps seriously limit the rights of victims to full compensation. From an economic point of view, this is a problem as well since there will be no full internalization of the risky activity. Furthermore Landes and Posner (1984) have argued that if the statutory limit is lower than the potential magnitude

of the accident, a problem of underdeterrence will arise. Moreover, insurability should not be an argument to introduce financial caps in environmental liability legislation. Liability can be unlimited and a possible duty to insure may be limited to an uninsurable amount (Faure, 1995b).

10.7 Moving beyond the original polluter

The classic model of tort law assumes that it is only the polluter who directly caused the environmental harm who will be held liable to compensate the victim. However, in practice, many deviations from this rather straightforward principle can be found whereby others rather than the direct polluter are held liable and liability is therefore shifted to other actors who may have some relationship to the pollution. The reason may be that the original polluter either cannot be identified or is insolvent. In other cases, there is uncertainty concerning the causal relationship between the damage suffered by the victim and the activity of the polluter. All of these issues are quite relevant in legal practice and therefore merit a brief discussion.

10.7.1 Causal uncertainty

In environmental liability, the problem will often arise of uncertainty concerning the causal link between an event (for example, an emission) and a certain outcome (for example, health damage). The question then arises how one should deal with this causal uncertainty if scientific evidence for example reports that there is a 40 percent probability that a certain cancer was caused by the wrongful act, but a 60 percent probability that the cancer came from another source (the so-called background risk). After early law and economics papers, where the importance of the causation issue was stressed (for example, Calabresi, 1975; Shavell, 1980a; and Landes and Posner, 1983), further studies explicitly addressed the problem of causal uncertainty. Shavell (1985) and Kerkmeester (1993) stressed that in case of causal uncertainty the liability of the injurer should be limited to those cases in which he actually caused the harm. Otherwise liability would be experienced by the injurer as 'crushing' or, in economic terms, overdeterrence would take place. This would result if, in our example, the firm were held liable to pay 100 percent damage even though there was only a 40 percent probability that his activity contributed to the harm. Rosenberg (1984), Kaye (1982) and Rizzo and Arnold (1980, 1986) have argued that there should only be liability to the extent that the activity contributes to the accident risk, meaning that on the basis of statistical evidence, the liability rule should be constructed in such a way that the polluter will never be held liable for the background risk (which he did not cause), but only for the so-called excess risk (the contribution of his activity to the risk). The question then arises what kind of legal rule can respect these principles.

Traditionally, there are two possible rules (for an overview, see Faure, 2003b and Faure and Bruggeman, 2007).

One possibility is to award 100 percent compensation to the victim once a certain threshold is passed, for example a 50 percent probability of causation. This is called a threshold liability (see Miller, 2006). This rule, which has been applied in the US for a long time, is considered to be inefficient and also unjust since it forces a firm to compensate (at least partially) for damage which it can never have caused from a statistical point of view. The alternative is to translate the probability of causation by awarding the victim a proportion of its damage (Bergkamp, 2001a). When there is a 40 percent chance, as was the case in our example, that the harm was caused by the tort, the victim will be awarded 40 percent of his loss. The advantage from an efficiency point of view is that the injurer is precisely exposed to the excess risk which he caused. This rule may also be preferable from the victim's perspective, since in this case he would have received nothing under a threshold liability as the 50 percent threshold had not been passed. The threshold liability is indeed an 'all or nothing' approach. Economic analysis generally holds that only the proportional liability rule will give optimal incentives for accident prevention (Landes and Posner, 1984; Robinson, 1985; Makdisi, 1989 and Faure, 1993). However, some scholars consider this probability of causation approaches a lottery since even scientists would not be able to make an accurate assessment of the probability that a certain activity may cause certain damage (Estep, 1960 and Tribe, 1971). Tribe argued that 'Mathematical evidence is more misleading than helpful'. Even though proportional liability seems to be more generally accepted now in many legal systems (such as recently in the UK and in the Netherlands, both in asbestos cases) there is also criticism (for example, by Nieuwenhuis, 2006).

10.7.2 Joint and several liability

An area which is closely related to the issue of causal uncertainty just discussed is the tendency to hold joint tortfeasors jointly and severally liable for all the damage to which their behaviour might have contributed. The reasons for doing so are well known. For the victim it is often difficult to prove a clear causal link with the actions of one particular polluter. This may sometimes lead to alleviations of the burden of proof or to holding several insurers jointly and severally liable. The often debated superfund regime under CERCLA is an example of such a joint and several liability regime. The effects of a joint and several liability are obviously also that the risk of insolvency is shifted to the injurer who will be sued by the victim. Indeed, joint and several liability means that the victim can claim full compensation from one injurer, who can then exercise redress against the other parties who contributed to the loss in proportion to their contribution.

If, however, the other parties were all insolvent, the one injurer who was the defendant would have to compensate for the total loss, including the losses he has not caused. In addition, the risks of uncertainty concerning the causal link are, under joint and several liability, also shifted to the one injurer who is sued in the particular case. It is sufficient for the victim to sue just one of the many potentially liable injurers and to claim full compensation. If the one injurer does not succeed in proving that others contributed to the loss, the damage will ultimately fall on him.

Although an argument could be made in favour of joint and several liability, namely that *ex ante* it should provide excellent incentives for mutual monitoring of potential injurers, there seem to be disadvantages as well. Joint and several liability may violate the principles of fair and efficient compensation which hold that an injurer should in principle only be held liable to compensate in proportion to his contribution to the loss. The effects on deterrence largely depend upon the legal regime chosen and upon the insolvency of the injurers. The classic argument in this respect is made by Tietenberg (1989). The effects of various systems of extended liability are also examined by Boyd and Ingberman who argue that under certain conditions, extended liability may promote cost internalization, but that there are serious drawbacks as well (Boyd and Ingberman, 2001). Some hold, however, that joint and several liability may violate the principles of fair and efficient compensation which hold that an injurer should in principle only be held liable to compensate in the proportion to his contribution to the loss (see in this respect Bergkamp, 2001a, who argues that joint and several liability is both unfair and leads to over-deterrence). The law and economics literature generally holds that the effects on deterrence largely depend upon the legal regime chosen and upon the (in)solvency of the injurers. A detailed analysis of joint and several liability when all defendants are fully solvent is provided in a classic paper by Kornhauser and Revesz (1989). Later they refined their analysis for the case of limited solvency of the actors involved (Kornhauser and Revesz, 1990). Hyde et al. considered regulation of multiple polluters when individual emissions are unobservable (Hyde et al., 2000). Feess and Hege (2002) propose a simple liability rule when several agents are jointly responsible for monitoring a risky economic activity or for certifying its security. Their rule does not require estimations of hypothetical accident scenarios or *ex ante* probabilities. Liability payments are thus dependent only on the actual accident, so that the court can ignore the impact of hypothetical accident scenarios (Feess and Hege, 2002).

Since one of the best-known cases of joint and several liability can be found in CERCLA, which instituted the so-called superfund liability regime, the joint and several liability of the so-called potentially responsible parties (PRPs) is examined in many papers, *inter alia* by Sigman (2001) and

by Kornhauser and Revesz (1994) in relation to the question of whether joint and several liability encourages settlements. Whether joint and several liability actually has positive effects on incentives for potentially responsible parties regarding prevention remains unclear.

10.7.3 Channelling of liability

There is another feature of some environmental liability statutes and/or conventions where again a deviation can be found from the principle that only the injurer who caused the damage should be held fully liable for the loss. This is the so-called channelling of liability. Whereas with joint and several liability a victim can in principle claim full compensation from any of the multiple injurers, channelling is in fact the reverse: under channelling, the liability is attached to one party who then becomes fully liable for the damage. This channelling, indicating which party will be held liable for the loss, is often exclusive, meaning that the victim can only sue the 'channelled injurer' and not another party who might have contributed to the loss as well. Channelling can also be found in international conventions concerning nuclear liability and oil pollution. In nuclear liability conventions, the liability is channelled to the licensee of a nuclear power plant; in conventions concerning damage caused by marine oil pollution, there is channelling to the tanker owner.

It has been argued that this channelling is inefficient because it has perverse effects on the incentives for care where the liability applies exclusively to one operator (Vanden Borre, 1999). This is the case if channelling means that victims no longer have the right to sue another party who could also influence the accident risk. Excluding that third party from liability is inefficient since his incentives for prevention would be diluted. That effect is obviously reduced if the licensee or operator who would be held liable still has a right of recourse against the third party or if liability could be passed on the basis of contract, for example. In that case, one could argue that the liability is simply transferred and that such a reallocation complies with the principles of the Coase theorem (Trebilcock and Winter, 1997). However, this private reallocation of liability may not always be possible and some of the conventions, moreover, even restrict the possibilities of a right of recourse. Channelling can hence hardly be considered as an efficient mechanism for the prevention of accidents.

10.7.4 Liability of lenders and producers

Many law and economics scholars have argued that environmental liability should be extended beyond the liability of the 'direct' polluter. The most important motivation for extending this environmental liability to, for example, producers, contractors and victims is cost-internalization (Boyd

and Ingberman, 2001). Extending liability to lenders has been defended on economic grounds by Segerson (1993) and is applied in superfund clean-up remedies in the US (Sigman, 1998; Boyer and Porrini, 2001, pp. 250–52). The potential dangers of this extended environmental liability have also been discussed by Boyd and Ingberman (1997a). The economic foundations for extending a liability rule to all producers that have the opportunity to engage in a risky activity are provided by Lewis and Sappington (2001). The economics behind the concept of extended producer responsibility for waste has also been explained by Lidgren and Skogh (1996) and in Faure and Skogh (2003, pp. 156–61).

10.8 Latency and retroactive liability

Very often one can observe that a long time elapses between the moment that a tort (for example, an emission) occurs and the moment that the damage manifests itself. This problem of a long time lapse between the harmful event and the damage occurrence is known in the Anglo-American literature as ‘latency’; in Europe, this problem is sometimes referred to as the ‘long tail risk’. This long time lapse can, by the way, not only be caused by the technical feature that it takes a very long time before some risks manifest themselves. In some cases, victims simply wait a long time before filing their lawsuit or, when they do, legal procedures may take a long time as well. The problem of legal transitions has been analysed in the law and economics literature, more particularly by Kaplow (1986). Some of these issues play an important role in determining the scope of environmental liability.

10.8.1 Retroactive liability?

Looking at the efficiency aspect first, one can relatively easily state that the retroactive application of a new standard of care seems contrary to the principle that liability should provide incentives for correct behaviour in the future. If suddenly a certain type of behaviour is considered to lead to liability *ex post*, whereas this was not the case *ex ante*, any finding of liability can obviously never affect the incentives for that particular tortfeasor for the future. Retroactive liability therefore does not seem to serve any purpose as far as the prevention of accidents is concerned. It has been shown both in the European (Faure and Fenn, 1999) and in the American context that retroactive liability seems inefficient. Boyd and Kunreuther even held that retroactive liability may weaken the incentive to take precautions against future environmental costs (Boyd and Kunreuther, 1997).

Many examples of retroactive liability nevertheless exist. For example, superfund liability under CERCLA is retroactive: potentially responsible parties may be held liable for activities that took place well before superfund legislation entered into force (Sigman, 2001). The potential liability

for remedying contaminated sites in Central and Eastern Europe also limits the possibilities for privatization in those countries since potential investors are scared away by the foresight of having to pay for the pollution of the past (Bluffstone and Panayotou, 2000). A similar conclusion concerning the investor's amount of information regarding the extent of past environmental contamination (and the related clean-up costs) and the investor's willingness to pay for a particular enterprise in a bid is also confirmed by Earnhart (2004). A distinction should, of course, be made between retroactive liability on the one hand and liability for future damage, for example future releases of greenhouse gases, on the other hand (so thus Bode and Jung, 2006).

10.8.2 *Changes in the level of care*

A related but still somewhat different issue is how the law should react where new risks emerge or when the standard of care increases (under negligence) through changes in technology. It would be too easy simply to state that the tortfeasor will only be held to comply with the 'old' standard of care and will never be liable for risks which he could not foresee. Indeed, it has equally been stated in the literature that the foresight that there may be liability *ex post* will obviously provide incentives to obtain information about risk to industrial operators (this point is extensively discussed in Shavell, 1992).

The fact that there may be *ex post* liability even if technology changes is one of the powerful arguments made in law and economics in favour of liability for so-called development risk. This should give an operator appropriate incentives for investments in research to acquire information about risk and about optimal technologies to prevent risk.

The question, however, arises whether this reasoning can also be used to justify a retrospective change of a liability rule or changes in the standard of care itself. The argument is hence a totally different one if not only the nature of the risk, but the liability rule itself, changes. The economics of tort law assume that future incentives for prevention will be affected, given the legal regime in force. Hence, it is hard to argue that an *ex post* change in the liability rule will positively affect the incentives for proper behaviour which was not considered wrongful at all at the time when the act was committed by the industrial operator. One can expect an operator to assume that new risks may emerge, but hardly that the content of the law will change. Requiring this would lead to an inefficiently high demand for preventive measures and thus to over-deterrence. Hence, retrospective liability indeed seems problematic, taking into account the deterrent function of tort law.

From this it follows that there is apparently a dilemma: on the one hand, it is obviously useful that the standard-setting process in civil law is

seen as a process of learning whereby the standard of care is not static, but changes dynamically over time (this argument has been stressed by Ott and Schäfer, 1997 and by Endres and Bertram, 2006). It would obviously be wrong to state that due care standards should never change. There may be many reasons, for instance new technological insights, leading judges to the efficient decision that a more stringent standard of care can be applied. This new case law can, moreover, have an important signalling function for other parties in the market who can, after all, adapt their future behaviour. But the question obviously arises as to what should be done with the individual defendant in the particular case in which a new standard of care is set. Should we sacrifice him for the benefit of a more efficient standard in the future and make him retroactively liable even though his behaviour was not considered wrongful at the time when it was committed? A possible way out of this dilemma is to make clear that the standard of care will become more stringent for future cases as a result of changes in technology, but not to hold the defendant in the individual case liable, assuming that the latter could not be aware of this modified care standard.

This approach is known in the American literature as the ‘prospective overruling’, meaning that a court follows an old duty of care in this particular case (with the result that there is no finding of liability), but announces that it will follow a different decision in the future.

In sum, the discussion above makes it clear that in fact a distinction has to be made (although the issues seem to be confused sometimes) between on the one hand a retrospective application of a new liability regime and on the other hand liability for development risks. A liability regime for risks which are not yet known today is not necessarily inefficient, precisely since, if this is known in advance, it will provide incentives to discover information on these new risks and on the optimal techniques to prevent the risk. In other words: a liability for development risks is not inefficient as long as it may positively influence incentives for prevention and as long as the development risk liability is not a disguised retroactive liability. The state of the art defence has also been addressed in the American context by Boyd and Ingberman (1997b). They show that the ‘customary practice test’ tends to induce inadequate safety, whereas the ‘technological advancement test’ tends to induce excessive safety.

10.9 Insurance of environmental liability

Obviously, within a discussion of compensation for environmental damage, one should also discuss insurance aspects, since the central focus of this chapter is on environmental liability. Hence, we shall merely summarize the most important research results related to the application of

insurance theory to environmental damage. Insurability issues in general have been discussed, among others, by Faure (1995a), Karten (1997) and Zeckhauser (1996). See more generally, for an application of traditional liability insurance to environmental liability, Abraham (1988), Kunreuther and Freeman (2001) as well as Cousy (1995). The environmental damage insurance in theory and practice is discussed by Faure (2002) and problems with the insurance of environmental liability are discussed by Faure and Grimeaud (2003) and Faure (2007d).

10.9.1 Moral hazard

First, one can note that the general principles underlying any insurance cover must obviously be respected with environmental liability insurance as well. Therefore the devices suggested by, for example, Shavell (1979) must be taken into account. One of these devices consists of still exposing the insured partially to risk, which will often be done through, for example, deductibles or by imposing an upper limit on coverage (the upper limit is therefore necessary not only given the limited capacity of the individual insurer, but also to control moral hazard). In addition, the insurer should monitor the behaviour of his insured as much as possible, adapt the premium accordingly and require specific preventive measures through the policy conditions. Such optimal control of moral hazard obviously requires information on the part of the insurer (Endres and Schwarze, 1991). This may require the specialization of insurers engaged in insuring the environmental liability risk in order to be able to exclude bad risks or reward good risks and require relevant preventive measures. On the role of insurance to promote sustainability, see Stahel (1997). Insurability issues with respect to hazardous waste have been analysed in the contributions in Kunreuther and Gowda (1990). If moral hazard is controlled optimally through the use of the above-mentioned devices, the insured will again behave as if no insurance coverage were available, with the advantage that the disutility of risk is removed from him. The incentives for care-taking are in that case no longer given by liability law since the threat to have to pay compensation to a victim is shifted to the insurance company (Kunreuther and Freeman, 2001, pp. 315–16). In case of insurance, the care-taking of the injurer is achieved through appropriately adapting the policy conditions to the behaviour of the individual insured. This also explains that liability insurance has a very important social function. Under liability insurance, the insurer has to guarantee that the insured will take efficient care and thus have an incentive to avoid accidents. This makes clear that an appropriate control of moral hazard is not only in the interest of the individual insurer, but also of society. If there were no efficient control of moral hazard, insurance would on the whole do more harm than good.

10.9.2 *Adverse selection*

In the absence of an accurate distinction between good and bad risks, risk pools may become too broad, giving the good risks an incentive to leave the pool, thereby creating the famous risk of adverse selection (Akerlof, 1970). This risk of adverse selection led – according to Priest (1987), but criticized by Viscusi (1991) – to an insurance crisis in the US. Adverse selection will, in other words, arise if potentially responsible parties fail to disclose their true risk profile appropriately, which may endanger the narrowing of risk pools. Rogge holds that in Belgium the financial capacity to insure will be limited precisely because only bad risks will have a demand for insurance. If this cannot be ‘compensated’ by good risks, an incurable adverse selection would remain (Rogge, 1997, p. 5). Thus ‘lack of demand has been matched by lack of supply’ (Cowell, 1991, p. 327).

10.9.3 *Latency and retroactive liability*

Another problem we have already referred to (in Section 10.8.1) is latency. When legal standards change over time and new standards are applied to ‘old’ situations (which will sometimes be the case with liability for soil clean-up), insurance problems may arise. If the risk must be considered to be totally unforeseeable the insurer will not be able to charge a premium *ex ante* for the specific risk, nor can he require specific preventive mechanisms or set aside reservations for potential losses. On the other hand, insurers principally always deal with uncertainty, so that the risk that the law may change must not under all circumstances be considered as unforeseeable. A specific risk premium could be charged in addition to the actuarially fair premium to cope with this uncertainty problem (Kunreuther, Hogarth and Meszaros, 1993).

Since latency problems will often arise in case of environmental liability, the insurer may want to protect himself against the risk of being held liable today (maybe even on the basis of a retroactive application of new standards) for risks that originated for example 15 or 20 years ago. One possibility often advocated in the literature now and applied in many insurance policies is to change the period of insurance cover. Instead of providing coverage for the period when the harmful event occurred or when the loss originated, insurers now often change to a system whereby the claim must have been filed during the period of insurance cover (a so-called claims-made system). By using this insurance technique, the insurer can exclude the risk of being confronted with claims years after the period of insurance cover. Hence, this ‘claims-made policy’ allows for an exclusion of the so-called ‘long-tail risk’ which is typical in the case of environmental liability with latency problems (Katzman, 1988; Hankey, 1994; Spier and Haazen, 1996).

10.9.4 Causal uncertainty

Another problem that may specifically arise in the case of environmental liability insurance is causal uncertainty (also discussed in Section 10.7.1). If, for example, a joint and several liability rule is used, this would mean that the insurer would have to cover risks that were not even caused by his insured. This may cause uninsurability, as has been shown by Abraham in relation to insurance for superfund clean-ups in the US (Abraham, 1988). A similar conclusion is reached by Katzman (1988) and by Bergkamp (2001b). Unless a proportionate liability rule is followed, it is not possible to cover a risk if that would mean that the insurer would not only cover the damage of his own insured parties but also the damage that might possibly have been caused by another party. These tendencies lead to a liability on the part of enterprises for risks that they have not caused themselves (in the case of causal uncertainty) or for risks that were not foreseen at the time when the tort was committed (in the case of retrospective liability). They are largely caused by a hidden redistributive agenda: the wish to provide victim protection no matter what it may cost. These tendencies may be far more problematic from an insurability point of view than the shift towards strict liability itself. Indeed, whereas we argued that strict liability as such is insurable, this is no longer true if retrospective liability is introduced or the risk of causal uncertainty is shifted to the enterprise.

10.9.5 Compulsory insurance

We should also point to the fact that the question can arise whether liability insurance for environmental damage should be made compulsory. We can be brief concerning this issue here since the law and economics of compulsory insurance is extensively discussed in the literature (see also Faure and Van den Bergh, 1989; Jost, 1996; Skogh, 1989b). In this respect we should only point out that some legal systems, for example Germany, have imposed a duty to insure on certain operators for environmental harm. The efficiency of such a duty and other aspects are analysed by Endres and Schwarze (1991) and Wagner (1991, 1992, 1996), specifically relating to the German Environmental Liability Act.

The traditional economic argument in favour of a duty to insure (or a duty to provide other financial guarantees) is usually the underdeterrence problem which could result from polluters being judgment-proof (Shavell, 1986). By introducing a duty to purchase insurance coverage for the amount of the expected loss, better results will be obtained than with insolvency whereby the magnitude of the loss exceeds the injurer's assets (Kunreuther and Freeman, 2001, p. 316). An overview of economic criteria for compulsory insurance is provided by Faure (2006); an overview of

financial techniques to guarantee financial assurance for environmental obligations is provided by Boyd (2002).

10.9.6 Disaster insurance

Recently, there have been many studies that examine insurance in a related area, more particularly natural disasters. The literature found that individuals generally have no adequate demand, for example for flood insurance (Kunreuther, 1996; Zeckhauser, 1996, p. 135) or for earthquake insurance (Kunreuther, Doherty and Kleffner, 1992). Empirical evidence shows that individuals take an 'it will not happen to me attitude' (Kunreuther, 1996, p. 175; Epstein, 1996, p. 293; Zeckhauser, 1996, p. 115). The data reveal that in Europe too, there is a serious lack of demand for disaster coverage (Schwarze and Wagner, 2004). Some claim that this may be the case because victims count on government relief, so that market failure becomes a self-fulfilling prophecy as a result of misguided regulation (Epstein, 1996, p. 305).

Because of the bounded rationality problems (Kunreuther, 1996, p. 175), many have argued that the perceived risk of hazards could be increased by introducing a mandatory purchase of disaster coverage in addition to small but likely losses (Slovic, Kunreuther and White, 2000, p. 15). Thus recently many have proposed a mandatory type of disaster coverage (Schwarze and Wagner, 2004; Priest, 1996, pp. 225–6 and Kunreuther, 2006). It is the type of coverage which today exists *inter alia* in France (see Faure, 2007b and 2007c).

10.10 Other compensation mechanisms

Increasingly, a lot of attention is paid to other mechanisms that could be used to cover environmental damage. Some believe that the insurance problems mentioned above are so important that insurance can in the end only play a small role in covering the environmental risk. Especially as far as financing clean-up of polluted sites is concerned, many have argued that alternative financial schemes must be investigated other than traditional liability and insurance.

Skogh (1982, 1989a) and Hansson and Skogh (1987) have stressed that when the two policy goals of optimal prevention and optimal compensation have to be fulfilled, the policy maker can choose between either liability rules with private insurance on the one hand, or safety regulation and public compensation mechanisms on the other. This literature develops criteria for when public compensation mechanisms, such as compensation funds, might show comparative benefits. Faure and Hartlief (1996) have argued that no matter how a compensation mechanism is organized, the incentives for prevention of damage should always remain untouched. Hence, the costs of harmful behaviour should as far as possible be

attributed to the one who caused the harm and a system of risk differentiation should be included in the financing system as well. Therefore, a public compensation mechanism should still provide incentives for prevention by forcing only those who actually contributed to the damage to contribute to the fund, for example.

Obviously, an alternative compensation mechanism for environmental damage could take various forms. One possibility one could think of would be mutual risk-sharing by operators. In the case of very technical risks, operators might for instance have better information on the risk than an insurance company or an administrative agency. Hence, the accident risk could be reduced via an optimal mutual monitoring of the operators. There has been wide experience with these risk-sharing agreements in the field of compensation for oil pollution. This is provided by the so-called Protection and Indemnity Clubs (P&I Clubs), which are based on a mutual risk-sharing between tanker owners (see, for example, Coghlin, 1984). Faure and Skogh (1992) have argued that a risk-sharing agreement between nuclear power plant operators could also lead to better monitoring and provide higher amounts of compensation for victims than traditional insurance. There was an expectation that risk-sharing agreements would be used in the revision of the Paris and Vienna Conventions on Nuclear Liability (Faure, 1995b).

Compensation funds are also advanced in some cases to cover the insolvency of insurance companies. These so-called guarantee funds usually intervene when traditional insurance fails for some reason. In those cases, a guarantee fund is usually applied in combination with traditional insurance; the fund then intervenes only, for example, when for some reason there is no insurance cover (for the basic argument see Finsinger, 1996). The third type of fund is a public compensation mechanism that really takes the place of traditional insurance because the particular risk may be uninsurable. In the environmental context, one can think of situations for which no individual injurer can be made liable, for example the degradation of a particular habitat caused by acid rain. Inevitably, the question arises how the fund can be financed, taking into account the causes of the particular pollution problem. If it is clear that, for example, sulphur dioxide emissions caused the particular problem from an economic point of view, one could argue that a tax should be introduced on the polluting activity which could be used to finance the compensation fund. This was basically the idea behind one of the major environmental funds known today, namely the American superfund introduced by CERCLA. The law and economics of the superfund experience has been analysed in a book edited by Revesz and Stewart (1995). This book provides a valuable insight into the economics of the superfund system, addressing issues such as the applicable liability regime, the role of the insurance industry, clean-up

standards and more particularly the transaction costs involved in the current superfund regime.

Other no-fault compensatory alternatives for environmental injuries are discussed by Dewees, Duff and Trebilcock (1996, pp. 328–31). They also discuss both compensation for oil pollution and nuclear liability, although they rightly stress that the American Price-Anderson Act (on nuclear liability) was largely motivated by a desire to allow the development of a nuclear power industry. They show little enthusiasm for an environmental disease compensation fund, arguing that many of the problems of the liability system, for example causal uncertainty, would not be removed by the instalment of a fund. Indeed, the administrative agency handling the fund would have to determine whether an individual disease is caused by the specific pollutant, which might render the administration of such a fund difficult and expensive. An overview of alternative compensation mechanisms for environmental damage is also provided by Radetzki and Radetzki (2000) and by Faure (2004). In Europe, there are some experiments introducing environmental compensation funds on a rather small scale (for an overview, see Bocken, 1987, 1988, 1990, 1991). Again, the question of adequate compensation is now often raised in the context of a related area to environmental liability, namely disaster relief. In practice, governments often intervene either on *ad hoc* basis or through a structural fund to provide relief for the victims of catastrophes. These solutions, whereby public means are randomly used to compensate victims, have been seriously criticized by law and economic scholars for being insufficiently capable of providing the same level of incentives for prevention as risk differentiation under insurance (Epstein, 1996, p. 297; Priest, 1996; Kaplow, 1991). Gron and Sykes (2002) similarly argue that a structural compensation fund may send the wrong signal to the market: it will provide them with few incentives to develop financial solutions themselves (see also Endres, Ohl and Rundshagen, 2003, p. 290, who argue that disaster victims can then free-ride on the state). In the words of Gollier: ‘Solidarity kills market insurance’ (Gollier, 2005, p. 25).

Some have provided general overviews of alternative compensation mechanisms, especially to deal with catastrophic (environmental) risks. See in that respect, for example, Radetzki and Radetzki (2000) and Faure (2004). Faure (2002 and 2007d) discusses particular shifts towards alternative compensation mechanisms for environmental damage, such as direct environmental insurance and risk-sharing agreements.

10.11 Environmental federalism and environmental liability

There is a body of literature that generally discusses the application of the economics of federalism to environmental issues. That literature is

discussed in the chapter on environmental regulation within the volume of the Encyclopedia on regulation. Some papers also deal with the specific question of whether environmental liability legislation should be shifted to the central level within a federal structure (see, for example, Faure and De Smedt, 2002). The general tenor of this literature is that harmonization may be indicated when transboundary externalities are at stake that cannot otherwise be cured or when an incurable race-to-the-bottom would emerge as a result of destructive competition between states to attract industry with lenient environmental liability rules. Many have applied these theoretical insights, for example to the question of whether environmental liability should be harmonized within Europe. Van Egteren and Smith (2001, 2002), Van Egteren, Smith and McAfee (2004) and Van Egteren, Smith and Eckert (2006) examine these issues with respect to the desirability of harmonization of environmental liability in the European Union. They conclude that if jurisdictions were to delegate standard setting to a central authority (as in the European Union), this would not implement the socially optimal outcome. However, they also demonstrate that if harmonization of environmental regulation were to be introduced, it would make more sense if strict liability were used rather than a simple negligence rule. Alberini and Frost (2007) conclude that the creation of a European environmental liability regime in the European Union may not necessarily negate the effects of country-specific liability regimes. This complies with critical studies by Bergkamp (2000, 2001a, 2001b, 2001c, pp. 381–2, 2002 and 2005) who similarly argue that there are no reasons for the harmonization of environmental liability within Europe.

Notwithstanding these warnings from law and economics scholars, on 21 April 2004 Directive 2004/35/CE on Environmental Liability was adopted. A few later studies critically review the Directive from a law and economics perspective and more particularly concerning the question whether environmental liability needed to be harmonized at a European level (Bergkamp, 2005; De Smedt, 2007a and 2007b).

10.12 The nuclear risk

There are two types of environmental risks that deserve a short separate treatment since there is some literature dealing specifically with nuclear risks and oil pollution. Obviously, most of the problems addressed so far apply to these two risks as well, so we shall simply report on some of the literature addressing specific issues concerning these risks.

As far as the nuclear risk is concerned, Nichols and Wildavsky (1987), Feinstein (1989) and Paté-Cornell (1987) stress the specific character of the nuclear risk, namely the low probability of an accident and the difficulties of probabilistic risk assessment in quantifying risk at nuclear power

plants. Feinstein examines the safety records of US nuclear power plants and found a sharp increase in detection of violations following the Three Mile Island accident.

Special attention has equally been given to nuclear liability and the insurance of the nuclear risk. Taking into account the economic test for strict liability, nuclear accidents pose a strong case in favour of strict liability, since these accidents are typically unilateral (Faure, 1995b). Most international conventions on nuclear liability also adopted a strict liability rule. However, in many legal systems the compensation due to victims is also statutorily limited to relatively low amounts. Here we can refer to the discussion of financial caps above: these are largely inefficient, lead to underdeterrence and undercompensation of victims (Trebilcock and Winter, 1997).

As far as nuclear insurance is concerned, it should be mentioned that in most legal systems, insurance is provided by national nuclear pools, which have brought resources together on a non-competitive basis and offer relatively low amounts for third-party insurance. This liability-insurance scheme for the nuclear risk can to a large extent be explained as the result of lobbying by the nuclear industry (Faure and Van den Bergh, 1990). The conventions on nuclear liability which were drafted in the 1960s had as their main goal to guarantee that nuclear power could further develop and that the nuclear industry would be protected against high claims. Hence, strict liability was combined with relatively low caps, also to make the nuclear risk insurable. An alternative compensation mechanism would be the pooling of risks by operators, based on a risk-sharing agreement whereby a mutual monitoring between plant operators would guarantee prevention and higher amounts of compensation could be made available (Faure and Skogh, 1992).

Vanden Borre has criticized the so-called channelling of liability. This means that only the licensee of a nuclear power plant can be held liable for the damage caused by a nuclear accident; the liability of all others who might also have contributed to the nuclear risk is hence excluded (Vanden Borre, 1999). In his dissertation, Vanden Borre (2001) also criticizes the compensation system for nuclear risks in international conventions, arguing that this leads to serious underdeterrence and undercompensation (Vanden Borre, 2001). Vanden Borre has also compared the compensation for nuclear accidents in international conventions with the compensation provided in the United States under the Price-Anderson Act and concludes that the US Price-Anderson Act is, also from an economic perspective, to be preferred to the international regime since Price-Anderson is no longer based on government intervention and involves a second layer of compensation paid by the collectivity of all nuclear operators. Hence, substantially

larger amounts are generated in the US than in the international regime (Vanden Borre, 2007).

Recently, a similar conclusion was reached by Fiore (2007), who similarly argues in her dissertation that the current international regime of compensation for damage caused by nuclear plants insufficiently internalizes the nuclear risk. This is due on the one hand to the financial limit (cap) on the liability of the operator of a nuclear plant and on the other hand to the fact that, in the international regime, there is a large amount of compensation provided by the state(s), which in fact amounts to a subsidy to nuclear power. Earlier, it had also been argued with respect to the US Price-Anderson Act that the limit on the liability of nuclear operators in fact constitutes a subsidy to the industry. Dubin and Rothwell (1990) valued the amount of the subsidy under the Price-Anderson Act at \$60,000,000 per reactor (and \$22,000,000 following the 1988 amendments). Heyes and Liston-Heyes (1998) criticized Dubin and Rothwell's calculation and came up with lower amounts.

Finally, it should also be mentioned that in the case of the nuclear risk many problems of causal uncertainty will arise. Usually a probability of causation formula is used to investigate the likelihood that a certain disease (for example, cancer) was caused by a certain exposure to radiation (Bond, 1981; Ketchum, 1985). However, in practice it is often very difficult to establish this probability of causation: data on these probabilities in individual cases are certainly not conclusive (Estep, 1960; Meddler and Moselly, 1985; Van Mieghem, 1988).

10.13 Marine oil pollution

Marine oil pollution is also an issue which received attention in the literature, even before environmental problems were analysed at a general level. Economists have always been interested in the question of how accidental or voluntary marine oil pollution by tankers could be prevented optimally either by investments in the safety of the tankers (in case of accidental pollution) or by increasing detection (in case of voluntary discharge) (see, for example, Burrows, Rowley and Owen, 1974). The problem of detection of oil spills has been modelled by Epple and Visscher (1984). They show how vessel size, the price of oil, the enforcement of pollution control regulations and the risk associated with variance in spill size affect the oil transporters' decisions concerning expenditures on measures for spill prevention. They provide empirical data to support their theoretical analysis. Cohen (1987) has followed up on their work by providing an optimal enforcement strategy to prevent oil spills. We can also point to a paper by Dunford (1992) on the natural resource damages from oil spills that addresses the question of under what kind of conditions there can be liability under the US Oil

Pollution Act for natural resource damages. The recovery for economic loss following the Exxon Valdez oil spill has been examined by Goldberg (1994).

One important weakness in the enforcement of marine oil pollution is the fact that the so-called Protection and Indemnity Clubs provide full insurance for the fines which are imposed (Lomas, 1989). However, Faure and Heine (1991) have argued that it is not the insurance itself which poses the problem, but the low probability of detection, which causes a low expected fine.

Furthermore, we can point to the fact that the liability regime for oil pollution is governed by international conventions that have a similar legal structure to the conventions on nuclear liability: strict liability with financial caps. Insurance is provided through the Protection and Indemnity Clubs, mutual insurance companies of the ship-owning companies, which is typically different from the nuclear liability sphere (see Bongaerts and De Bièvre, 1987). These oil pools are not inefficient as such and costly government regulations would not be able to improve efficiency to a large degree (see Libecap and Wiggins, 1984; Ault and Ekelund, 1988, p. 75). Another major difference from the nuclear liability regime is that in the case of maritime oil pollution, compensation is provided not only through these P&I clubs, which act as insurance companies, but also through an oil pollution fund, financed by taxes on crude oil. In this case, there is hence combined financing by the oil-producing industry and the ship owners (see on liability for marine oil pollution the contributions in De la Rue, 1993).

Compensation for marine oil pollution under the US Oil Pollution Act and more particularly the financial assurance mechanisms contained in this Act are discussed by Boyd (2002, 2003).

Recently, some critical studies were produced concerning the financial limit on the liability of the tanker owner and on the channelling of liability to this tanker owner. For a general economic analysis of the international oil pollution compensation regime, see Faure and Wang (2006). Also in the dissertation by Hay (2006), a criticism was formulated on the limitation of liability. Hay also shows that notwithstanding important adaptations in the conventions, victims, more particularly after the Erika incident off the coast of Brittany, still remained largely uncompensated.

An overview of the historical evolution of the international marine oil pollution compensation regime is provided by Wang (2007) and the shifts in this compensation regime are identified by Verheij (2007). An empirical analysis of these shifts is provided by Hendrickx (2007) who shows that clean-up operations have become more expensive, more particularly as a result of pressure from environmental groups and public opinion.

Hendrickx also found that, for a higher proportion of spills, polluters could not be identified. He suspects that, as a result of the strict liability of the tanker owner, they might have improved their skills of concealing their identity (Hendrickx, 2007, p. 257). Given the low liability limits and the increased amount of compensation, Hendrickx equally concludes that a larger proportion of the costs is borne by the International Oil Pollution Compensation Fund. A general overview of vessel-sourced marine pollution (both regulation aiming at prevention and compensation) is provided by Tan (2006).

10.14 Concluding remarks

The overview of the literature concerning environmental liability in this chapter, of course, had to be selective. We have mainly focused on the law and economics literature and even there, it was impossible to be comprehensive. Much more is published in the legal literature on environmental liability as well as in environmental economics dealing with the same topic. Some topics could not be discussed at all within the limited framework of this chapter (for example, the role of citizen suits), whereas other topics could only be briefly touched upon (for example, lender liability).

The overview provided in this chapter nevertheless shows that the application of the general law and economics framework to environmental pollution issues and more particularly to environmental liability has yielded rich results. Many studies apply the general framework of tort law and economics provided in other chapters in this volume (for example, concerning the choice between negligence and strict liability or concerning causation) to environmental liability. In that sense, the environmental area offers a suitable occasion for testing some of the hypotheses discussed in other chapters.

One can indeed observe that in much of the literature refinements of the traditional models have taken place in their application to specific environmental problems. In addition, one can also observe that the theoretical literature on environmental liability has developed strongly in the past 25 years. As a result of these developments, law and economics models have been refined to such an extent that they are much better able to explain (descriptively) existing environmental liability schemes or (normatively) to indicate which improvements are likely to improve social welfare.

Moreover, whereas in some areas one often hears the criticism that law and economics scholars are merely busy with technical refinements to existing models, as far as the domain of environmental liability is concerned, it should be stressed that much of the theoretical developments

in the literature are also quite relevant for actual environmental policy. One therefore notices that many studies deal, for example, with a critical evaluation of superfund legislation under CERCLA in the US or with the question whether and, if so, how an environmental liability regime should be shaped in Europe. Afterwards, *ex post* evaluations of those regimes take place as well. Moreover, one also notices that both in the US and in Europe, policy makers increasingly take the law and economics literature in this domain into account. Even though this does, of course, not mean that they will always listen to advice formulated by law and economics scholars, one observes that policy makers often have no difficulties accepting that economics has a useful message on how an environmental liability regime should be shaped. Whereas in domains like family law or criminal law, there may still be opposition to the application of economic notions, in the area of environmental liability, one notices to the contrary that for policy makers it is quite natural to take the findings of law and economics literature into account. Thus one could, for example, notice that in Europe in documents preceding the Directive on Environmental Liability explicit reference was made to the notion that an environmental liability regime should provide potential polluters with incentives for prevention.

Even though one can thus argue that this area of law and economics has gone through a whole development and that there is now an abundant and rich literature addressing various aspects of environmental liability, this, of course, does not mean that there remains no work to be done. First of all, at a theoretical level, there are various issues that undoubtedly merit further research. For example, the particular circumstances under which NGOs can play a role in environmental liability suits certainly deserves more attention. One can easily see the benefits of citizen suits, but there may be particular drawbacks as well. Hence, criteria should be developed to indicate under what circumstances citizen suits can play a positive role in the enforcement of environmental liability rules.

Even though it would be easy to list more topics that need further theoretical research, it is probably more important to focus future research on empirical work as well. Even though environmental liability is again an area where there is probably relatively more empirical work than in some other areas of law and economics, still more could undoubtedly be done. For example, questions still arise as to the precise way in which liability rules affect the behaviour of firms in their decision to invest more in care technology. Even though we have indicated that much empirical literature exists in that respect, many studies are of North American origin and much more could be done in this respect in Asia and Europe as well. Moreover, these empirical studies should also pay attention to the way in which

compensation mechanisms such as insurance affect the behaviour of firms. Particular attention in that respect should also be given to the fact that (at least in Europe) insurance companies apparently make less effort to differentiate risk than economic theory would predict. The question, of course, arises why this is the case and what the effects of this phenomenon are on the behaviour of firms. Only if more information becomes available on the actual reactions of polluters to changes in liability rules and compensation mechanisms will it also be possible to fine-tune legal rules in such a way that they can often play an optimal role in providing polluters with incentives for the prevention of environmental harm.

Finally, even though we have indicated that environmental liability is an area where policy makers already pay a lot of attention to the lessons from law and economics theory, more could still be done, more particularly at the level of implementation. It is surprising to notice that, for example as far as natural disasters are concerned, some European countries (like Germany, Italy or the Netherlands) apparently prefer to spend large parts of the public budget on random compensation of victims rather than securing facilitative strategies which would stimulate the efficient functioning of insurance markets. Also, it remains remarkable that, at the international level, the nuclear industry still enjoys the same protection as 40 years ago when the nuclear industry was at the beginning of its development and was awarded broad protection (through financial limits) in international conventions. Now that as a result of climate change more countries may be seduced to increase the use of nuclear power, governments may listen more seriously to the lesson from economic theory, namely that nuclear operators too should be forced to internalize the social costs resulting from their activities. The American Price-Anderson Act shows, moreover, that without government subsidy and with a risk-sharing agreement between nuclear operators, much larger amounts of compensation could be generated which would come much closer to realistic compensation amounts than under the international regime. Also the above-mentioned phenomenon of climate change may pose interesting challenges for law and economics scholars. Within the context of this contribution, we refer more particularly to a recent tendency in the literature to examine something which many held impossible, namely the application of liability rules to climate change. Even though this may still pose serious problems (Grossman, 2003; Faure and Nollkaemper, 2007; Tol and Verheyen, 2004; Verheyen, 2005; Spier, 2006), it is an issue which is receiving increasing attention and which may well dominate the research agenda for law and economics scholars interested in environmental liability in the decades to come.

Acknowledgements

I am grateful to Karine Fiore for useful comments on an earlier draft of this contribution and to Wanchi Tang for useful research assistance.

Bibliography

- Abraham, K. (1988), 'Environmental Liability and the Limits of Insurance', *Columbia Law Review*, 88, 949–60.
- Akerlof, G. (1970), 'The Market for "Lemons": Quality, Uncertainty and the Market Mechanism', *Quarterly Journal of Economics*, 33, 488–500.
- Alberini, A. and D. Austin (2001), 'Liability Policy and Toxic Pollution Releases', in A. Heyes (ed.), *The Law and Economics of the Environment*, Cheltenham, UK and Northampton, MA, USA: Edward Elgar, pp. 92–115.
- Alberini, A. and C. Frost (2007), 'Forcing Firms to Think about the Future: Economic Incentives and the Fate of Hazardous Waste', *Environmental & Resource Economics*, 36, 451–74.
- Arcuri, A. (2001), 'Controlling Environmental Risk in Europe: The Complementary Role of an EC Environmental Liability Regime', *Tijdschrift voor Milieuaansprakelijkheid (Environmental Liability Law Review)*, 37–45.
- Ault, R.W. and R.B. Ekelund, Jr (1988), 'Rent Seeking in a Static Model of Zoning', *American Real Estate and Urban Economics Association Journal*, 16, 69–76.
- Baumol, W.J. and W.E. Oates (1979), *Economics, Environmental Policy, and the Quality of Life*, New York: Prentice Hall.
- Bergkamp, L. (2000), 'The Commission's White Paper on Environmental Liability: A Weak Case for an Easy Strict Liability Regime', *European Environmental Law Review*, 9, 105–14 and 141–8.
- Bergkamp, L. (2001a), *Liability and Environment*, The Hague: Kluwer Law International.
- Bergkamp, L. (2001b), 'The Proper Scope of Joint and Several Liability', *Tijdschrift voor Milieuaansprakelijkheid (Environmental Liability Law Review)*, 153–5.
- Bergkamp, L. (2001c), *Liability and Environment: Private and Public Aspects of Civil Liability for Environmental Harm in an International Context*, The Hague: Kluwer Law International.
- Bergkamp, L. (2002), 'The Proposed Environmental Liability Directive', *European Environmental Law Review*, 11, 294–313.
- Bergkamp, L. (2005), 'The European Environmental Liability Directive and its Effects on Industry and Economy', in R. Mellenbergh and R. Uylenburg (eds), *Aansprakelijkheid voor schade aan de natuur*, Groningen: Europa Law Publishing, pp. 93–132.
- Bluffstone, R.A. and T. Panayotou (2000), 'Environmental Liability and Privatisation in Central and Eastern Europe: Towards an Optimal Policy', *Environmental and Resource Economic*, 17, 335–52.
- Bocken, H. (1987), 'Alternatives to Liability and Liability Insurance for the Compensation of Pollution Damages', Part I, *Tijdschrift voor Milieuaansprakelijkheid (Environmental Liability Law Review)*, 83–7.
- Bocken, H. (1988), 'Alternatives to Liability and Liability Insurance for the Compensation of Pollution Damages', Part II, *Tijdschrift voor Milieuaansprakelijkheid (Environmental Liability Law Review)*, 3–10.
- Bocken, H. (1990), 'Systèmes Alternatives pour l'Indemnisation des Dommages du à la Pollution', *Revue Général des Assurances et des Responsabilités*, 11698–714.
- Bocken, H. (1991), 'Complementary Compensation Mechanisms. A General Environmental Damage Fund?', in H. Bocken and D. Ryckbost (eds), *Insurance of Environmental Damage*, Brussels: Story-Scientia, pp. 425–37.
- Bode, S. and M. Jung (2006), 'Carbondioxide Capture and Storage – Liability for Non-permanence under the UNFCCC', *International Environmental Agreements*, 6, 173–86.
- Bohm, P. (1971), 'An Approach to the Problem of Estimating Demand for Public Goods', *Swedish Journal of Economics*, 73, 55–66.

- Bond, V. (1981), 'The Cancer Risk Attributable to Radiation Exposure: Some Practical Problems', *Health Physics*, 40, 108–11.
- Bongaerts, J.C. and A.F.M. De Bièvre (1987), 'Insurance for Civil Liability for Marine Oil Pollution Damages', *Geneva Papers on Risk and Insurance*, 12, 145–57.
- Bouckaert, B. (1991), 'La Responsabilité Civile Comme Base Institutionnelle d'une Protection Spontanée de l'Environnement', *Journal des Economistes et des Etudes Humaines*, 2, 315–35.
- Boyd, J. (2002), 'Financial Responsibility for Environmental Obligations: Are Bonding and Assurance Rules fulfilling their Promise?', in T. Swanson (ed.), *An Introduction to the Law and Economics of Environmental Policy: Issues in Institutional Design*, Amsterdam: JAI Press, pp. 417–85.
- Boyd, J. (2003), 'A Market-Based Analysis of Financial Insurance Issues associated with US Natural Resource Damage Liability', in M. Faure (ed.), *Deterrence, Insurability, and Compensation in Environmental Liability: Future Developments in a European Union*, Vienna: Springer, pp. 258–302.
- Boyd, J. and D. Ingberman (1997a), 'The Search of Deep Pocket: is "Extended Liability" Expensive Liability?', *Journal of Law, Economics, and Organisation*, 13, 232–58.
- Boyd, J. and D. Ingberman (1997b), 'Should "Relative Safety" be Test of Product Liability?', *Journal of Legal Studies*, 26, 433–73.
- Boyd, J. and D. Ingberman (2001), 'The Vertical Extension of Environmental Liability through Claims of Ownership, Contact and Supply', in A. Heyes (ed.), *The Law and Economics of the Environment*, Cheltenham, UK and Northampton, MA, USA: Edward Elgar, 44–70.
- Boyd, J. and H. Kunreuther (1997), 'Retroactive Liability or the Public Purse?', *Journal of Regulatory Economics*, 11, 79–90.
- Boyer, M. and D. Porrini (2001), 'Law versus Regulation: A Political Economy Model of Instrument Choice in Environmental Policy', in A. Heyes (ed.), *The Law and Economics of the Environment*, Cheltenham, UK and Northampton, MA, USA: Edward Elgar, pp. 249–79.
- Boyer, M. and D. Porrini (2002), 'The Choice of Instruments for Environmental Policy: Liability or Regulation?', in T. Swanson (ed.), *An Introduction to the Law & Economics of Environmental Policy: Issues in Institutional Design*, Amsterdam: JAI Press, pp. 245–67.
- Bradford, T. (1970), 'Cost Benefit Analysis and Demand Curse for Public Goods', *Kyklos*, 23, 775–91.
- Brown, J.P. (1973), 'Toward an Economic Theory of Liability', *Journal of Legal Studies*, 2, 323–49.
- Burrows, P. (1999), 'Combining Regulation and Liability for the Control of External Costs', *International Review of Law & Economics*, 19, 227–42.
- Burrows, P., C.K. Rowley and D. Owen (1974), 'The Economics of Accidental Oil Pollution by Tankers in Coastal Waters', *Journal of Public Economics*, 3, 251–68.
- Calabresi, G. (1961), 'Some Thoughts on Risk Distribution and the Law of Torts', *Yale Law Journal*, 60, 499–553.
- Calabresi, G. (1975), 'Concerning Cause and the Law of Torts', *University of Chicago Law Review*, 42, 69–108.
- Cane, P. (2002), 'Tort Law as Regulation', *Common Law World Review*, 31, 305–31.
- Chapman, D.J. and W.M. Hanemann (2001), 'Environmental Damages in Court: The *American Trader Case*', in A. Heyes (ed.), *The Law and Economics of the Environment*, Cheltenham, UK and Northampton, MA, USA: Edward Elgar, pp. 319–67.
- Coase, R.H. (1960), 'The Problem of Social Cost', *Journal of Law and Economics*, 3, 1–44.
- Coghlin, T.G. (1984), 'Protection and Indemnity Clubs', *Lloyds Maritime and Commercial Law Quarterly*, 11, 403–16.
- Cohen, M.A. (1987), 'Optimal Enforcement Strategy to Prevent Oil Spills: An Application of a Principal-Agent Model with Moral Hazard', *Journal of Law and Economics*, 30, 23–51.
- Cooter, R. (1984), 'Prices and Sanctions', *Columbia Law Review*, 84, 1343–523.

- Cousy, H. (1995), 'Recent Developments in Environmental Insurance', in F. Abraham, K. Deketelaere and J. Stuyck (eds), *Recent Economic and Legal Developments in European Environmental Policy*, Leuven: Acco, pp. 227–41.
- Cowell, J. (1991), 'Compulsory Environmental Liability Insurance', in H. Bocken and D. Ryckbost (eds), *Insurance of Environmental Damage*, Antwerp: Kluwer, pp. 317–30.
- Davis, R.K. (1963), 'Recreation Planning as an Economic Problem', *National Resources Journal*, 3, 239–49.
- De la Rue, C.M. (1993), *Liability for Damage to the Marine Environment*, London: Lloyd's of London Press Ltd.
- De Smedt, K. (2007a), 'Shifts in Compensation for Environmental Damage: From Member States to Europe', in M. Faure and A. Verheij (eds), *Shifts in Compensation for Environmental Damage*, Vienna: Springer, pp. 103–31.
- De Smedt, K. (2007b), *Environmental Liability in a Federal System: A Law and Economics Analysis*, Antwerp: Intersentia.
- Deweese, D.N., D. Duff and M.J. Trebilcock (1996), *Exploring the Domain of Accident Law: Taking the Facts Seriously*, Oxford: Oxford University Press.
- Dubin, J.A. and G.S. Rothwell (1990), 'Subsidy to Nuclear Power through Price-Anderson Liability Limit', *Contemporary Economic Policy*, 8 (3), 73–9.
- Dunford, R. (1992), 'Natural Resource Damages from Oil Spills', in T.H. Tietenberg (ed.), *Innovation in Environmental Policy, Economic and Legal Aspects of Recent Developments in Environmental Enforcement and Liability*, Aldershot, UK and Brookfield, USA: Edward Elgar, pp. 165–93.
- Earnhart, D. (2004), 'Liability for Past Environmental Contamination and Privatisation', *Environmental & Resource Economics*, 29, 97–122.
- Efroymsen, R.A., J.P. Nicolette and G.W. Suter (2004), 'A Framework for Net Environmental Benefit Analysis for Remediation or Restoration of Contaminated Sites', *Environmental Management*, 34 (3), 315–31.
- Endres, A. and R. Bertram (2006), 'The Development of Care Technology under Liability Law', *International Review of Law and Economics*, 26, 503–519.
- Endres, A., C. Ohl and B. Rundshagen (2003), "'Land unter!' Ein institutionenökonomische Zwischenruf", *List Forum für Wirtschafts- und Finanzpolitik*, 29, 284–94.
- Endres, A. and B. Staiger (1996), 'Ökonomische Aspekte des Umwelthaftungsrecht', in M. Ahrens and J. Simon (eds), *Umwelthaftung, Risikosteuerung und Versicherung*, Berlin: Erich Schmidt Verlag, pp. 79–93.
- Endres, A. and R. Schwarze (1991), 'Allokationswirkungen einer Umwelt-Haftpflichtversicherung (Allocative Effects of an Environmental Liability Insurance)', *Zeitschrift für Umweltpolitik und Umweltrecht*, 14, 1–25.
- Epple, D. and M. Visscher (1984), 'Environmental Pollution: Modelling Occurrence, Detection, and Deterrence', *Journal of Law and Economics*, 27, 29–60.
- Epstein, R. (1996), 'Catastrophic Responses to Catastrophic Risks', *Journal of Risk and Uncertainty*, 12, 287–308.
- Estep, E. (1960), 'Radiation Injuries and Statistics: The Need for a New Approach to Injury Litigation', *Michigan Law Review*, 59, 259–304.
- Faure, M. (1993), (*G*) *een Schijn van Kans. Beschouwingen over het Statistisch Causaliteitsbewijs bij Milieugezondheidsschade*, Inauguration, Antwerpen: Maklu.
- Faure, M. (1995a), 'The Limits to Insurability from a Law and Economics Perspective', *Geneva Papers on Risk and Insurance*, 20, 454–62.
- Faure, M. (1995b), 'Economic Models of Compensation for Damage Caused by Nuclear Accidents: Some Lessons for the Revision of the Paris and Vienna Conventions', *European Journal of Law and Economics*, 2, 21–43.
- Faure, M. (1996), 'Economic Aspects of Environmental Liability: An Introduction', *European Review of Private Law*, 6, 85–109.
- Faure, M. (2000), 'Environmental Regulation', in B. Bouckaert and G. De Geest (eds), *Encyclopedia of Law and Economics, II, Civil Law and Economics*, Cheltenham, UK and Northampton, MA, USA: Edward Elgar, pp. 443–520.

- Faure, M. (2002), 'Environmental Damage Insurance in Theory and Practice', in T. Swanson (ed.), *An Introduction to the Law and Economics of Environmental Policy: Issues in Institutional Design*, Amsterdam: JAI Press, pp. 283–328.
- Faure, M. (2003a), *Deterrence, Insurability, and Compensation in Environmental Liability: Future Developments in the European Union*, Vienna: Springer.
- Faure, M. (2003b), 'Causal Uncertainty, Joint and Several Liability and Insurance', in H. Koziol and J. Spier (eds), *Liber Amicorum Pierre Witmer*, Vienna: Springer, pp. 79–98.
- Faure, M. (2004), 'Alternative Compensation Mechanisms as Remedy for Uninsurability of Liability', *The Geneva Papers on Risk and Insurance*, 29 (3), 455–89.
- Faure, M. (2006), 'Economic Criteria for Compulsory Insurance', *The Geneva Papers on Risk and Insurance*, 31, 149–68.
- Faure, M. (2007a), 'Economics Analysis of Tort and Regulatory Law', in W.H. van Boom, M. Lukas and S.H.R. Kissling (eds), *Tort Law and Regulatory Law*, Vienna: Springer, pp. 399–415.
- Faure, M. (2007b), 'Insurability of Damage Caused by Climate Change: a Commentary', *University of Pennsylvania Law Review*, 155 (6), 1875–99.
- Faure, M. (2007c), 'Financial Compensation for Victims of Catastrophes: A Law and Economics Perspective', *Law and Policy*, 29 (3), 339–67.
- Faure, M. (2007d), 'A Shift toward Alternative Compensation Mechanisms for Environmental Damage?', in M. Faure and A. Verheij (eds), *Shifts in Compensation for Environmental Damage*, Vienna: Ectil, pp. 74–102.
- Faure, M. and V. Bruggeman (2007), 'Causal Uncertainty and Proportional Liability', in L. Tichý (ed.), *Causation in Law*, Universita Carlova, Prague, pp. 105–21.
- Faure, M. and K. De Smedt (2002), 'Should Europe Harmonize Environmental Liability Legislation?', *Environmental Liability*, 9, 217–37.
- Faure, M. and P. Fenn (1999), 'Retroactive Liability and the Insurability of Long-tail Risks', *International Review of Law and Economics*, 19, 487–500.
- Faure, M. and D. Grimeaud (2003), 'Financial Assurance Issues of Environmental Liability', in M. Faure (ed.), *Deterrence, Insurability, and Compensation in Environmental Liability: Future Developments in the European Union*, Vienna: Springer, pp. 8–255.
- Faure, M. and T. Hartlief (1996), 'Compensation Funds versus Liability and Insurance for Remedying Environmental Damage', *Review of European Community and International Environmental Law*, 5, 321–6.
- Faure, M. and T. Hartlief (1998), 'Remedies for Expanding Liability', *Oxford Journal of Legal Studies*, 18, 681–706.
- Faure, M. and G. Heine (1991), 'The Insurance of Fines: The Case of Oil Pollution', *The Geneva Papers on Risk and Insurance*, 16, 39–58.
- Faure, M. and A. Nollkaemper (2007), 'International Liability as an Instrument to Prevent and Compensate for Climate Change', *Stanford Environmental Law Journal*, 43A, 123–79.
- Faure, M. and M. Ruegg (1994), 'Standard Setting through General Principles of Environmental Law', in M. Faure, J. Vervaele and A. Weale (eds), *Environmental Standards in the European Union in an Interdisciplinary Framework*, Antwerpen: Maklu, pp. 39–60.
- Faure, M. and G. Skogh (1992), 'Compensation for Damages Caused by Nuclear Accidents: A Convention as Insurance', *The Geneva Papers on Risk and Insurance*, 17, 499–513.
- Faure, M. and G. Skogh (2003), *The Economic Analysis of Environmental Policy and Law. An Introduction*, Cheltenham, UK and Northampton, MA, USA: Edward Elgar.
- Faure, M. and R. Van den Bergh (1989), 'Compulsory Insurance for Professional Liability', *The Geneva Papers on Risk and Insurance*, 14, 308–30.
- Faure, M. and R. Van den Bergh (1990), 'Liability for Nuclear Accidents in Belgium from an Interest Group Perspective', *International Review of Law and Economics*, 10, 241–54.
- Faure, M. and A. Verheij (2007), *Shifts in Compensation for Environmental Damage*, Vienna: Springer.
- Faure, M. and H. Wang (2006), 'An Economic Analysis of Compensation for Oil Pollution Damage', *Journal of Maritime Law and Commerce*, 37, 179–217.

- Feess, E. and U. Hege (2002), 'Safety Regulation and Monitor Liability', *Review of Economic Design*, 7, 173–85.
- Feinstein, J.S. (1989), 'The Safety Regulation of U.S. Nuclear Power Plants: Violations, Inspections, and Abnormal Occurrences', *Journal of Political Economy*, 97, 115–54.
- Finsinger, J. (1996), 'The Basic Arguments Relating to Public Guarantee Funds for Insurance', in D. Heremans and H. Cousy (eds), *Essays in Law and Economics III, Financial Markets and Insurance*, Antwerpen: Maklu, pp. 243–71.
- Fiore, K. (2007), *Industrie Nucléaire et Gestion au Risque d'Accident en Europe: du Défaut d'Internationalisation à l'Organisation de la Couverture*, Ph.D. dissertation, Université Paul Cézanne, 15 December 2007.
- Frey, B.S. (1992), *Umweltökonomie*, Göttingen: Vandenhoeck & Ruprecht.
- Gimpel-Hinteregger, M. (1994), *Grundfragen der Umwelthaftung*, Vienna: Manz Publishers.
- Goldberg, V.P. (1994), 'Recovery for Economic Loss following the Exxon Valdez Oil Spill', *Journal of Legal Studies*, 23, 1–39.
- Gollier, C. (2005), 'Some Aspects of the Economics of Catastrophe Risk Insurance', in OECD, *Catastrophic Risks and Insurance*, Paris: OECD, pp. 13–30.
- Gron, A. and A.O. Sykes (2002), 'A Role for Government' *Regulation*, 25, 44–51.
- Grossman, D.A. (2003), 'Warming Up to a Not-so-radical Idea: Tort-based Climate Change Litigation', *Columbia Journal of Environmental Law*, 28, 1–61.
- Hankey, S. (1994), 'Claims Made Policies and Choice of Law in the European Union', *International Insurance Law Review*, 267.
- Hansson, I. and G. Skogh (1987), 'Moral Hazard and Safety Regulation', *The Geneva Papers on Risk and Insurance*, 12, 132–44.
- Harrison, D. and Daniel L. Rubinfeld (1978), 'Hedonic House Prices and the Demand for Clean Air', *Journal of Environmental Economics and Management*, 5, 81–102.
- Hausman, J.A. (1993), *Contingent Valuation: A Critical Assessment*, Amsterdam: North-Holland.
- Hay, J. (2006), *Analyse Économique du Système International CLC/FIPOL Comme Instrument de Prévention des Marées Noires*, Thèse de Doctorat, Université de Bretagne Occidentale, 19 Septembre 2006.
- Hendrickx, R. (2007), 'Maritime Oil Pollution: An Empirical Analysis', in M. Faure and A. Verheij (eds), *Shifts in Compensation for Environmental Damage*, Vienna: Ectil, pp. 243–60.
- Heyes, A. (2001), *The Law and Economics of the Environment*, Cheltenham, UK and Northampton, MA, USA: Edward Elgar.
- Heyes, A. and C. Liston-Heyes (1998), 'Subsidy to Nuclear Power through Price-Anderson Liability Limit: Comment', *Contemporary Economic Policy*, 16 (1), 122–4.
- Hoch, I. and J. Drake (1974), 'Wages Climate and the Quality of Life', *Journal of Environmental Economics and Management*, 1, 268–95.
- Hyde, C.E., G.C. Rausser and L.K. Simon (2000), 'Regulating Multiple Polluters: Deterrence and Liability Allocation', *International Economic Review*, 41 (2), 495–521.
- Hylton, K.M. (2002), 'When Should we Prefer Tort Law to Environmental Regulation?', *Washburn Law Journal*, 41, 515–43.
- Jost, P.J. (1996), 'Limited Liability and the Requirement to Purchase Insurance', *International Review of Law and Economics*, 16, 259–76.
- Kaplow, L. (1986), 'An Economic Analysis of Legal Transition', *Harvard Law Review*, 99, 509–617.
- Kaplow, L. (1991), 'Incentives and Government Relief for Risk', *Journal of Risk and Uncertainty*, 4, 167–75.
- Kapp, W. (1970), 'Environmental Disruption and Social Costs, a Challenge to Economics', *Kyklos*, 23, 833–43.
- Karten, W.T. (1997), 'How to Expand the Limits of Insurability', *The Geneva Papers on Risk and Insurance*, 22, 515–22.
- Katzman, M. (1988), 'Pollution Liability Insurance and Catastrophic Environmental Risk', *Journal of Risk and Insurance*, 55, 75–100.

- Kaye, D. (1982), 'The Limits of the Preponderance of the Evidence Standard: Justifiable Naked Statistical Evidence and Multiple Causation', *American Bar Foundation Research Journal*, 7, 487–516.
- Kerkmeester, H. (1993), 'De Betekenis van het Waarschijnlijkheidsbegrip voor de Aansprakelijkheid uit Onrechtmatige Daad: Meijers Geactualiseerd (The Meaning of the Concept Probability from Tort Law: Meijers Actualized)', *Weekblad voor Privaatrecht, Notariaat en Registratie*, 6111, 767–73.
- Ketchum, L. (1985), 'Epidemiologic Tables Law Ground Work for Future Radiogenic Cancer Claims', *The Journal of Nuclear Medicine*, 26, 967–72.
- Kolstad, C.D., T.S. Ulen and G.V. Johnson (1990), 'Ex Post Liability for Harm vs. Ex Ante Safety Regulation: Substitutes or Complements?', *American Economic Review*, 80, 888–901.
- Kornhauser, L.A. and R.L. Revesz (1989), 'Sharing Damages among Multiple Tortfeasors', *Yale Law Journal*, 98, 831–84.
- Kornhauser, L.A. and R.L. Revesz (1990), 'Apportioning Damages among Potentially Insolvent Actors', *Journal of Legal Studies*, 19, 617–51.
- Kornhauser, L.A. and R.L. Revesz (1994), 'Multi-defendant Settlements: The Impact of Joint and Several Liability', *Journal of Legal Studies*, 23, 41–76.
- Kornhauser, L.A. and R.J. Revesz (1998), 'Joint and Several Liability', in P. Newman (ed.), *The New Palgrave Dictionary of Economics and the Law*, London: Macmillan, pp. 371–6.
- Krutilla, J.V. (1967), 'Conservation Reconsidered', *American Economic Review*, 57, 777–86.
- Kunreuther, H. (1996), 'Mitigating Disaster Losses through Insurance', *Journal of Risk and Uncertainty*, 12, 171–87.
- Kunreuther, H. (2006), 'Has the Time Come for Comprehensive Natural Disaster Insurance?', in R.J. Daniels, D.F. Kettl and H. Kunreuther (eds), *On Risk and Disaster: Lessons from Hurricane Katrina*, Philadelphia: University of Pennsylvania Press, 175–201.
- Kunreuther, H., N. Doherty and A. Kleffner (1992), 'Should Society Deal with the Earthquake Problem?', *Regulation – The Cato Review of Business and Government*, 15/2.
- Kunreuther, H. and P. Freeman (2001), 'Insurability, Environmental Risks and the Law', in A. Heyes (ed.), *The Law and Economics of the Environment*, Cheltenham, UK and Northampton, MA, USA: Edward Elgar, pp. 302–18.
- Kunreuther, H. and R. Gowda (1990), *Integrating Insurance and Risk Management for Hazardous Wastes*, Dordrecht: Kluwer Academic Publishers.
- Kunreuther, H., R. Hogarth and J. Meszaros (1993), 'Insurer Ambiguity and Market Failure', *Journal of Risk and Uncertainty*, 7, 71–87.
- Landes, W.M. and R.A. Posner (1983), 'Causation in Tort Law: An Economic Approach', *Journal of Legal Studies*, 12, 109–34.
- Landes, W.M. and R.A. Posner (1984), 'Tort Law as a Regulatory Regime for Catastrophic Personal Injuries', *Journal of Legal Studies*, 13, 417–34.
- Lewis, T.R. and D.E.M. Sappington (2001), 'Horizontal Vicarious Liability', in A. Heyes (ed.), *The Law and Economics of the Environment*, Cheltenham, UK and Northampton, MA, USA: Edward Elgar, 71–91.
- Libecap, G.D. and S.N. Wiggins (1984), 'Contractual Responses to the Common Pool: Proportioning of Crude Oil Production', *American Economic Review*, 74, 87–98.
- Lidgren, K. and G. Skogh (1996), 'Extended Producer Responsibility: Recycling, Liability, and Guarantee Funds', *Geneva Papers on Risk and Insurance*, 21, 170–81.
- Lomas, O. (1989), 'The Prosecution of Marine Oil Pollution Offences and the Practice of Insuring against Fines', *Journal of Environmental Law*, 1, 48–64.
- Makdisi, J. (1989), 'Proportional Liability: A Comprehensive Rule to Apportion Tort Damages Based on Probability', *North Carolina Law Review*, 67, 1063–101.
- Maler, K.G. (1977), 'A Note on the Use of Property Values in Estimating Marginal Willingness to Pay for Environmental Quality', *Journal of Environmental Economics and Management*, 4, 355–69.
- Meddler, F. and R. Moselly (1985), *Medical Effects of Ionising Radiation*, Orlando: Grune & Stratton.

- Michelman, F.I. (1971), 'Pollution as a Tort: A Non-accidental Perspective on Calabresi's Costs', *Yale Law Journal*, 85, 647–86.
- Miller, C. (2006), 'Causation in Personal Injury: Legal or Epidemiological Common Sense?', *Legal Study*, 26(4), 545–69.
- Mishan, E.J. (1971a), 'The Post War Literature on Externalities: An Interpretative Essay', *Journal of Economic Literature*, 9, 1–25.
- Mishan, E.J. (1971b), 'Pangloss on Pollution', *Swedish Journal of Economics*, 73, 113–20.
- Monti, A. (2001), 'Environmental Risk: A Comparative Law and Economics Approach to Liability and Insurance', *European Review of Private Law*, 1, 51–79.
- Nelson, B.J. (1978), *Economic Analysis of Transportation Noise Abatement*, Cambridge, MA: Ballinger.
- Nichols, E. and A. Wildavsky (1987), 'Nuclear Power Regulation: Seeking Safety, Doing Harm?', *Regulation*, 11(1), 45–53.
- Nieuwenhuis, H. (2006), 'Eurocausality', in H. Tiberg et al. (ed.), *Essays on Tort, Insurance, Law and Society in Honour of Bill W. Dufwa*, Stockholm: Jure förlag AB, pp. 847–71.
- Oates, W.E. (1983), 'The Regulation of Externalities: Efficient Behaviour by Sources and Victims', *Public Finance*, 38(3), 362–75.
- Ogus, A.I. (1994), *Regulation: Legal Form and Economic Theory*, Oxford: Oxford Clarendon Press.
- Ogus, A. (2007), 'The Relationship between Regulation and Tort Law: Goals and Strategies', in W.H. van Boom, M. Lukas and S.H.R. Kissling (eds), *Tort Law and Regulatory Law*, Vienna: Springer, pp. 377–89.
- Ott, C. and H.-B. Schäfer (1997), 'Negligence as Untaken Precaution, Limited Information and Efficient Standard Formation in the Civil Liability System', *International Review of Law and Economics*, 1, 15–29.
- Paté-Cornell, M.E. (1987), 'Risk Analysis and Relevance of Uncertainties in Nuclear Safety Decisions', in E.E. Bailey (ed.), *Public Regulation: New Perspectives on Institutions and Policies. MIT Press Series on the Regulation of Economic Activity*, no. 14, Cambridge, MA: MIT Press, pp. 227–53.
- Pigou, A.C. (1951), *A Study in Public Finance*, London: Macmillan.
- Pommerehne, W.W. (1988), 'Measuring Environmental Benefits: A Comparison of Hedonic Technique and Contingent Valuation', in D. Bös, M. Rose and C. Seidl (eds), *Welfare and Efficiency in Public Economics*, Berlin: Springer, pp. 363–400.
- Posner, R. (1972), 'A Theory of Negligence', *Journal of Legal Studies*, 1, 29–96.
- Pozzo, B. (1996), 'The Liability Problem in Modern Environmental Statutes', *European Review of Private Law*, 4, 112–29.
- Priest, G. (1987), 'The Current Insurance Crisis and Modern Tort Law', *Yale Law Journal*, 97, 1521–90.
- Priest, G. (1996), 'The Government, the Market and the Problem of Catastrophic Loss', *Journal of Risk and Uncertainty*, 12, 219–37.
- Radetzki, M. and M. Radetzki (2000), 'Private Arrangements to Cover Large-scale Liabilities caused by Nuclear and other Industrial Catastrophes', *The Geneva Papers on Risk and Insurance*, 25, 180–95.
- Revesz, R. and R. Stewart (1995), *Analysing Superfund, Economics, Science and Law*, Washington, DC: RFF Press.
- Rhoads, T.A. and J.F. Shogren (2001), 'Coasean Bargaining in Collaborative Environmental Policy', in A. Heyes (ed.), *The Law and Economics of the Environment*, Cheltenham, UK and Northampton, MA, USA: Edward Elgar, pp. 18–43.
- Rizzo, M.J. and F.S. Arnold (1980), 'Causal Apportionment in the Law of Torts: An Economic Theory', *Columbia Law Review*, 80, 1399–429.
- Rizzo, M.J. and F.S. Arnold (1986), 'Causal Apportionment: Reply to the Critics', *Journal of Legal Studies*, 15, 219–26.
- Robinson, G.O. (1985), 'Probabilistic Causation and Compensation for Tortuous Risk', *Journal of Legal Studies*, 14, 779–98.

- Rogge, J. (1997), *Les Assurances en Matière d'Environnement*, The Hague: Kluwer Law International.
- Rose-Ackerman, S. (1992a), *Re-thinking the Progressive Agenda, the Reform of the American Regulatory State*, New York, NY: The Free Press.
- Rose-Ackerman, S. (1992b), 'Environmental Liability Law', in T.H. Tietenberg (ed.), *Innovation in Environmental Policy, Economic and Legal Aspects of Recent Developments in Environmental Enforcement and Liability*, Aldershot, UK and Brookfield, MA, USA: Edward Elgar, pp. 223–43.
- Rose-Ackerman, S. (1995a), 'Public Law versus Private Law in Environmental Regulation: European Union Proposals in the Light of United States and German Experience', *Review of European Community and International Environmental Law*, 4, 312–32.
- Rose-Ackerman, S. (1995b), *Controlling Environmental Policy: The Limits of Public Law in Germany and the United States*, New Haven, CT: Yale University Press.
- Rose-Ackerman, S. (1996), 'Public Law versus Private Law in Environmental Regulation: European Union Proposals in the Light of United States and German Experiences', in E. Eide and R. Van den Bergh (eds), *Law and Economics of the Environment*, Oslo: Juridisk Forlag, pp. 13–39.
- Rosenberg, D. (1984), 'The Causal Connection in Mass Exposure Cases: A "Public Law" Vision of the Tort System', *Harvard Law Review*, 97, 851–929.
- Schmitz, P.W. (2000), 'On the Joint Use of Liability and Safety Regulation', *International Review of Law and Economics*, 20, 371–82.
- Schulze, W. and R. D'Arge (1974), 'The Coase Proposition, Information Constraints, and Long Run Equilibrium', *American Economic Review*, 74, 763–72.
- Schwartz, A. (2000), 'Statutory Interpretation, Capture and Tort Law: The Regulatory Compliance Defence', *American Law & Economics Review*, 1, 1–57.
- Schwartz, G. (1997), 'Mixed Theories of Tort Law: Affirming both Deterrence and Corrective Justice', *Texas Law Review*, 75, 1801–34.
- Schwarze, R. and G. Wagner (2004), 'In the Aftermath of Dresden: New Directions in German Flood Insurance', *Geneva Papers on Risk and Insurance*, 29, 154–68.
- Segerson, K. (1993), 'Liability Transfers: An Economic Analysis of Buyer and Lender Liability', *Journal of Environmental Economics and Management*, 25, 46–63.
- Settle, C., T.M. Hurley and J.F. Shogren (2001), 'Citizen Suits', in A. Heyes (ed.), *The Law and Economics of the Environment*, Cheltenham, UK and Northampton, MA, USA: Edward Elgar, pp. 217–48.
- Shavell, S. (1979), 'On Moral Hazard and Insurance', *Quarterly Journal of Economics*, 93, 541–62.
- Shavell, S. (1980a), 'An Analysis of Causation and the Scope of Liability in the Law of Torts', *Journal of Legal Studies*, 9, 463–516.
- Shavell, S. (1980b), 'Strict Liability versus Negligence', *Journal of Legal Studies*, 9, 1–25.
- Shavell, S. (1984a), 'Liability for Harm versus Regulation of Safety', *Journal of Legal Studies*, 13, 357–74.
- Shavell, S. (1984b), 'A Model of the Optimal Use of Liability and Safety Regulation', *Rand Journal of Economics*, 15, 271–80.
- Shavell, S. (1985), 'Uncertainty over Causation and the Determination of Civil Liability', *Journal of Law and Economics*, 28, 587–609.
- Shavell, S. (1986), 'The Judgment-proof Problem', *International Review of Law and Economics*, 6, 43–58.
- Shavell, S. (1987a), 'The Optimal Use of Nonmonetary Sanctions as a Deterrent', *American Economic Review*, 77, 584–92.
- Shavell, S. (1987b), *Economic Analysis of Accident Law*, Cambridge, MA: Harvard University Press.
- Shavell, S. (1992), 'Liability and the Incentive to Obtain Information about Risk', *Journal of Legal Studies*, 21, 259–70.
- Sigman, H. (1998), 'Liability Fending and Superfund Clean-up Remedies', *Journal of Environmental Economics and Management*, 35, 205–24.

- Sigman, H. (2001), 'Environmental Liability in Practice: Liability for Clean-up of Contaminated Sites under Superfund', in A. Heyes (ed.), *The Law and Economics of the Environment*, Cheltenham, UK and Northampton, MA, USA: Edward Elgar, pp. 116–49.
- Skogh, G. (1982), 'Public Insurance and Accident Prevention', *International Review of Law and Economics*, 2, 67–80.
- Skogh, G. (1989a), 'The Combination of Private and Public Regulation of Safety', in M. Faure and R. Van den Bergh (eds), *Essays in Law and Economics: Corporations, Accident Prevention and Compensation for Losses*, Antwerpen: Maklu, pp. 87–101.
- Skogh, G. (1989b), 'The Transactions Cost Theory of Insurance, Contract Impediments and Costs', *Journal of Risk and Insurance*, 65, 726–32.
- Skogh, G. and D. Rehme (1998), 'An Economic Analysis of a Swedish Environmental Liability Case', *European Journal of Law and Economics*, 5, 167–77.
- Slovic, P., H. Kunreuther and G. White (2000), 'Decision Processes, Rationality and Adjustment to Natural Hazards', in P. Slovic (ed.), *The Perception of Risk*, London: Earthscan, pp. 1–31.
- Spier, J. (2006), 'Legal Aspects of Global Climate Change and Sustainable Development', *Revista para el Analisis del Derecho* (http://www.indret.com/pdf/346_en.pdf).
- Spier, J. and O.A. Haazen (1996), *Aansprakelijkheidsverzekeringen op Claims-Made-Grondslag (Liability Insurance on Claims-Made-Grounds)*, Deventer: Kluwer.
- Stahel, W.R. (1997), 'Some Thoughts on Sustainability, Insurability and Insurance', *Geneva Papers on Risk and Insurance*, 22, 477–95.
- Tan, A. (2006), *Vessel-Source Marine Pollution: The Law and Politics of International Regulation*, Cambridge: Cambridge University Press.
- Tietenberg, T.H. (1989), 'Indivisible Toxic Torts: The Economics of Joint and Several Liability', *Land Economics*, 65, 305–19.
- Tol, R.S.J. and R. Verheyen (2004), 'State Responsibility and Compensation for Climate Change Damages – A Legal and Economic Assessment', *Energy Policy*, 32, 1109–30.
- Trebilcock, M.J. (1987), 'The Social Insurance – Deterrence Dilemma of Modern North American Tort Law: A Canadian Perspective on the Liability Insurance Crisis', *San Diego Law Review*, 24, 929–1002.
- Trebilcock, M.J. and R. Winter (1997), 'The Economics of Nuclear Accident Law', *International Review of Law and Economics*, 17, 215–43.
- Tribe, B. (1971), 'Trial by Mathematics: Precision and Rituals in the Legal Process', *Harvard Law Review*, 84, 1329–93.
- Vanden Borre, T. (1999), 'Channelling of Liability: A few Juridical and Economic Views on an Inadequate Legal Construction', in N.L.J.T. Horbach (ed.), *Contemporary Developments in Nuclear Energy Law: Harmonizing Legislation in CEE/NIS*, The Hague: Kluwer Law International, pp. 13–39.
- Vanden Borre, T. (2001), *Efficiënte preventie en compensatie van catastroferisico's – het voorbeeld van schade door kernongevallen*, Antwerpen: Intersentia.
- Vanden Borre, T. (2007), 'Shifts in Governance in Compensation for Nuclear Damage, 20 Years after Chernobyl', in M. Faure and A. Verheij (eds), *Shifts in Compensation for Environmental Damage*, Vienna: Springer, pp. 261–311.
- Van Egteren, H. and R.T. Smith (2001), 'International Harmonization of Environmental Law: Theory with Application to the European Union', in A. Heyes, *The Law and Economics of the Environment*, Cheltenham, UK and Northampton, MA, USA: Edward Elgar, pp. 280–301.
- Van Egteren, H. and R.T. Smith (2002), 'Environmental Regulations under Simple Negligence or Strict Liability', *Environmental and Resource Economics*, 21, 369–96.
- Van Egteren, H., R.T. Smith and A. Eckert (2006), 'Environmental Liability and Harmonisation in the Presence of Transboundary Effects and Hidden Assets', *European Journal of Law and Economics*, 22, 143–63.
- Van Egteren, H., R.T. Smith and D. McAfee (2004), 'Harmonisation of Environmental Regulations when Firms are Judgement-proof', *European Journal of Law and Economics*, 17, 139–64.

- Van Mieghem, E. (1988), *Het Kankerrisico bij Professionele Blootstelling aan Lage Dosissen Ioniserende Straling*, Leuven: Universitaire Pers.
- Verheij, A. (2007), 'Shifts in Governance: Oil Pollution', in M. Faure and A. Verheij (eds), *Shifts in Compensation for Environmental Damage*, Vienna: Ectil, pp. 133–95.
- Verheyen, R. (2005), *Climate Change Damage and International Law: Prevention Duties and State Responsibility*, Leiden: Martinus Nijhoff Publishers (Brill Publishers).
- Viscusi, W.K. (1991), 'The Dimensions of the Product Liability Crisis', *Journal of Legal Studies*, 20, 147–77.
- Wagner, G. (1991), 'Umwelthaftung und Versicherung', *Versicherungsrecht*, 249–60.
- Wagner, G. (1992), 'Die Zukunft der Umwelthaftpflichtversicherung', *Versicherungsrecht*, 261–72.
- Wagner, G. (1996), 'Umwelthaftung und Versicherung', in M. Ahrens and J. Simon (eds), *Umwelthaftung, Risikosteuerung und Versicherung*, Berlin: Erich Schimdt Verlag, pp. 97–146.
- Wagner, G. (1999), 'Haftung und Versicherung als Instrumente der Techniksteuerung', *Versicherungsrecht*, 1441–80.
- Wang, H. (2007), 'Shifts in Governance in the International Regime of Marine Oil Pollution Compensation: Legal History Perspective', in M. Faure and A. Verheij (eds), *Shifts in Compensation for Environmental Damage*, Vienna: Ectil, pp. 197–241.
- Wittman, D.A. (1977), 'Prior Regulation versus Post Liability: The Choice between Input and Output Monitoring', *Journal of Legal Studies*, 6, 193–211.
- Zeckhauser, R. (1996), 'The Economics of Catastrophes', *Journal of Risk and Uncertainty*, 12, 113–40.

11 Products liability

*Mark A. Geistfeld**

11.1 Introduction

Products liability is a field of tort law governing liability for injuries caused by defective products that were commercially sold or transferred. Under the rule of strict products liability, a product seller is strictly liable for the physical harms caused by a defect in its product. The US rule of strict products liability closely corresponds to the EC Directive 85/374, which establishes a strict liability regime for defective products in all member countries of the European Union. As compared to the US, the liability rule has had much less of an impact in Europe. The US rule and EC directive, in turn, have influenced products liability rules in other countries, including Japan.

The problem of product-caused injury is one of the most important issues addressed by tort law. Based on government data and 17 other large data sets, nonfatal consumer product injuries in the US had an estimated total social cost of approximately \$500 billion in 1996 (Lawrence et al., 2000). This cost would be considerably increased by the inclusion of fatalities, such as the annual deaths caused by automobiles, chemicals, drugs, and firearms. The vast majority of these accident costs are not covered by tort liability payments (compare Hensler et al., 1991, finding that tort liability payments constituted less than 10 percent of compensatory payments for accidental injuries). For those product accidents resulting in tort litigation, one government estimate found that plaintiffs won 37.1 percent of all products liability cases, excluding asbestos, that went to trial in state courts in 1996, receiving a median award of \$177,000 (Congressional Budget Office, 2003, p. 8). For such cases tried in federal courts, plaintiffs won 26.6 percent of the cases and received a median award of \$368,500 (*ibid.*). Most product-caused injuries do not result in tort litigation because only a fraction are caused by product defects.

Products liability first emerged as a significant form of liability in the 1960s. Legal scholars who analyzed the emerging field rarely addressed efficiency concerns (McKean, 1970a; Priest, 1985). Similarly, court opinions

* © Mark A. Geistfeld, New York University School of Law; geistfeld@juris.law.nyu.edu.

typically gave little or no explicit attention to efficiency (Henderson, 1991). But as the economic analysis of products liability has developed over the past few decades and the economic consequences of liability have become more apparent, legal decisionmakers have paid increased attention to the economics of products liability. Today efficiency considerations often strongly influence the formulation of products liability laws. References to efficiency and cost-benefit analysis recur throughout the *Restatement (Third) of Torts: Products Liability* (American Law Institute, 1998), the successor to the highly influential section 402A of the *Restatement (Second) of Torts* (American Law Institute, 1965), which first promulgated the rule of strict products liability.

The economic orientation of products liability, however, is not ordinarily apparent. Courts regularly emphasize that the primary purpose of products liability is to fairly protect consumer interests. Based on these cases, the *Restatement (Third)* concludes that 'it is not a factor . . . that the imposition of liability would have a negative effect on corporate earnings or would reduce employment in a given industry' (§ 2, comment f). Similarly, EC consumer law emphasizes consumer interests (Wilhelmsson, 2006). The objective of products liability is one of fairness, not efficiency.

Upon inspection, the fair protection of consumer interests justifies efficient liability rules (Geistfeld, 2006, pp. 35–40). Cost-benefit analysis depends on prices, which in turn depend on the initial allocation of property rights. The specification of these legal entitlements, and thus the substantive content of any liability rule, necessarily requires noneconomic justification of some sort, presumably normative. These initial entitlements define the appropriate baseline for evaluating the distributive impact of tort liability. At the normatively justified baseline, the equilibrium product price must cover all of the seller's costs, including liability costs. At this baseline, the consumer pays for the full cost of tort liability, explaining why the liability rules exclusively focus on consumer interests. An exclusive focus on consumer interests, in turn, justifies efficient liability rules. Consumers both pay for and receive the benefits of tort liability, and so their preference for efficient liability rules – those that maximize the net benefit of tort liability – should govern.

As a matter of efficiency, products liability does not have to be a form of tort liability, except for cases involving bystander injuries (to be discussed separately). If unregulated market transactions were efficient, courts would only have to enforce contractual allocations of product risk in order to maximize consumer welfare. Courts, though, do not ordinarily enforce contractual disclaimers of seller liability, making it necessary to identify the market failures that may justify tort regulation. Sections 11.2 through

11.10 accordingly develop the economic framework for evaluating different liability rules. Sections 11.11 through 11.13 describe the impact that the products liability system has had on product safety, innovation, and the market for liability insurance. The remaining sections discuss the efficiency properties of the main doctrines in products liability.

11.2 The basic model for analyzing the efficiency properties of contracting and tort liability

The economic analysis of products liability can be largely described in terms of a simple model. Shavell (1987) and Spulber (1989) provide more rigorous analyses of many of these issues.

The inquiry addresses product-caused injuries, and so the model does not consider any product characteristics unrelated to the risk of injury (such as aesthetics, functionality, and durability). Hence the product to be analyzed is homogeneous in all respects, except for the risk of injury posed by the product and the extent of contractual liability the seller incurs under the product warranty. The following assumptions are also unrealistic, but most will be relaxed in the ensuing discussion. All firms have identical production technologies and sell the product, exclusive of safety and liability costs, in a perfectly competitive market at a price p equal to the unit cost. By making safety investments s per unit of product, a firm affects the probability or risk $r(s)$ that the product will cause injury. Increased safety investments reduce the risk of injury at a decreasing rate [$r'(s) < 0$; $r''(s) > 0$]. All injuries caused by the product have a monetary equivalent of L that is suffered by risk-neutral buyers who are identical and unable to influence the risk of injury.

In light of these assumptions, the total cost or *full price* \mathbf{P} of the product is given by

$$\mathbf{P} = p + s + r(s)L. \quad (11.1)$$

If perfectly informed consumers bear the injury cost L in the event of accident, they pay a purchase price of $p + s$ for the product, while also recognizing that this cost is increased by the expected accident cost $r(s)L$ for which they are liable. Consequently, consumers make their purchase decisions on the basis of the full price \mathbf{P} rather than the price they pay to purchase the product, making consumer demand a function of the full price: $Q^D = Q^D(\mathbf{P})$. Sellers then compete by offering the amount of safety and warranty coverage that minimizes \mathbf{P} .

Under these conditions, it does not matter whether a perfectly informed consumer or the seller is liable for the injury (for example, Hamada, 1976). If the consumer is liable, the seller must choose the amount of safety

investments to minimize \mathbf{P} , which from equation (11.1) implies that the seller chooses the amount s^* defined by

$$1 = -r'(s^*)L. \quad (11.2)$$

In other words, the seller invests in safety until the last dollar spent reduces expected injury costs by one dollar. Such a product is optimally safe.

If the seller is fully liable for the consumer's injuries, it sells the product and warranty at a price of $p + s + r(s)L = \mathbf{P}$. Once again, the seller must minimize the full price, so it chooses the optimal amount of safety investment s^* . Under these conditions, whether the consumer or producer is liable for the product-caused injury does not affect product safety or the full price.

11.3 The significance of imperfectly competitive markets

An early justification for tort regulation was based on the claim that manufacturers can take advantage of their market power by supplying unsafe products (discussed in Priest, 1985). This claim is not supported by the basic model (for example, Epple and Raviv, 1978).

A seller's market power can be represented by the amount that it can increase the product's full price above the competitive level. When the product price is increased by this amount, the seller's profits per sale are increased by the same amount. As an alternative strategy, the seller could achieve an identical increase in the full price by reducing safety investments below the optimal level s^* . Each \$1 of reduced safety investment necessarily increases expected accident costs $r'(s^*)L$ by more than \$1, thereby increasing the product's full price. This strategy does not affect the seller's profits per sale, however, because the product must sell for a reduced price equal to the unit cost of $p + s$ (any price above cost is equivalent to an increase in the product price, the alternative strategy under consideration). Hence a monopolist can make higher profits by selling perfectly informed consumers an optimally safe product at a supracompetitive price. Similar reasoning shows that if it would be efficient for the seller to bear full liability under the warranty, then a monopolist would maximize profits by offering a full warranty while selling the product at a supracompetitive price (for example, Heal, 1977).

Once the assumptions of the basic model are relaxed, market structure can affect product safety. The basic model assumes a constant marginal cost of safety investment per unit of product (the term s). Consequently, a manufacturer's decision regarding safety investments does not depend on its output level (as reflected by equation (11.2) above), implying that product safety will be unaffected by the reduced quantity of output that

occurs in imperfectly competitive markets. The magnitude of many product risks, though, is determined by the quantity of products sold or otherwise consumed by an individual (Marino, 1988a, 1988b). The risks posed by many chemicals often depend on cumulative exposure. The magnitude of these risks would be affected by the higher prices, and reduced consumption, of products sold in imperfectly competitive markets. In addition, the cost of safety investments can be influenced by a manufacturer's output level, in which case the amount of safety investments made by a monopolist depends on the cross-effects of safety investments and output on the monopolist's costs (Spulber, 1989, pp. 407–10). For either reason, sellers in imperfectly competitive markets could supply products that are insufficiently safe. Such market failures, however, are probably best addressed by the antitrust or trade competition laws.

11.4 The role of consumer information about product risk

The analysis so far has assumed that consumers are perfectly informed of risk, an assumption typically made by early economic analyses of products liability (for example, McKean, 1970a; Oi, 1973). But product safety becomes a regulatory problem only if consumers are inadequately informed (Goldberg, 1974). Subsequent economic analyses focused on the safety effects of imperfect information about product risk.

When imperfectly informed consumers are liable for their injuries, they must estimate their expected injury costs, denoted $E[r(s)L]$, and hence the full price, denoted $E[\mathbf{P}]$. Consequently, equation (11.1) above is changed to

$$E[\mathbf{P}] = p + s + E[r(s)L]. \quad (11.1)$$

Consumer demand now depends on the estimated full price $E[\mathbf{P}]$, not the actual full price. A seller must minimize $E[\mathbf{P}]$ if consumers are to buy its product, inducing sellers to choose the amount of safety investment S that minimizes $E[\mathbf{P}]$:

$$1 = -E[r'(s)L]. \quad (11.2)$$

When consumers are imperfectly informed of product risk, the seller invests in safety until the last dollar spent on safety reduces the consumer's *estimate* of expected injury costs by one dollar (Spence, 1977). If consumers underestimate the decrease in expected injury costs, they will undervalue risk reduction and demand less than the optimal amount of safety; that is, if $-E[r'(s)L] < -r'(s)L$, then $S < s^*$. A similar result occurs when consumers cannot observe manufacturer safety investments. Consumers who

cannot tell the difference between a low-risk and high-risk product will treat the differential in safety as if $-E[r'(s)L] = 0$, when in fact $-r'(s)L > 0$. Price competition prevents manufacturers from incurring the higher cost of producing a low-risk product for which these uninformed consumers are unwilling to pay. The market supplies only high-risk products, an outcome analogous to the well-known 'lemons problem' (Akerlof, 1970).

Imperfect information does not necessarily yield equilibria in which producers supply overly unsafe products. If consumers overestimate the way in which increased safety investments reduce risk, they will attribute too great a value to safety investments and demand more than the optimal amount of safety. Although this outcome is inefficient, it seems unwise to construct a regulatory regime, with its attendant administrative costs, in order to reduce product safety.

11.5 Do consumers undervalue product safety?

The way in which individuals evaluate risk has been extensively studied by psychologists. These studies have found that imperfectly informed consumers frequently rely on rules-of-thumb or heuristics to make decisions about risk (for example, Kahneman et al., 1982). Individuals tend to overestimate risks that are brought to their attention. This finding could mean that consumers tend to overestimate product risks (A. Schwartz, 1988, 1992). Most product risks, though, are not salient because product-caused injuries are a rare occurrence for most individuals, leading consumers to infer (erroneously) from the more common or representative experience of safe product use that risk is not present or worth worrying about (Latin, 1994). Due to this heuristic, imperfectly informed consumers tend to underestimate product risks and undervalue product safety.

Market competition also forces a seller to portray its product in a manner that causes consumers to underestimate risk, which decreases their estimate of the product's full price and increases aggregate demand. To do so, the seller does not have to commit fraud. Rather than misrepresenting risk, the seller can emphasize only those product attributes that are likely to trigger consumer heuristics resulting in the underestimation of risk. The dynamics of market competition predictably lead sellers to exploit consumer heuristics in the very manner that justifies tort liability (Hanson and Kysar, 1999a, 1999b).

Although consumer understanding of product risk is relevant to the regulatory problem, it should also be recognized that consumers can undervalue product safety even if they are perfectly informed. Suppose consumers are covered by health insurance that would fully indemnify them for the product-caused injury. The amount an individual pays for health insurance, whether privately or publicly provided, does not

ordinarily depend on the riskiness of products purchased by the individual (Hanson and Logue, 1990). Since the consumer's cost of health insurance is unaffected by her consumption choices, neither that cost nor the expected cost of injury (which is fully insured) is relevant to the consumer's purchase decision. The full price to the consumer is given by $\mathbf{P} = p + s$, and sellers minimize this full price by setting $s = 0$. Simply put, fully insured consumers have no need for risk reduction, eliminating demand for product safety. Of course, this example is extreme (because insurance plans rarely provide full coverage), but the conclusion is general: fully informed consumers will undervalue product safety when some of their injury costs are borne by an insurance plan.

11.6 Informational mechanisms in product markets

An uninformed consumer can learn about product risk, presumably in the hope of making fewer mistaken product choices. The increased knowledge, however, typically comes at a cost – the additional time and effort the consumer must expend to acquire and process the information. These information costs explain why consumers are not perfectly informed of product risk. The consumer might not have enough time to collect all the information, or the available information can take too much time to evaluate. The benefit of learning about a 1-in-10,000 risk of being injured by a particular configuration of a car's steering wheel, for example, is likely to be lower than the cost the consumer would incur to become informed of the risk. For such risks, the ordinary consumer would rationally decide to remain uninformed.

The cost consumers incur to get risk-related information, and their need for it, depends on a variety of market mechanisms. For example, consumers who communicate among themselves by 'word of mouth' advertising may increase the amount of high-quality goods in the market (Rogerson, 1983). Consumers also can purchase product-related information from intermediaries, and such information may come from sellers.

Brand names, for example, are a method sellers use to implicitly guarantee superior quality (Klein and Leffler, 1981; Price and Dawar, 2002), because product quality must be sufficiently high if the seller is to attract repeat purchases (for example, Shapiro 1982, 1983). For the same reason, sellers can convey indirect information about product quality through advertising and prices (for a literature survey, see Riley, 2001, pp. 451–5). The price-quality signal, however, is highly dependent on the market context. In some settings, low prices signal high quality, whereas in other settings, high prices signal high quality (Tirole, 1990, pp. 110–12). In addition, prices provide a signal of product quality only if consumers have at least some brand-specific information about quality, although this information does

not have to be perfect (Wolinsky, 1983). As long as consumer experience with a product brand provides enough information so that consumers are more likely to believe the brand is of high quality when in fact it is, then high-quality firms will attract more customers (Rogerson, 1983).

The need to protect their reputation or brand name may force sellers to provide more safety than depicted by the basic economic model of products liability, but these market mechanisms do not solve the safety problem. Many risks are latent and do not become manifest for years (like carcinogens). In addition, many safety characteristics are not observable during normal product use (such as whether a motor vehicle is optimally designed for different types of accidents). Given the very low probabilities of most product-caused injuries and the fact that optimally safe products typically pose some risk of injury, very little information will be conveyed by a consumer's experience with the product.

For example, suppose an unsafe product doubles the risk of injury from 1-in-10,000 to 2-in-10,000. Based on their experience, it will take consumers a long time (involving numerous iterations of Bayesian updating) to discover the increased risk. In the interim, consumers may not have the amount of brand-specific information required for signaling.

Moreover, the price-quality relationship depicted by signaling models is based on equilibrium conditions for products that vary in one dimension of quality. Even within the confines of such a simplified market, it is doubtful that consumers ordinarily will have enough information about the market context and cost structures to draw the correct inferences about product safety (Kirmani and Rao, 2000, pp. 72–3).

Once one allows for the (realistic) possibility of disequilibria in markets for products that are heterogeneous in more than one dimension, it becomes even less likely that consumers will be able to obtain good information about product safety from prices. Automobiles, for example, contain dozens of safety components that interact in complicated ways (Burrows, 1992, pp. 465–6). The number of product choices is also staggering. Over 30,000 items are available in the typical US supermarket (Cross, 2000). Experience with a brand may provide the consumer with some knowledge, but even that is short-lived. From 1972 to 1997, almost two-thirds of the US manufacturing firms that remained in operation over a five-year manufacturing census period changed their product mixes, with the product switches involving almost half of existing products (Bernard et al., 2006). Product switching increases the consumer's difficulty of evaluating product risk, a problem that is then compounded by the increased complexity of products. Who has the time, energy and desire to evaluate each individual product risk, particularly given the range of other decisions we face on a daily basis?

Given the limited amount of information provided by signaling mechanisms, it is puzzling why sellers do not voluntarily disclose risk-related information. Under realistic assumptions, firms can choose either to signal or voluntarily disclose product quality (Daughety and Reinganum, 2006b). It is an open question, though, whether these mechanisms induce the same responses from consumers, even when their informational content is otherwise substantively equivalent. When price signals product safety, consumers may frame the signaled safety as a positive attribute of the product. But when sellers instead choose to disclose voluntarily, consumers may frame the disclosed risk as a negative product attribute. The frame matters, because consumers tend to overreact to negative information about products (see the sources cited in A. Schwartz, 1988, p. 381). Insofar as consumers overreact to risk disclosures, sellers are better off by not disclosing. Burrows (1992) provides other reasons why sellers might not voluntarily disclose information about product risk, and Geistfeld (1997) explains why a system of voluntary disclosure would function much like a tort regime of negligence.

Indeed, market mechanisms that transmit information can exacerbate the safety problem. Manufacturers have an incentive to provide optimally safe products if there is a large enough proportion of well-informed 'shoppers' in the market (Schwartz and Wilde, 1983a). The information held by some consumers can benefit others who are uninformed about product safety. This informational externality, however, reduces consumer incentives to acquire costly information in the first instance (Geistfeld, 2006, pp. 47–8). When information is costly to acquire and process, any consumer may rationally decide to free ride on the informed choices of others, thereby saving the information costs. The consumer can get the benefits of information (safe products) without incurring the costs of acquiring and processing the information. Reasoning similarly, other consumers will make the same choice. The free-rider problem may result in no consumer incurring the costs necessary for making informed decisions about product safety.

11.7 Product warranties

Rather than attempting to evaluate all product risks, consumers can instead purchase a product warranty that subjects the product seller to liability for product-caused injuries (for a literature survey, see Murthy and Djameludin, 2002). As discussed in Section 11.2, when the seller is fully liable for product-caused injuries, the price at which the product sells on the market equals the full price, forcing the seller to provide the cost-effective amount of product safety. Product warranties can remedy the consumer's informational problem in a straightforward way, unlike other signaling

mechanisms that require consumers to engage in complex calculations (other differences in these mechanisms are discussed in Noll, 2004).

For example, assume that the manufacturer is the least-cost insurer and that consumers are unable to observe manufacturer safety investments. In this setting, insurance costs are minimized if the manufacturer provides a warranty that fully compensates the consumer for any product-caused injuries. A manufacturer that provides full warranty coverage must also provide an optimally safe product in order to minimize the market price (which equals the full price) of its product. A manufacturer that does not provide the optimally safe product would signal this fact to consumers via the product's higher market price. To avoid this outcome, the manufacturer cannot offer a full warranty. Imperfectly informed consumers, however, would infer that products without full warranty coverage must have less than the optimal amount of safety, making this strategy undesirable for the manufacturer. To maximize profits, manufacturers must offer imperfectly informed consumers optimally safe products with full warranty coverage (Grossman, 1981).

Full warranties might not result in such equilibria, though, if sellers purchase insurance to cover their liability under the warranty. A study directed by the US Department of Commerce found that liability insurance in the 1970s was rarely priced in a manner that reflected the degree of risk posed by the manufacturer-policyholder's products (Inter-Agency Task Force on Products Liability, 1977). Although such insurance reduces the manufacturer's incentive to invest in product safety (as the increased accident costs do not cause a commensurate increase in premiums), developments in the liability-insurance market have significantly restored this incentive. Based on estimates of firms' total liability costs, self-insurance costs accounted for 4.9 percent of the total in 1970 and increased to 51.7 percent in 1979 (Priest, 1991). The amount of uninsured risk exposure faced by firms probably increased in the 1980s for reasons discussed in Section 11.13, strongly suggesting that the prospect of liability gives sellers an incentive to invest in safer products.

Like any other form of legal liability, warranties will not necessarily induce optimal care when product sellers are judgment proof. For example, firms can reduce the expected cost of liability by accumulating less capital (Mason, 2004); going out of business before latent hazards cause injury and result in legal liability (Boyd and Ingerman, 2003; Mason, 2004; Merolla, 1998; Wiggins and Ringleb, 1992); or financing the business with debt rather than equity (for example, Lopucki, 1996). The mere fact that a seller warrants the quality of its product does not make the commitment credible, a problem with warranties that can be somewhat ameliorated by a tort rule subjecting all sellers in the distribution chain to liability for the defective product (see Section 11.19).

11.8 Insurance costs and warranty liability

The efficient outcome involves both the optimal amount of product safety and optimal insurance coverage for any residual product risks. Unless sellers are the least-cost insurer for all product risks, warranties that make sellers fully liable for all product-caused injuries will not satisfy this efficiency condition.

Manufacturers are likely to have a comparative advantage in insuring against some risks, like those involving repair of complicated machinery, but consumers can have a comparative advantage in insuring against other risks (Priest, 1981). In particular, risk-averse consumers ordinarily will have a comparative advantage in insuring against many of the risks associated with physical injury, because the cost consumers incur in making their own insurance arrangements, typically called *first-party insurance*, often is lower than the cost sellers incur in making insurance arrangements to cover product-caused injuries suffered by consumers, typically called *third-party insurance*. Due to the higher cost of third-party insurance, full seller liability under product warranties creates an insurance inefficiency.

As compared to third-party insurance, first-party insurance is more capable of minimizing the costs of moral hazard and adverse selection (Epstein, 1985; Priest, 1987). The primary reasons for the cost differential between the two insurance mechanisms stem from the event that triggers coverage and the scope of coverage.

Coverage under many first-party insurance policies, such as health insurance, is triggered by the fact of loss (like medical expenses), making the cause of injury irrelevant in most cases. The fact of injury or loss usually is easy to prove (submitting bills), so policyholders usually do not have to hire a lawyer to receive insurance proceeds. By contrast, the third-party insurance supplied by product sellers is triggered only if the product caused the injury. Often, many products are causally implicated in an accident, and a potentially contentious factual inquiry may be needed to resolve the liability question (Geistfeld, 1992). Some items of damages, particularly those pertaining to pain-and-suffering damages and future economic loss, are also costly to determine. The resultant litigation expenses increase the cost of third-party insurance, which probably explains why the administrative costs of third-party insurance per dollar of coverage substantially exceed the administrative costs of first-party insurance (see sources cited in Shavell, 1987, pp. 262–4).

In order to provide full coverage, third-party insurance must indemnify the consumer for pain-and-suffering injuries. It might be inefficient for consumers to insure against these nonmonetary injuries (see Section 11.23). If so, it would be cheaper for consumers to suffer or ‘self-insure’ these injuries, providing another cost advantage for first-party insurance.

In other respects, the scope of coverage provided by third-party insurance is not extensive enough, as it does not cover losses unrelated to product use. To be insured against these contingencies (like medical expenses due to illness), individuals must be covered by other insurance plans. But since first-party insurance coverage is triggered by the fact of loss rather than its cause, individuals who have such insurance might receive double compensation when injured by products. The first-party insurer is obligated to pay whenever the policyholder suffered an insured-against loss (medical expenses), and despite this payment, the seller may also be obligated to pay the consumer for the injury (due to the collateral-source rule). Double recovery can be avoided if the first-party insurer exercises a contractual or statutory right to indemnification out of the warranty recovery received by the policyholder, but the separate legal proceeding often is complicated and expensive due to the need to determine which part of the damages award or settlement is covered by the policy. Consequently, many insurers do not exercise this right. Insurance provided by product sellers, therefore, may be an inefficient form of double insurance or otherwise increase the administrative cost of first-party insurance policies, providing another reason why consumers may reduce their insurance costs if they disclaim seller liability under the warranty.

The higher cost of third-party insurance can have a feedback effect on the safety benefits that would otherwise be produced by full warranty coverage (Wickelgren, 2005). Once the product is available to the consumer in the marketplace, the manufacturer has already made its investments in product safety. The consumer knows that purchasing full warranty coverage at this point will not affect the product's safety attributes, and so she rationally chooses to reduce the purchase price by waiving warranty coverage in favor of the less costly first-party insurance. Manufacturers will anticipate this consumer behavior, which in turn erodes their incentive to supply safe products. The safety problem cannot be solved by voluntary warranties, because the higher cost of third-party insurance prevents consumers from being able to credibly commit to warranties. The commitment problem does not exist when warranties are mandatory, in which case liability is based on tort law and not contract law (for discussion of how warranty provided the doctrinal basis for strict products liability, see Geistfeld, 2006, pp. 10–19).

11.9 The regulatory problem

Due to the significance of insurance costs, the basic model must be revised to account for differences in the insurance costs of consumers and manufacturers. Let L_I denote the consumer's cost of compensating the injury with first-party insurance, and L_W the seller's cost of compensating the injury under the product warranty. Whether the seller is liable for the

injury may affect product safety, so the seller's safety investment will be denoted by s_I when the consumer insures against the injury and by s_W when the seller is liable under the warranty. Finally, assume that any insurance costs faced by the consumer equal the actuarially fair amount $r(s_I)L_I$. (The other extreme – the case in which premiums do not depend on risk – was discussed in Section 11.6.)

There are two possible full prices to consider:

$$\mathbf{P}_I = p + s_I + r(s_I)L_I. \quad (11.3)$$

$$\mathbf{P}_W = p + s_W + r(s_W)L_W. \quad (11.4)$$

Consumers will disclaim seller liability when doing so would reduce the full price (that is, when $\mathbf{P}_I < \mathbf{P}_W$), and otherwise will purchase full warranty coverage (when $\mathbf{P}_I > \mathbf{P}_W$).

To illustrate how the difference in insurance costs affects the analysis, suppose that consumers are unable to observe manufacturer safety investments. For reasons given in Section 11.4, in the absence of any warranty liability, manufacturers will set $s_I = 0$, yielding a full price $\mathbf{P}_I = p + r(0)L_I$. By contrast, when the manufacturer is fully liable under the warranty, it provides an optimally safe product, yielding a full price $\mathbf{P}_W = p + s_W^* + r(s_W^*)L_W$. Even though product safety increases when the manufacturer is fully liable under the warranty ($s_W^* > s_I = 0$), if the consumer has a comparative advantage in compensating the injury ($L_I < L_W$), it is possible that $\mathbf{P}_I < \mathbf{P}_W$. Consumers may be better off with the less-safe products (and reduced insurance costs) than with the safer products and more expensive insurance provided by full product warranties.

Whether sellers should be subject to mandatory liability when consumers are imperfectly informed, therefore, depends on a tradeoff between safety and insurance considerations. Increasing the amount of mandatory seller liability will predictably increase manufacturer investments in product safety, but is also likely to increase the average cost of compensating product-caused injuries.

This regulatory problem involves an additional consideration when consumers have different risk profiles due to differences in product use, abilities to reduce risk for a given level of care, or damages. Suppose that consumers are of two types, either low risk or high risk, with each type demanding products of different qualities. Mandatory liability can force sellers to provide only one level of quality that is efficient for the average consumer, but inefficient for both the low-risk and high-risk consumers (Endres and Lüdeke, 1998a; Oi, 1973). Mandatory seller liability can inefficiently reduce product variety.

The foregoing analysis also relies on partial equilibrium conditions within each product market, subjecting it to problems posed by the theory of second best. Increased product prices, for example, could cause consumers to purchase fewer products like prescription drugs that reduce risk, or to substitute towards more risky, nonmarket activities, with the net result that seller liability increases total risk (Henderson and Twerski, 1991).

These tradeoffs only exist when consumers are not adequately informed about product risk. Consequently, mandatory seller liability can be efficient only when limited to cases in which information costs prevent consumers from making adequately informed decisions about product safety. To be efficient, a tort rule must balance the safety benefits of seller liability against the costs of reduced product differentiation and increased insurance expenses.

11.10 The choice between negligence and strict liability

We have been analyzing seller liability in terms of a rule that holds sellers strictly liable for injuries caused by their products. An alternative liability rule of negligence holds sellers liable only for those injuries caused by unreasonably dangerous products.

According to the economic interpretation of negligence liability, a product is unreasonably dangerous if it contains less than the optimal amount of safety s^* defined by equation (11.2) above. Because each dollar of safety investment below s^* increases expected accident (and thus liability) costs by more than one dollar, sellers minimize total costs by making total safety investments equal to s^* . When this liability rule is perfectly enforced, sellers have an incentive to supply optimally safe products. The same incentive is also created by strict liability (see Section 11.2). Negligence differs from strict liability in that consumers in a negligence regime incur the cost of injuries caused by optimally safe products, giving them the opportunity to utilize insurance arrangements that minimize the cost of injury compensation. In theory, a negligence regime can yield optimally safe products while enabling consumers to minimize insurance costs, unlike strict liability. The limitations of liability in a negligence regime can also be formulated to promote product variety, unlike a complete regime of strict liability (compare Section 11.17).

Negligence will not lead to efficient outcomes, however, when consumers are imperfectly informed of product risk (Shavell 1980; Polinsky, 1980). Because sellers are not liable for injuries caused by their (optimally safe) products, the product sells for $p + s^*$. Consumers need to estimate expected injury costs $r(s^*)L_i$ in order to determine the product's full price P . Consumers who underestimate product risk will underestimate the full price, increasing their demand above the amount they would choose if

they were perfectly informed. This overconsumption increases the total number of injuries above the efficient amount and can affect product-safety attributes dependent on the quantity of output (discussed in Section 11.3).

In a negligence regime, it is also often difficult (and expensive) for the plaintiff to enforce the standard of reasonable product safety. Consider, for example, the complicated issues that must be resolved in order to determine whether a product is optimally designed. To prove that the existing design is unreasonably dangerous, the plaintiff must identify an alternative design that would reduce risk in a cost-effective manner (see Section 11.17). The difficulty of litigating these issues can undermine the manufacturer's safety incentives. Prior to filing suit, injured consumers who are not well-informed about manufacturer safety investments often will be unable to determine whether the product is reasonably safe. These consumers (or their contingent-fee attorneys) may be unwilling to incur the cost of proceeding with the lawsuit, enabling some manufacturers with suboptimally safe products to escape liability. Under these conditions, a proportion of manufacturers choose to be negligent (Simon, 1981).

The complicated issues in products liability cases (many of which are discussed below) also make court error possible. A negligence standard with court error and costly litigation can lead to inefficiently high or low levels of safety (Hylton, 1990). An imperfectly enforced negligence standard can also give manufacturers inefficient incentives for adopting new safety technologies (Endres and Bertram, 2006) or acquiring information about risk (Shavell, 1992).

Strict liability, by contrast, is less costly for plaintiffs to enforce and easier for courts to administer, thereby avoiding many of the safety problems generated by an imperfectly enforced rule of negligence liability. In addition, the full price of the product under strict liability equals its sales price, resulting in the efficient amount of aggregate demand even when consumers are imperfectly informed. All told, strict liability is more efficient in the safety dimension.

The choice between negligence and strict liability ultimately involves the same tradeoff described in Section 11.9. Increased seller liability (that is, strict liability) is likely to yield efficient levels of safety and inefficient outcomes with respect to insurance and product variety, whereas decreased seller liability (negligence) is likely to cause safety problems while increasing product variety and reducing insurance costs.

11.11 Empirical studies of the effect of seller liability on product safety

The relationship between seller liability and product risk is hard to identify empirically. The available data do not directly measure the relationship,

and the injury rate is affected by a number of other factors such as changes in technology and the composition of product markets and consumer populations, undermining the conclusions one can draw from attempts to measure the impact that seller liability has had on product safety.

For example, Priest (1988a) compares the amount of products liability litigation to aggregate death rates and the rate of product-related injuries requiring emergency room treatment, concluding that the expansion in litigation had no discernible effect on accident rates. Although Priest acknowledges that the study is exploratory, Huber and Litan (1991, p. 6) assert that it raises 'serious doubts that the benefits of expanded seller liability have been large'. But as Dewees et al. (1996, p. 203) point out, Priest's study does not necessarily show anything about the relationship between seller liability and accident rates: 'Because the data sets fail to segregate accidents involving defective products from accidents involving nondefective products, any effect that the expansion of product liability may have had on the production of defective products could easily be lost among the vastly greater number of accidents involving nondefective products'.

Higgins (1978) relies on accidental fatalities in the home as a proxy for product-caused injuries. The econometric analysis finds that producer liability reduces the frequency of these accidents in states with low levels of educational attainment and increases it in states with high levels. Insofar as low educational attainment makes it more likely that consumers will be imperfectly informed, this study partially supports the claim that producer liability increases safety when consumers are not well informed of risk. However, in addition to the previously mentioned problems of relying on such aggregated accident data, this study is problematic because it measures the impact of producer liability in a state by reference to the year when its highest court adopted a form of producer liability involving the elimination of the contractual requirement of privity. This expansion in seller liability was unlikely to be significant enough to produce observable results, particularly since courts had previously recognized numerous exceptions to the privity doctrine, thereby exposing sellers to considerable liability for injuries suffered by victims with whom there was no direct contractual relationship.

Graham (1991) attempts to determine the relationship between products liability and passenger-car death rates. The regression does not detect any beneficial impact of liability on aggregate death rates, where the extent of liability is measured by an index based on the annual number of reported crashworthiness cases. Measuring liability rules in this manner is particularly problematic, however, because the vast majority of lawsuits are settled prior to trial. A very effective liability rule, for example, could cause all cases to settle, giving sellers a strong incentive to reduce risk. Graham's

model would not impute this risk reduction to the liability rule (nor would the study of Priest, 1988a). Moreover, MacKay (1991) argues that federal regulations of automobile design have forced all manufacturers toward a common standard, which undermines the attempt to derive a simple causal link between products liability and traffic accidents.

Other studies have circumvented these data problems (and created others) by asking producers how their behavior has been influenced by liability. Eads and Reuter (1983) conducted interviews with nine large manufacturers, concluding that products liability significantly influences product-design decisions. Based on interviews with 101 senior-level corporate executives from the largest publicly held companies in the US, Egon Zehnder International (1987) found that over half of these companies had increased their research and development budgets devoted to product safety, and added safety features as a result of liability concerns. About 20 percent of the companies chose not to introduce new products on account of products liability. Two other studies conducted by the Conference Board surveyed risk managers and CEOs of major corporations, finding that products liability concerns led to significant safety improvements while also causing a significant number of firms to discontinue product lines or not introduce new products (Weber, 1987; McGuire, 1988). The Egon Zehnder survey is probably the most reliable due to its excellent response rate; the Conference Board surveys had poor return rates and may have been influenced by a variety of biases (G. Schwartz, 1994a, pp. 408–10).

A different approach to evaluating the effects of seller liability examines the impact of products liability events on stock prices. Viscusi and Hersch (1990) find that news stories reporting on products liability suits significantly decrease a firm's stock value. Garber and Adams (1998) find no significant effects from verdicts entered against firms in the automobile and pharmaceutical industries, but Prince and Rubin (2002) find that all litigation-related events significantly reduced the value of these firms. Other studies find that product recalls cause a substantial drop in a firm's market value (for example, Jarrell and Peltzman, 1985, criticized by Hoffer et al., 1988; Rubin et al., 1988; Dowdell et al., 1992; Sloan et al., 2005; Takaoka, 2006). The reduced stock value generally costs the firm more than the associated liability or recall costs, although firms recover some of the lost market value as information on actual costs becomes available (Govindaraj and Jaggi, 2004). Any drop in the firm's market value, however, implies that the stock market has not fully accounted for the product costs in question, indirectly confirming that the market underestimates the risk posed by particular products. Moreover, the loss in stock value gives firms an additional incentive to avoid products liability litigation, providing

another reason for believing that seller liability increases manufacturer investments in product safety.

Rubin and Shepherd (2007) find that general reductions in tort liability stemming from tort-reform measures adopted by individual states, such as limitations on damage awards, were associated with an estimated 24,000 fewer deaths between 1981 and 2000. In their estimate, tort reforms specific to products liability were responsible for a reduced 16,841 deaths across all years. Rubin and Shepherd attribute the reduced fatalities to decreased prices for ‘risk-reducing products such as safety equipment, medicines, or medical services’ (*ibid.*, p. 24; compare Manning, 1994, 1997, finding that lower liability costs reduced the price of vaccines and prescription drugs). As Rubin and Shepherd acknowledge, their study involves state-level reforms that may not accurately measure safety effects attributable to national markets. This limitation significantly limits their findings. A reform that reduces liability in one state will not ordinarily affect the safety decisions of a manufacturer supplying the national market (compare Hay, 1992). For these products, an individual state can reduce producer liability without negatively impacting product safety within the state, even though those safety investments are induced by the products liability rules in other jurisdictions. The study is also subject to many of the limitations inherent in Priest (1988a) discussed at the outset of this section, further illustrating the difficulty of teasing out causal relationships from aggregate data sets that do not directly measure how liability rules affect manufacturer investments in product safety or otherwise distinguish between injuries caused by defective and nondefective products.

11.12 The impact of tort liability on innovation and productivity

The political debate regarding products liability reform in the US has often involved the claim that tort liability reduces innovation and undermines the competitiveness of domestic products in a global economy. Tort liability probably has reduced some types of innovation, but the welfare effects of that reduction are unclear, particularly since it is even more likely that tort liability has also induced beneficial safety innovations.

Relative to a rule of no liability, tort liability can increase a producer’s cost by forcing the firm to increase its safety investments (see Section 11.4). Tort liability also requires that firms make disclosures in product warnings that enable imperfectly informed consumers to make better estimates of accident costs (see Section 11.18). Insofar as tort liability increases safety investments and consumer estimates of accident costs, there is an increase in the product’s full price. In these circumstances, tort liability can encourage safety innovations much in the same way that other cost-driven price increases, such as those stemming from labor scarcity, induce innovation.

An increase in cost enhances the profitability of any innovation reducing that cost. The resultant increase in firm demand for such technical change should produce more innovation, a theory of technical change called *induced innovation*. This theory has substantial analytical and empirical support for innovations unrelated to product safety (Thirtle and Ruttan, 1987; Popp et al., 2007). There is no apparent reason why the theory does not apply to safety innovations, particularly since the results from the traditional economic model of tort law are quite analogous to those obtained in a dynamic model of induced innovation (Endres and Bertram, 2006).

For example, an optimal research and development (R&D) program without a fixed budget will expend resources until the marginal cost of additional research equals the marginal benefit. The benefit depends on the potential cost savings from the research, and those savings are increased as firms face increased tort liability. Expansions in tort liability, therefore, should increase R&D expenditures for safety technologies. This conclusion is consistent with the analytical results obtained by Daughety and Reinganum (1995), and the empirical study by Egon Zehnder International (1987) finding that over half of the surveyed companies had increased their R&D expenditures as a result of liability concerns. Insofar as the increased R&D expenditures have yielded more safety innovations, tort liability has promoted safety innovation.

A liability rule that increases the product's price can have a negative effect on innovations unrelated to product safety. Assuming that the increased price reduces consumer demand, both theory (Binswanger, 1974) and historical evidence (Schmookler, 1966) indicate that the reduced profitability of the product line discourages innovation. This conclusion finds further theoretical support in Viscusi and Moore (1993), which shows how the firm's increased expenditures on developing safety improvements can decrease R&D expenditures on new products or processes.

Viscusi and Moore (1991a, 1991b, 1993) study the effect of liability costs on innovation, finding that firms with new products have higher liability insurance costs. Econometric analysis shows that increased seller liability increases safety incentives, but at some point further increases in liability reduce innovation by making new products unprofitable (*ibid.*, 1991b, 1993). One study (1993) shows that ten industry groups were at or near this threshold in the mid-1980s, indicating that the incentive effects of seller liability vary across industries. This variable effect is confirmed by case studies of different industries regarding the impact of tort liability on innovation (Ashford and Stone, 1991; Craig, 1991; Graham, 1991; Johnson, 1991; Lasagna, 1991; Martin, 1991; Swazey, 1991). The variable effect finds theoretical support in Takaoka (2005), which identifies parameters under which increased liability will reduce a monopolist's R&D

investments when consumers are uninformed of both those investments and product quality.

Products liability can also affect innovation due to its influence on the structure of business organization. If a firm suspects that a product may pose long-term risks that are likely to cause widespread injury, it has an incentive to avoid paying damages by divesting production tasks that involve such products (MacMinn and Brockett, 1995). This incentive is consistent with empirical studies finding that increased seller liability apparently increased the number of small corporations in hazardous sectors (Ringleb and Wiggins, 1990; see also Merolla, 1998; Brooks, 2002). To insulate itself from legal liability, the parent company must divest early in the R&D stage. Once firms have fully divested the hazardous product lines, economies of scale in care technology will affect the size of these firms, for example, whether the divested firm produces only one type of hazardous product or a number of such products (van't Veld, 2006). But insofar as the reorganized firm is unable to capture fully any economies of scale in care technology, tort liability will have increased innovation costs.

Products liability could also affect social welfare by altering productivity. Campbell, Kessler, and Shepherd (1998) find that states which reduced tort liability by legislative reform during 1970 to 1990 experienced greater increases in aggregate productivity than states that did not. The study measures productivity in terms of constant-dollar gross state product for workers, which has an ambiguous relationship to safety and is a questionable measure of productivity in any event (Klevorick, 1998). 'In particular, if a liability-reform-induced change in relative prices were to change the optimal factor proportions, and specifically the labor-capital mix, the resulting substitution would be reflected [inaccurately] as a change in productivity – when measured, as here, by labor productivity – when in fact there has been no change in the relevant isoquants' (ibid., p. 143). Such an outcome seems highly likely. The study measures reductions in tort liability with legislative reforms, an important governmental signal of a 'business friendly' environment that could readily attract new investment, thereby reducing the cost of capital and increasing the demand for, and cost of, labor within the jurisdiction. Consequently, 'the observed positive relation between state-level labor productivity and reforms that reduce liability pressure then could reflect zero-sum capital flows among the states, not a more efficient allocation of resources at the national level' (ibid., p. 147).

11.13 Products liability and the market for liability insurance

A report published by the US Attorney General's Tort Policy Working Group concluded that increased tort liability was a major cause of the so-called 'liability insurance crisis' that occurred in the mid-1980s (US

Department of Justice, 1986). During this period, the amount of net written premiums for liability insurance tripled, the supply of coverage severely contracted, and insurer profitability declined considerably (Priest, 1987; Viscusi, 1991a, pp. 27–30). To stabilize the insurance market, most states enacted tort reform measures that limit tort liability.

It is unclear why the liability-insurance market would contract because of expanded tort liability. Increased liability should increase the demand for liability insurance, causing an expansion of the market and increased profitability. This conundrum has attracted much attention, leading to a number of different explanations for the liability-insurance crisis (surveyed in American Law Institute, 1991a, pp. 66–97). Scholars have subsequently identified a number of factors that explain why the insurance industry goes through cycles of ‘hard’ and ‘soft’ markets (surveyed in Baker, 2005). For our purposes, the most interesting finding to emerge from this literature pertains to the way in which legal uncertainty affects the cost of liability insurance.

The typical liability-insurance policy covers a product seller’s legal liability for personal injury or property damage that ‘occurs’ to third parties during the policy period. In product cases, a number of years typically pass before the policyholder incurs legal liabilities covered by the policy. To forecast its expected costs, a liability insurer needs to predict whether tort law, damage awards, and insurance law (like the interpretation of an ‘occurrence’) will change during the lengthy period between the issuance of the policy, manifestation of injury, and conclusion of the lawsuit. Under conditions of legal stability, the insurer can confidently predict its liability exposure based upon prior experience. In the 1980s, however, liability insurers faced various sources of legal uncertainty, making it difficult to predict the likelihood or magnitude of covered losses (Abraham, 1987; Trebilcock, 1987). This increased uncertainty increased the variance of the insurer’s expected loss and thus the cost of bearing that risk (Venezian, 1975; Froot and O’Connell, 1999). Actuaries, underwriters and insurers report that they will add an additional cost above the expected value of loss when there is uncertainty (or ‘ambiguity’) regarding the probability or magnitude of the insured-against loss (Kunreuther et al., 1993). Consistently with this result, an econometric study involving a large number of insurance policies issued during 1980–84 finds that risk ambiguity tended to exert a positive influence on actual premium rates, controlling for the regulated rate (Viscusi, 1993a). As a matter of economic theory, uncertainty can affect the industry supply of liability insurance in this manner due to the higher cost of outside capital (Winter, 1991), with a recent example provided by the market response to terrorism insurance after September 11, 2001 (Cummins and Lewis, 2003).

Thus, in addition to affecting the demand for insurance, products liability can affect the supply of insurance by increasing legal uncertainty. The uncertainty can be particularly problematic due to the correlated losses among individual products that are defective in design or warnings (discussed in Sections 11.17 and 11.18). Each product has the same design and warning, and so a finding of defect in an individual case can render the entire product line defective in this respect. The asbestos cases provide an extreme example, involving estimated total liabilities of \$199 to \$264 billion (Congressional Budget Office, 2003, p. 7).

By accounting for the detrimental impact of legal uncertainty on the supply of insurance, it becomes more understandable why liability insurers have lobbied for tort reforms that significantly reduce the demand for their product. The reforms limit liability in various ways, but each addresses a significant source of legal uncertainty (Geistfeld, 1994).

Empirical studies have found that the legislative reductions in tort liability increase the profitability and availability of liability insurance (Born and Viscusi, 1999; Viscusi, 1990a; Viscusi et al., 1993). These findings do not establish that the liability-reducing reforms were efficient, however. The increased insurance costs of the 1980s could have internalized costs that had been externalized prior to the expansion of seller tort liability, producing more efficient levels of deterrence (Croley and Hanson, 1991). Like other issues, empirical findings regarding one market effect do not provide enough information to reach conclusions regarding the overall efficiency of products liability. As a nonpartisan body of the US government recently concluded, 'the current state of data and economic analysis do not allow [us] to judge whether the costs of the tort system are efficient or excessive on the whole' (Congressional Budget Office, 2003, p. 23).

11.14 Introduction to the main doctrines of products liability

In both the EU and US, commercial product sellers are subject to strict liability when a defect in their product causes *physical harm* – bodily injury or damage to other tangible property. The rule is truly one of strict liability, however, only when the defect prevents the product from performing its intended function. For defects of design or warnings, the rule is one of negligence liability for manufacturers. The defect could have been cured by a reasonable design or warning, so manufacturers incur liability only when engaging in unreasonably dangerous practices – the result attained by negligence liability. Subsequent sellers of the product, however, are strictly liable for the defect. The rules of products liability accordingly contain pockets of both negligence liability and strict liability. Regardless of the type of defect, the scope of products liability is then limited by contractual considerations.

Having previously analyzed the costs and benefits of contracting, negligence, and strict liability, we can use those results to analyze the efficiency properties of various products liability doctrines. Consequently, the ensuing discussion will delineate the role of contracting, negligence, and strict liability, while raising new considerations relevant to the analysis. Geistfeld (2006) provides a comprehensive overview of US law and discusses the economic implications of various doctrines, and Stapleton (1994) analyzes and discusses the EC law of products liability.

11.15 The requirement of defect

Strict liability only applies to defective products. This requirement substantially reduces insurance costs while allowing tort law to regulate product safety by specifying the safety attributes that are required in order for a product to be nondefective (Geistfeld, 2006, pp. 51–8).

Under the rule adopted by most states and the EC products liability directive, a product is defective when it frustrates the safety expectations of the ordinary consumer. Other states determine whether a product is defective in design or warning with the *risk-utility test*, which balances the reduced risk created by a safety investment against the disutility or cost of the investment. Properly understood, each test is complementary and necessary for completely specifying the liability rules (ibid., pp. 59–68).

The concept of consumer expectations enables tort law to account for the appropriate role of contracting over product risk. When the ordinary consumer faces low information costs and can make the safety decision on an informed basis, both her actual and reasonable expectations of product safety will be satisfied. In these circumstances, contracting adequately protects consumer interests, eliminating the possibility that the consumer could reasonably expect the seller to provide even more safety. Courts exclude these cases from the ambit of tort liability by two different methods. The most common approach expressly recognizes that liability is inappropriate because consumer expectations are satisfied, preventing the product from being defective in the manner alleged by the plaintiff. The alternative approach absolves the product seller of any tort duty in these circumstances without making an express finding on the issue of defect. Regardless of the doctrinal label, products that satisfy both actual and reasonable consumer expectations of safety are not subject to tort liability, thereby protecting an important sphere of consumer choice in product markets.

By contrast, when information costs prevent the ordinary consumer from making an informed safety decision, products can be more dangerous than expected by the consumer, creating an efficiency-enhancing role for tort liability. The tort duty protects consumers only because they are

unable to make informed product choices, and so the tort duty can require the amount of product safety that would be chosen by consumers if they were adequately informed. A well-informed consumer reasonably chooses the amount of product safety that best promotes her interests or well-being, excluding instances of bystander injury (discussed in Section 11.22). Reasonable consumer expectations are frustrated by a product lacking a safety investment that costs less than the associated reduction of expected accident costs, rendering the product defective and subject to liability. The same outcome is produced by the risk-utility test. Rather than representing competing conceptions of tort liability, the otherwise vague concept of reasonable consumer expectations can be concretely expressed by the risk-utility test.

So too, the concept of reasonable expectations gives much-needed content to the risk-utility test. Traditionally, courts in the US have applied the risk-utility test in a manner that does not correspond to the requirements of cost-benefit analysis (Viscusi, 1990b). Indeed, the courts have not even adopted a uniform approach to applying the risk-utility factors (Owen, 1997). Once conceptualized in terms of reasonable consumer expectations, the content of the risk-utility test becomes apparent. Consumers reasonably expect a product design to balance risk reduction against the disutility of the associated safety investment in whatever manner best promotes consumer welfare. The concept of reasonable consumer expectations can provide courts with the missing guidance on how to apply the risk-utility factors, thereby improving products liability both as a matter of efficiency and fairness (see Section 11.1).

11.16 Construction or manufacturing defects

A construction or manufacturing defect occurs when the product departs from its intended design. Materials or component parts of the product can be flawed or contaminated; the product can be improperly assembled or constructed; or the product can be improperly packaged. These defects can also occur after the product has been constructed or manufactured. Delivery of the product can create the defect, as when a soda bottle is mishandled during delivery and incurs hairline fractures that unduly weaken the bottle, causing it to explode when lifted by the consumer. In all these instances, the defect is defined by reference to the product's departure from its intended specifications, obviating the need for the court to define defect by relying on consumer expectations or the risk-utility test.

This type of defect implicates the quality control of manufacturing, inspection, and delivery processes. Perfect quality control ordinarily is neither attainable nor desirable, and so some products containing these defects will reach the marketplace. Whenever such a defect causes physical

harm, the seller is liable regardless of whether it employed the most efficient quality-control measures.

Most agree that strict liability is the efficient rule for these cases. Plaintiffs will often be unable to prove that the seller or one of its agents did not use appropriate quality-control measures, which tend to involve complex systems or unverifiable workplace behavior, posing difficult problems of proof in the courtroom. Insofar as these precautions are effectively immune from negligence liability due to problems of proof, strict liability can restore the seller's incentive to adopt efficient quality-control measures (Shavell, 1980). Strict liability may also be more efficient because it gives sellers a better incentive to foster advances in technology that reduce the incidence of these defects (Landes and Posner, 1985).

11.17 Design defects

Many of the most important and vexing issues in products liability involve defective product design. These claims implicate the entire product line. A finding that the product is defectively designed means that all products with the design are defective. The potential extent of liability vastly exceeds the manufacturer's liability for defects in construction or manufacturing, which usually are aberrational departures from the rest of the product line. The large stakes at issue in design cases create a practical need for well-defined liability rules, which in turn has created a pronounced problem. The courts have had a hard time deciding whether design defects should be defined in terms of consumer expectations, the risk-utility test, or some combination thereof.

The different approaches can be attributed to the path-dependent effects of case selection within a particular jurisdiction, with a more complete set of cases over time causing the various jurisdictions to converge towards the efficient rule (Geistfeld, 2006, pp. 85–102). According to the *Restatement (Third) of Torts: Products Liability*, 'the test is whether a reasonable alternative design would, at reasonable cost, have reduced the foreseeable risks of harm posed by the product, and if so, whether the omission of the alternative design rendered the product not reasonably safe' (American Law Institute, 1998, p. 19). The way in which the risk-utility test depends on 'reasonableness' can be developed by the concept of reasonable consumer expectations, yielding a cost-benefit test for defective product design (see Section 11.15).

A design is defective if it does not incorporate safety features costing less than the associated reduction of expected injury costs, making it 'unreasonably dangerous' in the parlance of tort law. Proof of such a defect is tantamount to proof of negligence – the creation of an unreasonably dangerous risk – and so this issue is resolved by a negligence rule. (The only

exception involves designs that prevent the product from performing its intended function, which are defective *per se*.)

The biggest problem with this form of negligence liability involves the court's ability to evaluate the complex engineering issues involved in product design (Henderson, 1973; A. Schwartz, 1988). Courts typically do not make this determination by comparing the defendant's product design with other designs in the market, and defining defect in terms of 'relative safety' is unlikely to be efficient in any event (Boyd and Ingberman, 1997a). Since the defect applies to the entire product line, an erroneous finding of liability is particularly problematic. Any uncertainty about the matter will have significant repercussions, suggesting that design-defect litigation has significantly influenced developments in the market for liability insurance (see Section 11.13).

Due to the difficulty of determining whether a product is defectively designed, courts have limited the scope of tort liability for design defects in a manner that fosters product differentiation. Courts are unwilling to consider whether a product is defective no matter how it is designed – a claim of *categorical liability*, recognizing that they cannot competently evaluate the total costs and benefits of a product (Henderson and Twerski, 1991). For example, courts will not consider whether a subcompact car is defectively designed merely because larger (more expensive) cars are safer. Instead, design-defect litigation involves modifications to existing product lines (like redesigning the gasoline tank in a subcompact car to reduce the risk of explosion). Limiting the scope of tort liability in this manner allows the market to determine the viability of product lines (subcompact cars versus larger, safer cars), which enhances the likelihood that product lines can be varied to better satisfy consumers of different types.

This limitation of liability is also likely to be efficient. The tort duty requires that the product must be free of manufacturing or construction flaws. The tort duty also requires that each product design within any category must be reasonably safe. These tort duties guarantee the reasonable safety of all products within any category, enabling the ordinary consumer to focus on risk-utility comparisons across product categories. In making choices across product categories, the ordinary consumer also benefits from the duty to warn, which guarantees that the product warning provides the ordinary consumer with the material information required for informed safety decisions (see Section 11.18). Once the information already held by the ordinary consumer is supplemented by the information provided by the product warning, she presumably is able to make an informed categorical choice, illustrating once again how tort liability does not apply to cases in which the ordinary consumer can make adequately informed safety choices.

11.18 Warning defects

When high information costs prevent consumers from making adequately informed decisions about product safety, product sellers will not necessarily voluntarily disclose information about product risk (see Section 11.6). As a result of this informational problem, product sellers have a duty to disclose information about any product risk that would be material to the ordinary consumer's purchase and use decisions. A product that does not adequately warn or instruct the consumer about these product risks is defective.

As in the case of design defects, courts have used either the consumer-expectations test or the risk-utility test to define warning defects. To satisfy either test, the warning must provide the minimal amount of information necessary for the ordinary consumer to estimate the product's full price, which can occur only if the warning increases the consumer's information by describing unavoidable risks and cost-effective safety instructions that are not obvious or otherwise commonly known. By not disclosing such risks, the warning is both defective and unreasonably dangerous, and so the liability rule in this respect is one of negligence.

The most problematic aspect of this form of tort liability relates to the cost of disclosure. '[I]n failure-to-warn cases the common assumption is that warnings can be improved upon but can never be made worse; that is, the issue at stake is always whether the defendant ought to have supplied consumers with more, and by definition better, information about product risks' (Henderson and Twerski, 1990, pp. 269–70). More information is always better only if the cost of warnings is insignificant. Consistently with this reasoning, courts routinely hold that the 'minimal' cost of product warnings 'usually weighs in favor of an obligation to warn' (*Anderson v. Hedstrom Corporation*, 1999, p. 440).

Not surprisingly, this liability rule gives product sellers an incentive to over warn. For example, aluminum extension ladders have had up to 44 different warnings and directions (Waldman, 1988, p. 40). Not only does an added disclosure protect the seller from liability for a warning defect, excessive disclosure also dilutes the overall negative impact of the product warning on the consumer's overall assessment of the product, further benefiting the seller. The consumer incurs a cost by reading and remembering the various disclosures in a warning. Individuals will stop reading a warning if they find that the benefit of reading is not worth the effort. Empirical studies have found that the amount and format of hazard information contained in a product warning affects consumers' ability to recall the information, so that added disclosures can reduce the effectiveness of other disclosures in the warning (for example, Magat and Viscusi, 1992). A liability rule that induces the disclosure of too much information is self-defeating.

Due to this problem, an increasing number of courts have held that the risk-utility test for warnings should account for the consumer's costs of processing information. Based on this line of cases, the *Restatement (Third) of Torts: Products Liability* incorporates information costs into the definition of warning defect (American Law Institute, 1998, pp. 29–30). The doctrinal foundation for this rule is substantially broader. Tort law overrides contractual choices of product safety because of the way in which information costs hamper informed consumer decisionmaking about product safety. The tort duty is predicated on information costs, and so the substantive content of any duty to facilitate consumer decisionmaking should also account for those costs.

At present, however, jury instructions in the US do not highlight information costs or require the jury to consider how an additional warning would affect the consumer's understanding of the entire warning. It may be possible to reformulate jury instructions to enable jurors to account for information costs (Geistfeld, 2006, pp. 143–50), although the possibility remains that courts cannot competently evaluate information-processing costs (Latin, 1994, p. 1284).

A warning defect, like a design defect, can be defined by reference to information that is available at the time of trial (the *hindsight test*), even if the risk was not reasonably foreseeable at the time of product sale. A few states have adopted the hindsight test, although the vast majority requires disclosure of only those risks that were known or should have been known at the time of sale. A similar split has occurred among the members of the EU with respect to the *development risk defense*. In all these jurisdictions, the seller is strictly liable for the warning defect, but whether the warning is defective depends either on a rule of negligence liability (reasonable foreseeability/the development risk defense) or strict liability (the hindsight test).

As in the case of quality-control measures, the difficulty of proving negligence can justify strict liability. To prove that the seller should have discovered a previously unknown risk, the plaintiff must show what 'reasonable testing would reveal'. This proof is extraordinarily demanding. The plaintiff must establish the parameters of a reasonable research program covering all product hazards potentially posed by the manufacturer's full line of products, and then show that such a research program would have identified the particular product risk that caused the plaintiff's injury. Establishing an appropriate research budget and scope of research projects requires wide-ranging, costly proof. As a practical matter, plaintiffs ordinarily cannot prove that the manufacturer should have discovered a risk that was not otherwise known within the scientific community. Due to the

difficulty of proof, sellers are effectively immune from this form of liability, undermining their incentives to research product risks (Wagner, 1997).

A full regime of strict liability for all product-caused injuries gives sellers an incentive to discover the efficient amount of information (Shavell, 1992; Kaplow and Shavell, 1996). The hindsight test, however, only creates a pocket of strict liability within a body of negligence liability for design and warning defects, thereby distorting incentives in a manner having ambiguous welfare effects (Ben-Shahar, 1998). Moreover, unforeseeable risks pose a hard actuarial problem for liability insurers, making the provision of insurance substantially more difficult. Liability attaches to the entire product line for risks that were not actually known at the time of sale (and issuance of the policy). This extreme form of uncertainty for highly correlated risks can make the risk uninsurable (compare Faure and Fenn, 2000).

Without data on the respective costs and benefits of each approach, we cannot determine which liability rule is more efficient. This indeterminacy, however, explains why different jurisdictions can reach different conclusions about the appropriate liability rule while still relying on substantively equivalent conceptions of products liability.

11.19 Extended seller liability

The rule of strict products liability applies both to the manufacturer of the defective product and to any other entity that commercially distributes the product, including wholesalers, retailers, and restaurant operators. Product sellers can incur liability regardless of whether they could have reasonably prevented the defect from occurring. In these cases, the rule truly is one of strict liability.

Once the retailer has incurred liability for the product defect, it can be indemnified by other product sellers further up the distribution chain. When all members of the producing and marketing enterprise are solvent, the indemnity actions will pass liability along to the party responsible for the defect, thereby creating the correct safety incentives. Of course, an upstream distributor or the manufacturer can be insolvent, leaving a nonmanufacturing seller without recourse. That prospect, however, gives sellers an incentive to deal with financially sound distributors and manufacturers. And to the extent that a seller is concerned about liability, it has an incentive to engage in independent product testing, a practice that is increasingly being adopted by large US retailers of products manufactured by foreign firms.

To be sure, this efficiency rationale is problematic. Even if the retailer can be indemnified, it must incur substantial legal costs to achieve this outcome. Why permit the plaintiff to sue the retailer when recovery is available from the manufacturer? Inclusion of the retailer in the suit merely

raises the cost of distribution (and product price) without providing any safety benefit. Moreover, a small business can sell hundreds of products from different manufacturers and distributors. Does a small business have knowledge of these varied product risks? Finally, liability concerns can distort other firm decisions and patterns of trade, producing welfare losses (Boyd and Ingerman, 1997b). These problems help to explain why at least 17 states have enacted tort-reform statutes limiting the liability of a non-negligent, nonmanufacturing product seller to cases in which the plaintiff cannot recover from the manufacturer.

11.20 Defenses based on consumer conduct

In most jurisdictions, a plaintiff whose misuse of the product combined with the defect in causing the injury will have her recovery reduced, based upon a comparison of her responsibility with that of the product sellers. Whether comparative responsibility is less efficient than barring the plaintiff from recovery depends on a variety of factors (Bar-Gill and Ben-Shahar, 2003). Nevertheless, the doctrine is unlikely to reduce consumer incentives to exercise care while using products. Numerous studies have found that individuals rarely initiate liability claims for accidental injuries (for example, Hensler et al., 1991, p. 127). Ordinarily, the consumer will not expect to recover any damages from the seller, and so comparative responsibility will not significantly influence her decision of how to use the product. By contrast, denying recovery altogether to someone who misused the product can create safety problems. For example, suppose a car is defective for having tires that explode once the car is driven at least 5 miles per hour above the legal speed limit. Anyone who drives the car at such a speed is acting unreasonably by driving in excess of the legal speed limit. If the plaintiff's contributory negligence always barred recovery, the car manufacturer would never be liable for defects involving the risk of speeding. To give manufacturers an incentive to reduce the risks of foreseeable product misuse, those plaintiffs who misuse the product must be able to receive some damages, the result attained by comparative responsibility. The award of compensatory damages, in turn, makes it possible for the plaintiff to receive punitive damages when required for deterrence purposes, thereby giving sellers an adequate incentive to supply products that are not defective in this respect (see Section 11.24 below).

11.21 The enforceability of contractual waivers of seller liability

Contract terms that disclaim a seller's liability for product defects ordinarily are not enforceable unless the disclaimer pertains to cases in which a product damages itself, causing financial losses such as repair costs and lost profits, but does not cause bodily injury or damage to any other tangible

property. Contracting probably is a more efficient way to allocate liability for this form of damages, typically called *economic loss*, because buyers have better control over and information regarding the magnitude of loss (Jones, 1990). Moreover, allowing sellers to disclaim liability for economic loss is unlikely to have significant deterrence effects, as the seller is fully liable whenever the defect causes physical harm.

A number of scholars argue that it would be efficient if courts were to enforce a greater variety of contractual limitations of seller liability (for example, Epstein, 1989; Rubin, 1993). Unless the contracting process is structured to give consumers risk-related information, these proposals raise the same safety–insurance tradeoff presented by any proposal to limit a seller’s tort liability (see Section 11.9).

Contracting could increase risk-related information if the enforceability of a disclaimer is conditioned on the requirement that the seller provides a separate price quotation of its liability costs under a rule of strict liability. Such a price tells consumers something about the product’s safety and enables them to compare safety across brands (Geistfeld, 1988; A. Schwartz, 1988). Nevertheless, imperfectly informed consumers are still likely to disclaim seller liability when it would be inefficient to do so (Geistfeld, 1994). Giving consumers the opportunity to sell their unmatu- red tort claims to third parties also has interesting possibilities (Cooter, 1989b; Choharis, 1995), although this reform may also lead to inefficient reductions in seller liability (A. Schwartz, 1989). These proposals do not resolve the regulatory problem, but measures like them that enhance information and facilitate contracting are a promising approach to efficient reform (A. Schwartz, 1995).

11.22 Bystander injuries

By focusing almost exclusively on the consumer, our approach so far reflects the orientation of products liability. The consumer includes the buyer and other users of the product. The buyer pays for the safety precautions and guarantees of injury compensation via the associated price increases. One who buys a product frequently contemplates that it will be used by others, typically family members, friends, or employees. In making the purchase decision, the buyer presumably gives equal consideration to the welfare of these other users, including employees (due to either liability concerns or the need to minimize the cost of compensating the employee for facing work-related risk). The interests of these parties coincide, making it defensible to conceptualize the consumer as including both the buyer and any other reasonably foreseeable user of the product. Most cases involve these types of plaintiffs, explaining why products liability rules are framed in terms of consumer interests.

A liability rule that maximizes consumer welfare, however, may not adequately protect third parties or bystanders from the risk of product-caused injury. If the consumer were strictly liable for bystander injuries and financially capable of paying damages, then consumer-only liability is more efficient than manufacturer liability (Hay and Spier, 2005). But under current law, negligence liability is the default rule for accidental harms, and so the consumer is not forced to internalize fully the costs of third-party injuries. Moreover, the consumer of a defective product is not ordinarily negligent towards bystanders who were injured by the product defect, leaving the manufacturer or other product sellers as the only potentially responsible parties for such liability. Consequently, the US courts quickly extended the rule of strict products liability to encompass bystanders, thereby internalizing these product costs into the product price. The EU accomplishes this objective by framing the liability rule in terms of the safety expectations of a *person* rather than just the consumer.

11.23 Compensatory damages

For cases in which the product defect causes *physical harm* – bodily injury or damage to tangible property – tort law provides the plaintiff with the greatest range of damage remedies. In these cases, the plaintiff can receive compensatory damages for the bodily injury, pain and suffering, property damage, and the economic losses caused by the defect.

A different rule applies to cases in which the plaintiff suffers only economic loss consisting of damage to the product itself and ensuing financial harms, such as repair costs, decreased product value, and reduced profits or earnings. In strong majority jurisdictions, a seller is not liable in tort for these damages pursuant to the *economic loss rule*. By excluding these damages from tort liability, the law allows the parties to allocate purely financial liabilities by contracting, which is probably the most efficient outcome given the consumer's informational advantage regarding the magnitude of the losses and the degree of product safety otherwise guaranteed by the tort duty governing the risk of physical harm (see Section 11.21).

The most controversial component of compensatory damages involves awards for the nonmonetary injuries of pain and suffering. These damages are likely to be an inefficient form of insurance (for example, Danzon, 1984; Calfee and Rubin, 1992; Frech, 1994). One proposed remedy is to eliminate this item of damages (thereby eliminating the insurance inefficiency) while requiring that firms pay a fine to the state equal to the amount needed for efficient deterrence (Shavell, 1987; Polinsky and Che, 1991). Eliminating these damages within the current system is unlikely to be efficient, however. Even if pain-and-suffering damages inefficiently

insure against that particular injury, a complete efficiency analysis must account for the deterrence value of the tort award; that consumers are not optimally insured against all other tortiously caused injuries, such as legal expenses; and that sellers are not forced to internalize the cost of all tortiously caused nonmonetary injuries, most notably, the loss of life's pleasures caused by premature death. Revising the analysis to account for these factors shows that nonmonetary damages could be efficient if courts were to instruct juries on how to calculate the appropriate award, which is based on consumer willingness to pay to eliminate the risk (Geistfeld, 1995b).

At present, however, courts do not instruct jurors on how to compute the award, producing variable awards that significantly increase the uncertainty of legal liability (*ibid.*). A large number of states have responded to the problem by limiting these awards, typically by capping the amount at figures like \$250,000. These reforms inequitably shift injury costs to the most severely injured plaintiffs without solving the underlying problem.

11.24 Punitive damages

Punitive or extracompensatory damages have become a focal point in the debate over products liability reform in the US, even though they are awarded infrequently (for example, Rustad, 1992). The awards have undeniable benefits that are offset, perhaps completely, by problems of implementation.

Punitive damages can be efficient when victims with valid legal claims do not sue, enabling sellers to escape liability in some cases (for example, Cooter, 1989a). If only 50 percent of all victims sue, for example, compensatory damages must be doubled if the seller is to internalize the full cost of injury. The optimal adjustment to the compensatory damages award, however, depends on a variety of other factors such as the possibility of court error (Polinsky and Shavell, 1989), the impact of litigation costs on social welfare (Polinsky and Rubinfeld, 1988), the impact of publicity on the likelihood of suit (Yun, 2004), and risk aversion (Craswell, 1996). Punitive damages can also make product price more capable of signaling product quality (Daughety and Reinganum, 1997).

It is doubtful that jury awards of punitive damages are based on these economic considerations. Juries typically are given little or no instruction on how to compute the appropriate award. Even when provided with the relevant information, (mock) jurors base the award on anchoring effects supplied by the plaintiff's attorney or media coverage of similar awards (Viscusi, 2001).

Indeed, the legal standard governing punitive damages is misleading in product cases. The standard has been substantially, if not wholly

influenced by the intentional torts governing deliberately caused harms (for which punitive damages were available under the early common law). This standard is highly problematic in a products case, where the critical issue is not whether the manufacturer's actions were deliberate (they usually were), but whether the manufacturer knew it was selling a defective product.

By focusing on deliberate conduct rather than on the seller's awareness of defect, the inquiry can easily lead to unwarranted punitive damages. If hindsight shows that the manufacturer erred in concluding that the cost of a safety improvement outweighed the benefit of risk reduction, then even if the manufacturer thought that the product was optimally safe, the legal standard for punitive damages may be satisfied. In choosing not to decrease risk out of cost concerns, the manufacturer engaged in 'wanton' or 'wilful' conduct that 'consciously disregards the safety of others', the type of behavior subject to punitive damages under standard jury instructions. Any type of cost-benefit balancing involving the risk of injury may be subject to punitive damages, the outcome in some cases that has also been reproduced by a mock juror study (Viscusi, 2000). To avoid this outcome, manufacturers in design-defect cases often are unwilling to admit that they made safety decisions on the basis of cost considerations (G. Schwartz, 1991a). This is a perverse result given that the legal test for design defects relies on cost-benefit balancing, and indicates that the punitive damages standard undermines the accuracy of legal determinations of design defect.

11.25 The evolution of products liability, and the evolution of economics

Today, it often is easy to critique products liability with economic analysis. Yet one could just as readily rely on products liability to criticize the methodology of economics. The rule of strict products liability was firmly entrenched in the US by the mid-1970s, with courts relying on consumer informational problems and insurance considerations to justify the imposition of tort liability on product sellers. By contrast, the state of economic analysis was lagging far behind. Economists were still studying the market behavior of perfectly informed, completely rational actors, and the economics of insurance was not well understood. Matters have changed considerably since then, with economists now regularly addressing the types of problems that courts have long had to confront without the aid of economic analysis. Viewed from this perspective, the performance of the legal system is much more impressive than it might otherwise seem. There is still considerable room for improvement, but unlike in the past, legal decisionmakers can now rely on a substantial and growing body of economic literature.

Bibliography

- Abraham, Kenneth S. (1987), 'Making Sense of the Liability Insurance Crisis', *Ohio State Law Journal*, 48, 399–411.
- Abraham, Kenneth S. (1988), 'The Causes of the Insurance Crisis', in Walter Olson (ed.), *New Directions in Liability Law*, New York: The Academy of Political Science, pp. 54–66.
- Abraham, Kenneth S. (1990), 'Products Liability Law and Insurance Profitability', *Journal of Legal Studies*, 19, 837–44.
- Abraham, Kenneth S. (2002), 'The Insurance Effects of Regulation by Litigation', in W. Kip Viscusi (ed.), *Regulation through Litigation*, Washington, DC: AEI-Brookings Joint Center for Regulatory Studies, pp. 212–32.
- Adams, Michael (1987a), 'Ökonomische Analyse der Produkthaftung (Economic Analysis of Product Liability)', *Der Betriebs-Berater*, 87.
- Adams, Michael (1987b), 'Produkthaftung – Wohltat oder Plage – Eine ökonomische Analyse (Product Liability – Benefit or Plague – An Economic Analysis)', *Der Betriebs-Berater*, 3124.
- Adams, Michael (1989), 'Ökonomische Begründung des AGB-Gesetzes – Verträge bei asymmetrischer Information (The Economic Basis of the German Unfair Contract Terms Law)', *Der Betriebs-Berater*, 781–8.
- Adams, Michael (1995), 'The Conflict of Jurisdictions – An Economic Analysis of Pretrial Discovery, Fact Gathering and Cost Allocation Rules in the United States and Germany', *European Review of Private Law*, 3 (1), 53–94.
- Akerlof, George A. (1970), 'The Markets for "Lemons": Qualitative Uncertainty and the Market Mechanism', *Quarterly Journal of Economics*, 84, 488–500.
- Allen, Franklin (1984), 'Reputation and Product Quality', *Rand Journal of Economics*, 15, 311–27.
- American Law Institute (1965), *Restatement (Second) of Torts*, Philadelphia: The American Law Institute.
- American Law Institute (1991a), *Reporters' Study, 'Enterprise Liability for Personal Injury: Volume I, The Institutional Framework'*, Philadelphia: The American Law Institute.
- American Law Institute (1991b), *Reporters' Study, 'Enterprise Liability for Personal Injury: Volume II, Approaches to Legal and Institutional Change'*, Philadelphia: The American Law Institute.
- American Law Institute (1998), *Restatement of the Law (Third) of Torts: Products Liability*, Philadelphia: The American Law Institute.
- Arlen, Jennifer H. (1992), 'Book Review: W. Kip Viscusi, Reforming Products Liability', *Journal of Economic Literature*, 30, 2170–72.
- Arlen, Jennifer H. (1993), 'Compensation Systems and Efficient Deterrence', *Maryland Law Review*, 52, 1093–136.
- Armstrong, Dwight L. (1976), 'Products Liability, Comparative Negligence and the Allocation of Damages among Multiple Defendants', *Southern California Law Review*, 50, 73–108.
- Arrow, Kenneth J. (1971), *Essays in the Theory of Risk Bearing*, Chicago: Markham.
- Arrow, Kenneth J. (1982), 'Risk Perception in Psychology and Economics', *Economic Inquiry*, 20, 1–9.
- Ashford, Nicholas A. and Robert F. Stone (1991), *The Liability Maze: The Impact of Liability Law on Safety and Innovation*, Washington, DC: The Brookings Institution.
- Attanasio, John B. (1988), 'The Principle of Aggregate Autonomy and the Calabresian Approach to Products Liability', *Virginia Law Review*, 74, 677–750.
- Ausness, Richard C. (1997a), 'An Insurance-Based Compensation System for Product-Related Injuries', *University of Pittsburgh Law Review*, 58, 669–717.
- Ausness, Richard C. (1997b), 'Product Category Liability: A Critical Analysis', *Northern Kentucky Law Review*, 24, 423–56.
- Ausness, Richard C. (1998a), 'Replacing Strict Liability with a Contract-Based Products Liability Regime', *Temple Law Review*, 71, 171–216.
- Ausness, Richard C. (1998b), 'Paying for the Health Costs of Smoking: Loss Shifting and Loss Bearing', *Southwestern University Law Review*, 27, 537–76.

- Ausness, Richard C. (2000), “Waive” Goodbye to Tort Liability: A Proposal to Remove Paternalism from Product Sales Transactions’, *San Diego Law Review*, 37, 293–346.
- Bae, Hung (2004), ‘Limited Liability Effect on Product Safety’, *International Economic Journal*, 18, 409–17.
- Bagwell, Kyle and Michael H. Riordan (1991), ‘High and Declining Prices Signal Product Quality’, *American Economic Review*, 81, 224–39.
- Baker, Tom (2005), ‘Medical Malpractice and the Insurance Underwriting Cycle’, *DePaul Law Review*, 54, 393–438.
- Ballard, Raymond J. and Dale R. Funderburk (2002), ‘Punitive Damages and the Optimal Level of Product Failure’, *Journal of Economics*, 28, 67–78.
- Bar-Gill, Oren (2006), ‘Bundling and Consumer Misperception’, *University of Chicago Law Review*, 73, 33–62.
- Bar-Gill, Oren and Omri Ben-Shahar (2003), ‘The Uneasy Case for Comparative Negligence’, *American Law and Economics Review*, 5, 433–69.
- Barker, Drucilla K. (1991), ‘An Empirical Analysis of the Effects of Product Liability Laws on Underwriting Risk’, *Journal of Risk and Insurance*, 51, 63–79.
- Beales, J. Howard, III, Richard Craswell and Steven C. Salop (1981a), ‘The Efficient Regulation of Consumer Information’, *Journal of Law and Economics*, 24, 491–539.
- Beales, J. Howard, III, Richard Craswell and Steven C. Salop (1981b), ‘Information Remedies for Consumer Protection’, *American Economic Review: Papers and Proceedings*, 71, 410–13.
- Becker, Gary S. and Isaac Ehrlich (1972), ‘Market Insurance, Self-insurance, and Self-protection’, *Journal of Political Economy*, 80, 623–48.
- Bell, John W. (1977), ‘Averting a Crisis in Product Liability: An Evolutionary Process of Socioeconomic Justice’, *Illinois Bar Journal*, 65, 640–48.
- Bell, Peter A. (1990), ‘Analyzing Tort Law: The Flawed Promise of Neocontract’, *Minnesota Law Review*, 74, 1177–249.
- Ben-Shahar, Omri (1998), ‘Should Products Liability be Based on Hindsight?’, *Journal of Law, Economics, and Organization*, 14, 325–57.
- Benson, Bruce L. (1996), ‘Uncertainty, the Race for Property Rights, and Rent Dissipation due to Judicial Changes in Product Liability Tort Law’, *Cultural Dynamics*, 8, 333–51.
- Bernard, Andrew B., Stephen J. Redding and Peter K. Schott (2006), ‘Multi-product Firms and Product Switching’, *NBER Working Paper Series*, Working Paper 12293, Cambridge, MA: National Bureau of Economic Research.
- Blight, Catherine (1989), “What if that Snail had been in a Bottle of Milk?” or Product Liability in the UK – The Special Case of Agricultural Products’, in Michael Faure and Roger Van den Bergh (eds), *Essays in Law and Economics: Corporations, Accident Prevention and Compensation for Losses*, Antwerpen: Maklu, pp. 215–32.
- Bonney, Paul R. (1985), ‘Manufacturers’ Strict Liability for Handgun Injuries: An Economic Analysis’, *Georgetown Law Journal*, 73, 1437–63.
- Born, Patricia and W. Kip Viscusi (1999), ‘The Distribution of the Insurance Market Effects of Tort Liability Reforms’, in *Brookings Papers on Economic Activity: Microeconomics: 1998*, Washington, DC: The Brookings Institution.
- Boulding, William and Amna Kirmani (1993), ‘A Consumer-side Experimental Examination of Signaling Theory: Do Consumers Perceive Warranties as Signals of Quality?’, *Journal of Consumer Research*, 20, 111–23.
- Boulding, William and Devavrat Purohit (1996), ‘The Price of Safety’, *Journal of Consumer Research*, 23, 12–25.
- Boyd, James and Daniel E. Ingberman (1994), ‘Noncompensatory Damages and Potential Insolvency’, *Journal of Legal Studies*, 23, 895–910.
- Boyd, James and Daniel E. Ingberman (1997a), ‘Should “Relative Safety” be a Test of Product Liability?’, *Journal of Legal Studies*, 26, 433–73.
- Boyd, James and Daniel E. Ingberman (1997b), ‘The Search for Deep Pockets: Is “Extended Liability” Expensive Liability?’, *Journal of Law, Economics and Organization*, 13, 232–58.

- Boyd, James and Daniel E. Ingberman (2003), 'Fly by Night or Face the Music? Premature Dissolution and the Desirability of Extended Liability', *American Law and Economics Review*, 5, 189–232.
- Brooks, Richard R.W. (2002), 'Liability and Organizational Choice', *Journal of Law and Economics*, 45, 91–125.
- Brown, John Prather (1974), 'Product Liability: The Case of an Asset with Random Life', *American Economic Review*, 64, 149–61.
- Brüggemeier, Gert (1989), 'Die Gefährdungshaftung der Produzenten nach der EG-Richtlinie – ein Fortschritt der Rechtentwicklung? (Strict Liability of Producers According to the EC-Regulation – A Directive of Legal Evolution)', in Claus Ott and Hans-Bernd Schäfer (eds), *Allokationseffizienz in der Rechtsordnung*, Berlin: Springer-Verlag, pp. 228–47.
- Bryant, W. Keith and Jennifer L. Gerner (1978), 'The Price of a Warranty: The Case for Refrigerators', *Journal of Consumer Affairs*, 12, 30–47.
- Buchanan, James M. (1970), 'In Defense of Caveat Emptor', *University of Chicago Law Review*, 38, 64–73.
- Burrows, Paul (1992), 'Consumer Safety under Products Liability and Duty to Disclose', *International Review of Law and Economics*, 12, 457–78.
- Burrows, Paul (1994), 'Products Liability and the Control of Product Risk in the European Community', *Oxford Review of Economic Policy*, 10, 68–83.
- Butters, Gerard R. (1986), 'The Impact of Product Recalls on the Wealth of Sellers: Comments', in Pauline M. Ippolito and David T. Scheffman (eds), *Empirical Approaches to Consumer Protection Economics*, Washington, DC: Federal Trade Commission, pp. 411–13.
- Calabresi, Guido (1984), 'First Party, Third Party, and Product Liability Systems: Can Economic Analysis of Law Tell Us Anything About Them?', *Iowa Law Review*, 69, 833–51.
- Calabresi, Guido and Kenneth C. II Bass (1970), 'Right Approach, Wrong Implications: A Critique of McKean on Products Liability', *University of Chicago Law Review*, 38, 74–91.
- Calabresi, Guido and Jon T. Hirschoff (1972), 'Toward a Test for Strict Liability in Tort', *Yale Law Journal*, 81, 1054–85. Reprinted in Rabin, Robert L. (ed.) (1983), *Perspectives on Tort Law*, Boston: Little Brown, pp. 192–212.
- Calfee, John E. and Paul H. Rubin (1992), 'Some Implications of Damage Payments for Nonpecuniary Losses', *Journal of Legal Studies*, 21, 371–411.
- Calfee, John E. and Clifford Winston (1988), 'Economic Aspects of Liability Rules and Liability Insurance', in Robert E. Litan and Clifford Winston (eds), *Liability: Perspectives and Policy*, Washington, DC: The Brookings Institution, pp. 16–41.
- Calfee, John E. and Clifford Winston (1993), 'The Consumer Welfare Effects of Liability for Pain and Suffering: An Exploratory Analysis', *Brookings Papers on Economic Activity: Microeconomics*, 1, 133–96.
- Camerer, Colin F. and Howard Kunreuther (1993), 'Making Decisions about Liability and Insurance: Editors' Comments', *Journal of Risk and Uncertainty*, 7, 5–15.
- Campbell, Thomas J., Daniel P. Kessler and George P. Shepherd (1998), 'The Link between Liability Reforms and Productivity: Some Evidence', *Brookings Papers on Economic Activity: Microeconomics*, Washington, DC: The Brookings Institution, pp. 107–37.
- Cass, Ronald A. and Clayton P. Gillette (1991), 'The Government Contractor Defense: Contractual Allocation of Public Risk', *Virginia Law Review*, 77, 257–336.
- Castaing, Francois J. (1994), 'The Effects of Product Liability on Automotive Engineering Practice', in Janet R. Hunziker and Trevor O. Jones (eds), *Product Liability and Innovation: Managing Risk in an Uncertain Environment*, Washington, DC: National Academy Press, pp. 71–81.
- Cavaliere, Alberto (2004), 'Product Liability in the European Union: Compensation and Deterrence Issues', *European Journal of Law and Economics*, 18, 299–318.
- Caves, R.E. and D.P. Greene (1996), 'Brands' Quality Levels, Prices, and Advertising Outlays: Empirical Evidence on Signals and Information Costs', *International Journal of Industrial Organization*, 14, 29–52.
- Centner, Terence J. (1992), 'The New "Tractor Lemon Laws": An Attempt to Squeeze Manufacturers Draws Sour Benefits', *Journal of Products Liability*, 14, 121–37.

- Centner, Terence J. (1993), 'Separating Lemons: Automobiles and Tractors under the "Motor Vehicle Warranty Rights Act" and the "Farm Tractor Warranty Act"', *Georgia State Bar Journal*, 30, 36–43.
- Centner, Terence J. (1995), 'Lemon Laws: Sour Options for Consumers of Farm Tractors', *Hamline Law Review*, 18, 347–62.
- Centner, Terence J. and Michael E. Wetzstein (1995), 'Obligations and Penalties under Lemon Laws: Automobiles versus Tractors', *Journal of Agricultural and Resource Economics*, 20, 135–45.
- Chan, Yuk-Shee and Hayne E. Leland (1982), 'Prices and Qualities in Markets with Costly Information', *Review of Economic Studies*, 49, 499–516.
- Chapman, Kenneth and Michael J. Meurer (1989), 'Efficient Remedies for Breach of Warranty', *Law and Contemporary Problems*, 52 (1), 107–31.
- Choharis, Peter Charles (1995), 'A Comprehensive Market Strategy for Tort Reform', *Yale Journal on Regulation*, 12, 435–525.
- Congressional Budget Office (2003), *The Economics of U.S. Tort Liability: A Primer*, Washington, DC: A CBO Study, The Congress of the United States.
- Cook, Philip J. and Daniel A. Graham (1977), 'The Demand for Insurance and Protection: The Case of Irreplaceable Commodities', *Quarterly Journal of Economics*, 91, 143–56.
- Cook, Philip J. and Jens Ludwig (2002), 'Litigation as Regulation: Firearms', in W. Kip Viscusi (ed.), *Regulation through Litigation*, Washington, DC: AEI-Brookings Joint Center for Regulatory Studies, pp. 67–92.
- Cooper, Russell and Thomas W. Ross (1984), 'Prices, Product Qualities and Asymmetric Information: The Competitive Case', *Review of Economic Studies*, 51, 197–208.
- Cooper, Russell and Thomas W. Ross (1985a), 'Product Warranties and Double Moral Hazard', *Rand Journal of Economics*, 16, 103–13.
- Cooper, Russell and Thomas W. Ross (1985b), 'Monopoly Provision of Product Quality with Uninformed Buyers', *International Journal of Industrial Organization*, 3, 433–49.
- Cooter, Robert D. (1985), 'Defective Warnings, Remote Causes, and Bankruptcy: Comment on Schwartz', *Journal of Legal Studies*, 14, 737–50.
- Cooter, Robert D. (1989a), 'Punitive Damages for Deterrence: When and How Much?', *Alabama Law Review*, 40, 1143–96.
- Cooter, Robert D. (1989b), 'Towards a Market in Unmatured Tort Claims', *University of Virginia Law Review*, 75, 383–411.
- Cooter, Robert D. (1991), 'Economic Theories of Legal Liability' *Journal of Economic Perspectives*, 5, 11–30.
- Cooter, Robert D. and Stephen D. Sugarman (1988), 'A Regulated Market in Unmatured Tort Claims: Tort Reform by Contract', in Walter Olson (ed.), *New Directions in Liability Law*, New York: The Academy of Political Science, pp. 174–85.
- Cooter, Robert D. and Thomas S. Ulen (1988), *Law and Economics*, Glenview, IL: Scott, Foresman and Company.
- Cosentino, Fabrizio (1989), 'Responsabilità da Prodotto Difettoso: Appunti di Analisi Economica del Diritto (nota a U.S. Supreme Court California, 31 marzo 1988, Brown c. Abbott Laboratories) (Liability for Defective Products: An Economic Analysis of Law)', *Foro Italiano*, 4, 137–43.
- Courville, Léon and Warren H. Hausman (1979), 'Warranty Scope and Reliability under Imperfect Information and Alternative Market Structures', *Journal of Business*, 52, 361–78.
- Cousy, Herman (1976), 'Produktenaansprakelijkheid. Proeven van een Juridisch-Economische Analyse (Product Liability. Attempt of a Legal-Economic Analysis)', *Tijdschrift voor Privaatrecht*, 995–1035.
- Craig, Andrew (1991), 'Product Liability and Safety in General Aviation', in Peter W. Huber and Robert E. Litan (eds), *The Liability Maze: The Impact of Liability Law on Safety and Innovation*, Washington, DC: The Brookings Institution, pp. 456–77.
- Craswell, Richard (1991), 'Passing on the Costs of Legal Rules: Efficiency and Distribution in Buyer-Seller Relationships', *Stanford Law Review*, 43, 361–98.

- Craswell, Richard (1996), 'Damage Multipliers in Market Relationships', *Journal of Legal Studies*, 25, 463–92.
- Croley, Steven P. and Jon D. Hanson (1991), 'What Liability Crisis? An Alternative Explanation for Recent Events in Products Liability', *Yale Journal on Regulation*, 8, 1–111.
- Croley, Steven P. and Jon D. Hanson (1993), 'Rescuing the Revolution: The Revived Case for Enterprise Liability', *Michigan Law Review*, 91, 683–797.
- Croley, Steven P. and Jon D. Hanson (1995), 'The Nonpecuniary Costs of Accidents: Pain and-Suffering Damages in Tort Law', *Harvard Law Review*, 108, 1785–917.
- Cummins, David J. and Christopher M. Lewis (2003), 'Catastrophic Events, Parameter Uncertainty and the Breakdown of Implicit Long-term Contracting: The Case of Terrorism Insurance', *Journal of Risk and Uncertainty*, 26, 153–78.
- Curran, Christopher (1992), 'The Spread of Comparative Negligence in the United States', *International Review of Law and Economics*, 12, 317–32.
- Daniels, Stephen and Joanne Martin (1990), 'Myth and Reality in Punitive Damages', *Minnesota Law Review*, 75, 1–64.
- Danzon, Patricia M. (1984), 'Tort Reform and the Role of Government in Private Insurance Markets', *Journal of Legal Studies*, 13, 517–49.
- Danzon, Patricia M. (1985), 'Comments on Landes and Posner: A Positive Economic Analysis of Products Liability', *Journal of Legal Studies*, 14, 569–83.
- Danzon, Patricia M. (1988), 'The Political Economy of Workers' Compensation: Lessons for Product Liability', *American Economic Review: Papers and Proceedings*, 78, 305–10.
- Daughety, Andrew F. and Jennifer F. Reinganum (1995), 'Product Safety: Liability, R&D, and Signaling', *American Economic Review*, 85, 1187–206.
- Daughety, Andrew F. and Jennifer F. Reinganum (1997), 'Everybody Out of the Pool: Products Liability, Punitive Damages, and Competition', *Journal of Law, Economics, and Organization*, 13, 410–32.
- Daughety, Andrew F. and Jennifer F. Reinganum (2005a), 'Secrecy and Safety', *American Economic Review*, 95, 1074–91.
- Daughety, Andrew F. and Jennifer F. Reinganum (2005b), 'Imperfect Competition and Quality Signaling', Working Paper No. 05-W20, Department of Economics, Vanderbilt University.
- Daughety, Andrew F. and Jennifer F. Reinganum (2006a), 'Markets, Torts, and Social Inefficiency', *Rand Journal of Economics*, 37, 300–23.
- Daughety, Andrew F. and Jennifer F. Reinganum (2006b), 'Products Liability, Signaling and Disclosure', Working Paper, Department of Economics, Vanderbilt University.
- De Alessi, Louis (1994), 'Reputation and the Efficiency of Legal Rules', *Cato Journal*, 14, 11–21.
- De Alessi, Louis and Robert J. Staaf (1987), 'Liability, Control and the Organization of Economic Activity', *International Review of Law and Economics*, 7, 5–20.
- Deweese, Donald N., David Duff and Michael J. Trebilcock (1996), *Exploring the Domain of Accident Law: Taking the Facts Seriously*, New York: Oxford University Press.
- Dorfman, Robert (1970), 'The Economics of Product Liability: A Reaction to McKean', *University of Chicago Law Review*, 38, 92–102.
- Dowdell, T.D., S. Govindaraj and P.C. Jain (1992), 'The Tylenol Incident, Ensuing Regulation, and Stock Prices', *Journal of Financial and Quantitative Analysis*, 27, 283–301.
- Dungworth, Terence (1988), *Product Liability and the Business Sector: Litigation Trends in Federal Courts*, Santa Monica, CA: Institute for Civil Justice, Rand Corporation.
- Dutcher, J. Scott (2006), Comment, 'Caution: This Superman Suit Will Not Enable You to Fly – Are Consumer Product Warning Labels Out of Control?', *Arizona State Law Journal*, 38, 633–60.
- Eads, George C. and Peter Reuter (1983), *Designing Safer Products: Corporate Responses to Product Liability Law and Regulation*, Santa Monica, CA: Institute for Civil Justice, Rand Corporation.
- Egon Zehnder International (1987), 'The Litigious Society: Is it Hampering Creativity, Innovation, and Our Ability to Compete?', *Corporate Issues Monitor*, 2 (3), 1 ff.

- Eisman, Deborah E. (1983), 'Product Liability: Who should Bear the Burden?', *American Economist*, 27, 54–7.
- Emons, Winand (1988), 'Warranties, Moral Hazard, and the Lemons Problem', *Journal of Economic Theory*, 46, 16–33.
- Emons, Winand (1990), 'Some Recent Developments in the Economic Analysis of Liability Law: An Introduction', *Journal of Institutional and Theoretical Economics*, 146, 237–48.
- Endres, A. and A. Lüdeke (1998a), 'Incomplete Strict Liability: Effects on Product Differentiation and Information Provision', *International Review of Law and Economics*, 18, 511–28.
- Endres, A. and A. Lüdeke (1998b), 'Limited Liability and Imperfect Information – On the Existence of Safety Equilibria under Products Liability Law', *European Journal of Law and Economics*, 5, 153–65.
- Endres, Alfred and Regina Bertram (2006), 'The Development of Care Technology under Liability Law', *International Review of Law and Economics*, 26, 503–18.
- Epple, Dennis and Artur Raviv (1978), 'Product Safety: Liability Rules, Market Structure, and Imperfect Information', *American Economic Review*, 68, 80–95.
- Epstein, Richard A. (1980), *Modern Product Liability Law*. Westport, CN: Quorum Books.
- Epstein, Richard A. (1984), 'The Legal and Insurance Dynamics of Mass Tort Litigation', *Journal of Legal Studies*, 13, 475–506.
- Epstein, Richard A. (1985), 'Products Liability as an Insurance Market', *Journal of Legal Studies*, 14, 645–69.
- Epstein, Richard A. (1986), 'The Temporal Dimension in Tort Law', *University of Chicago Law Review*, 53, 1175–218.
- Epstein, Richard A. (1987), 'The Risks of Risk/Utility', *Ohio State Law Journal*, 48, 469–77.
- Epstein, Richard A. (1988), 'The Political Economy of Product Liability Reform', *American Economic Review: Papers and Proceedings*, 78, 311–15.
- Epstein, Richard A. (1989), 'The Unintended Revolution in Product Liability Law', *Cardozo Law Review*, 10, 2193–222.
- Evans, Scott S. (2007), Note, 'Dynamic Incentives: Improving the Safety, Effectivity, and Availability of Medical Products through Progressively Increasing Damage Caps for Manufacturers', *University of Illinois Law Review*, 2007, 1069–106.
- Faure, Michael G. (1986), 'Commentaar bij de paper van Dr. Jan C. Bongaerts: Coase en Produktaansprakelijkheid (Comment on the paper of Dr Jan C. Bongaerts: Coase Products Liability)', in Roger Van den Bergh (ed.), *Verslagboek Eerste Werkvergadering Recht en Economie*, Antwerpen: Handelshogeschool, pp. 31–7.
- Faure, Michael G. (2002), 'Product Liability and Product Safety in a Federal System: Economic Reflections on the Proper Role of Europe', in Alain Marciano and Jean-Michel Josselin (eds), *The Economics of Harmonizing European Law*, Cheltenham, UK and Northampton, MA, USA: Edward Elgar Press, pp. 131–77.
- Faure, Michael and Paul Fenn (2000), 'Retroactive Liability and the Insurability of Long-Tail Risks', *International Review of Law and Economics*, 19, 487–500.
- Faure, Michael G. and Willy Van Buggenhout (1987), 'Produktaansprakelijkheid. De Europese Richtlijn: Harmonisatie en consumentenbescherming? (The European Directive Concerning Product Liability, Harmonization and Consumer Protection?)', *Rechtskundig Weekblad*, 51, 33–88.
- Finsinger, Jörg (1991), 'The Choice of Risky Technologies and Liability', *International Review of Law and Economics*, 11, 11–22.
- Finsinger, Jörg, T. Hoehn and A. Pototschnig (1991), 'The Enforcement of Product Liability Rules: A Two-country Analysis of Court Cases', *International Review of Law and Economics*, 11, 133–48.
- Finsinger, Jörg and Jürgen Simon (1988), *Eine ökonomische Bewertung der EG-Produkthaftung*, An Lüneburg, Fachbereich Wirtschafts- und Sozialwissenschaften, 44 ff.
- Finsinger, Jörg and Jürgen Simon (1989), 'An Economic Assessment of the EC Product Liability Directive and the Product Liability Law of the Federal Republic of Germany', in

- Michael Faure and Roger Van den Bergh (eds), *Essays in Law and Economics: Corporations, Accident Prevention and Compensation for Losses*, Antwerpen: Maklu, pp. 185–214.
- Fischer, David A. (2002), 'Product Liability: A Commentary on the Liability of Suppliers of Component Parts and Raw Materials', *South Carolina Law Review*, 53, 1137–92
- Fischhoff, Baruch and Jon F. Merz (1994), 'The Inconvenient Public: Behavioral Research Approaches to Reducing Product Liability Risks', in Janet R. Hunziker and Trevor O. Jones (eds), *Product Liability and Innovation: Managing Risk in an Uncertain Environment*, Washington, DC: National Academy Press, pp. 159–89.
- Folmer, Henk, Wim J.M. Heijman and Auke R. Leen (2002), 'Product Liability: A Neo-Austrian Based Perspective', *European Journal of Law and Economics*, 13, 73–84.
- Frech, H.E. III (1994), 'State-dependent Utility and the Tort System as Insurance: Strict Liability versus Negligence', *International Review of Law and Economics*, 14, 261–71.
- Froot, Kenneth A. and Paul G.J. O'Connell (1999), 'The Pricing of U.S. Catastrophe Reinsurance', in Kenneth A. Froot (ed.), *The Financing of Catastrophe Insurance*, Chicago, IL: The University of Chicago Press, pp. 195–232.
- Gal-Or, Esther (1989), 'Warranties as a Signal of Quality', *Canadian Journal of Economics*, 22, 50–61.
- Galitsky, S. (1979), 'Manufacturers' Liability: An Examination of the Policy and Social Cost of a New Regime', *University of New South Wales Law Journal*, 3, 145–74.
- Garber, Steven (1998), 'Product Liability, Punitive Damages, Business Decisions and Economic Outcomes', *Wisconsin Law Review*, 1998, 237–96.
- Garber, Steven and John Adams (1998), 'Product and Stock Market Responses to Automotive Product Liability Verdicts', *Brookings Papers on Economic Activity: Microeconomics*, 1–44.
- Garber, Steven and Anthony G. Bower (1999), 'Newspaper Coverage of Automotive Product Liability Verdicts', *Law and Society Review*, 33, 93–122.
- Geistfeld, Mark (1988), 'Note: Imperfect Information, the Pricing Mechanism, and Products Liability', *Columbia Law Review*, 88, 1057–68.
- Geistfeld, Mark (1992), 'Implementing Enterprise Liability: A Comment on Henderson and Twerski', *New York University Law Review*, 67, 1157–73.
- Geistfeld, Mark (1994), 'The Political Economy of Neocontractual Proposals for Products Liability Reform', *Texas Law Review*, 72, 803–47.
- Geistfeld, Mark (1995a), 'Manufacturer Moral Hazard and the Tort Contract Issue in Products Liability', *International Review of Law and Economics*, 15, 241–57.
- Geistfeld, Mark (1995b), 'Placing a Price on Pain and Suffering: A Method for Helping Juries Determine Tort Damages for Nonmonetary Injuries', *California Law Review*, 83, 773–852.
- Geistfeld, Mark (1997), 'Inadequate Product Warnings and Causation', *University of Michigan Journal of Law Reform*, 30, 309–51.
- Geistfeld, Mark A. (2006), *Principles of Products Liability*, New York: Foundation Press.
- Gerner, Jennifer L. and W. Keith Bryant (1981), 'Appliance Warranties as a Market Signal?', *Journal of Consumer Affairs*, 15, 75–86.
- Gifford, Donald G. (2006), 'The Death of Causation: Mass Products Torts' Incomplete Incorporation of Social Welfare Principles', *Wake Forest Law Review*, 41, 943–1002.
- Gilmore, Grant (1970), 'Products Liability: A Commentary', *University of Chicago Law Review*, 38, 103–16.
- Goldberg, Victor P. (1974), 'The Economics of Product Safety and Imperfect Information', *Bell Journal of Economics and Management Science*, 5, 683–8.
- Govindaraj, Suresh and Bikki Jaggi (2004), 'Market Overreaction to Product Recall Revisited – The Case of Firestone Tires and the Ford Explorer', *Review of Quantitative Finance and Accounting*, 23, 31–54.
- Graham, Daniel A. and Ellen R. Price (1984), 'Contingent Damages for Products Liability', *Journal of Legal Studies*, 13, 441–68.
- Graham, John D. (1991), 'Product Liability and Motor Vehicle Safety', in Peter W. Huber and Robert E. Litan (eds), *The Liability Maze: The Impact of Liability Law on Safety and Innovation*, Washington, DC: The Brookings Institution, pp. 120–90.

- Grether, David M., Alan Schwartz and Louis L. Wilde (1986), 'The Irrelevance of Information Overload: An Analysis of Search and Disclosure', *Southern California Law Review*, 59, 277–303.
- Grether, David M., Alan Schwartz and Louis L. Wilde (1988), 'Uncertainty and Shopping Behavior: An Experimental Analysis', *Review of Economic Studies*, 55, 323–42.
- Grether, David M., Alan Schwartz and Louis L. Wilde (1992), 'Price, Quality and Timing of Moves in Markets with Incomplete Information: An Experimental Analysis', *Economic Journal*, 102, 754–71.
- Grossman, Sanford J. (1981), 'The Informational Role of Warranties and Private Disclosure about Product Quality', *Journal of Law and Economics*, 24, 461–83.
- Gupta, Pola and Brian T. Ratchford (1992), 'Estimating the Efficiency of Consumer Choices of New Automobiles', *Journal of Economic Psychology*, 13, 375–97.
- Hamada, Koichi (1976), 'Liability Rules and Income Distribution in Products Liability', *American Economic Review*, 66, 228–34.
- Hamada, Koichi (1995), 'Product Liability Rules: A Consideration of Law and Economics in Japan', *Japanese Economic Review*, 46, 2–22.
- Hamada, Koichi, Hidetoh Ishida and Masahiro Murakami (1986), 'The Evolution and Economic Consequences of Product Liability Rules in Japan', in Gary R. Saxonhouse and Kojo Yamamura (eds), *Law and Trade Issues of the Japanese Economy: Amer*, Seattle: University of Washington Press, pp. 83–106.
- Hamilton, Stephen F. (1998), 'Taxation, Fines, and Producer Liability Rules: Efficiency and Market Structure Implications', *Southern Economic Journal*, 65, 140–50.
- Hamilton, Stephen F. and David L. Sunding (2000), 'Product Liability, Entry Incentives and Market Structure', *International Review of Law and Economics*, 20, 269–83.
- Hammit, James K., Stephen J. Carroll and Daniel A. Relles (1985), 'Tort Standards and Jury Decisions', *Journal of Legal Studies*, 14, 751–62.
- Hanson, Jon D. and Douglas A. Kysar (1999a), 'Taking Behavioralism Seriously: The Problem of Market Manipulation', *New York University Law Review*, 74, 630–749.
- Hanson, Jon D. and Douglas A. Kysar (1999b), 'Taking Behavioralism Seriously: Some Evidence of Market Manipulation', *Harvard Law Review*, 112, 1420–573.
- Hanson, Jon D. and Douglas A. Kysar (2000), 'Taking Behavioralism Seriously: A Response to Market Manipulation', *Rogers Williams University Law Review*, 6, 259–392.
- Hanson, Jon D. and Kyle D. Logue (1990), 'The First-Party Insurance Externality: An Economic Justification for Enterprise Liability', *Cornell Law Review*, 76, 129–96.
- Hanson, Jon D. and Kyle D. Logue (1998), 'The Costs of Cigarettes: The Economic Case for Ex Post Incentive-Based Regulation', *Yale Law Journal*, 107, 1163–362.
- Harrington, Scott E. (1988), 'Prices and Profits in the Liability Insurance Market', in Robert E. Litan and Clifford Winston (eds), *Liability: Perspectives and Policy*, Washington, DC: The Brookings Institution, pp. 42–100.
- Harrington, Scott E. (1991), 'Liability Insurance: Volatility in Prices and in the Availability of Coverage', in Peter H. Schuck (ed.), *Tort Law and the Public Interest: Competition, Innovation, and Consumer Welfare*, New York: W.W. Norton & Co., pp. 47–79.
- Hay, Bruce L. (1992), 'Conflicts of Law and State Competition in the Product Liability System', *Georgetown Law Journal*, 80, 617–52.
- Hay, Bruce L. and Kathryn E. Spier (2005), 'Manufacturer Liability for Harms Caused by Consumers to Others', *American Economic Review*, 95, 1700–11.
- Heal, Geoffrey M. (1977), 'Guarantees and Risk Sharing', *Review of Economic Studies*, 44, 549–60.
- Heinkel, R. (1981), 'Uncertain Product Quality: The Market for Lemons with an Imperfect Testing Technology', *Bell Journal of Economics*, 12, 625–36.
- Henderson, James A. (1973), 'Judicial Review of Manufacturer's Conscious Design Choices: The Limits of Adjudication', *Columbia Law Review*, 73, 1531–78.
- Henderson, James A. (1980), 'Extending the Boundaries of Strict Products Liability: Implications of the Theory of Second Best', *University of Pennsylvania Law Review*, 128, 1036–93.

- Henderson, James A. (1983), 'Product Liability and the Passage of Time: The Imprisonment of Corporate Rationality', *New York University Law Review*, 58, 765–95.
- Henderson, James A. (1991), 'Judicial Reliance on Public Policy: An Empirical Analysis', *George Washington Law Review*, 59, 1570–613.
- Henderson, James A. and Jeffrey J. Rachlinksi (2000), 'Product-Related Risk and Cognitive Biases: The Shortcomings of Enterprise Liability', *Roger Williams University Law Review*, 6, 213–58.
- Henderson, James A. and Aaron D. Twerski (1990), 'Doctrinal Collapse in Products Liability: The Empty Shell of Failure to Warn', *New York University Law Review*, 65, 265–327.
- Henderson, James A. and Aaron D. Twerski (1991), 'Closing the American Products Liability Frontier: The Rejection of Liability without Fault', *New York University Law Review*, 66, 1263–331.
- Henderson, James A. and Aaron D. Twerski (1998), 'The Politics of the Products Liability Restatement', *Hofstra Law Review*, 26, 667–96.
- Henderson, James A. and Aaron D. Twerski (2003), 'Consumer Expectations' Last Hope: A Response to Professor Kysar', *Columbia Law Review*, 103, 1791–802.
- Hensler, Deborah R., M. Susan Marquis, Allan F. Abrahamse, Sandra H. Berry, Patricia A. Ebener, Elizabeth G. Lewis, E. Allan Lind, Robert J. Maccoun, Willard G. Manning, Jeannette A. Rogowski and Mary E. Vaiana (1991), *Compensation for Accidental Injuries in the United States*, Santa Monica, CA: Institute for Civil Justice, Rand Corporation.
- Hersch, Joni (2002), 'Breast Implants: Regulation, Litigation, and Science', in W. Kip Viscusi (ed.), *Regulation through Litigation*, Washington, DC: AEI-Brookings Joint Center for Regulatory Studies, pp. 142–77.
- Higgins, Richard S. (1978), 'Producers' Liability and Product Related Accidents', *Journal of Legal Studies*, 7, 299–321.
- Higgins, Richard S. (1981), 'Products Liability Insurance, Moral Hazard, and Contributory Negligence', *Journal of Legal Studies*, 10, 111–30.
- Hiriart, Yolande, David Martimort and Jerome Pouyet (2004), 'On the Optimal Use of Ex Ante Regulation and Ex Post Liability', *Economic Letters*, 84, 231–35.
- Hoffer, George E., Stephen W. Pruitt and Robert J. Reilly (1988), 'The Impact of Product Recalls on the Wealth of Sellers: A Reexamination', *Journal of Political Economy*, 96, 663–70.
- Holmström, Bengt (1979), 'Moral Hazard and Observability', *Bell Journal of Economics*, 10, 74–91.
- Horvitz, Sigmund A. and Louis H. Stern (1987), 'Liability Rules and the Selection of a Socially Optimal Production Technology', *International Review of Law and Economics*, 7, 121–6.
- Huber, Peter W. (1986), 'Safety and the Second Best: The Hazards of Public Risk Management in the Courts', *Columbia Law Review*, 85, 277–337.
- Huber, Peter W. (1988), *Liability: The Legal Revolution and its Consequences*, New York: Basic Books.
- Huber, Peter W. (1992), 'Liability and Insurance Problems in the Commercialization of New Products: A Perspective from the United States and England', in Nathan Rosenbergh, Ralph Landau and David C. Mowery (eds), *Technology and the Wealth of Nations*, Stanford, CA: Stanford University Press, pp. 207–21.
- Huber, Peter W. and Robert E. Litan (1991), 'Overview', in Peter W. Huber and Robert E. Litan (eds), *The Liability Maze: The Impact of Liability Law on Safety and Innovation*, Washington, DC: The Brookings Institution, pp. 1–27.
- Hylton, Keith (1990), 'Costly Litigation and Legal Error under Negligence', *Journal of Law, Economics and Organization*, 6, 433–52.
- Inter-Agency Task Force on Products Liability (1977), *Report*, Washington, DC: United States Department of Commerce.
- Jarrell, Gregg A. and Sam Peltzman (1985), 'The Impact of Product Recalls on the Wealth of Sellers', *Journal of Political Economy*, 93, 512–36. Reprinted in Pauline M. Ippolito and David T. Scheffman (eds), *Empirical Approaches to Consumer Protection Economics*, Washington, DC: Federal Trade Commission, pp. 377–409.

- Johnson, Rollin B. (1991), 'The Impact of Liability on Innovation in the Chemical Industry', in Peter W. Huber and Robert E. Litan (eds), *The Liability Maze: The Impact of Liability Law on Safety and Innovation*, Washington, DC: The Brookings Institution, pp. 428–55.
- Jones, P. and J. Hudson (1996), 'Signalling Product Quality: When is Price Relevant?', *Journal of Economic Behavior and Organization*, 30, 257–66.
- Jones, William K. (1990), 'Product Defects Causing Commercial Loss: The Ascendency of Contract over Tort', *University of Miami Law Review*, 44, 731–806.
- Kahneman, Daniel, Paul Slovic and Amos Tversky (1982), *Judgment and Uncertainty: Heuristics and Biases*, Cambridge: Cambridge University Press.
- Kahneman, Daniel and Amos Tversky (1979), 'Prospect Theory: An Analysis of Decision under Risk', *Econometrica*, 47, 160–73.
- Kambhu, John (1982), 'Optimal Product Quality under Asymmetric Information and Moral Hazard', *Bell Journal of Economics*, 483–92.
- Kaplow, Louis and Steven Shavell (1996), 'Accuracy in the Assessment of Damages', *Journal of Law and Economics*, 39, 191–210.
- Kaprelian, Mark A. (1985), 'Privity Revisited: Tort Recovery by a Commercial Buyer for a Defective Product's Self-Inflicted Damage', *Michigan Law Review*, 84, 517–40.
- Keenan, Donald C. and Paul H. Rubin (1988), 'Shadow Interest Groups and Safety Regulation', *International Review of Law and Economics*, 8, 21–36.
- Kinkaid, Peter M. and William J. Stuntz (1983), 'Note: Enforcing Waivers in Products Liability', *Virginia Law Review*, 69, 1111–52.
- Kirchner, Christian (1989), 'Kommentar (Comment on Brüggemeier)', in Claus Ott and Hans-Bernd Schäfer (eds), *Allokationseffizienz in der Rechtsordnung*, Berlin: Springer-Verlag, pp. 248–53.
- Kirmani, A. and A.R. Rao (2000), 'No Pain, No Gain: A Critical Review of the Literature on Signaling Unobservable Product Quality', *Journal of Marketing*, 64, 66–79.
- Kitch, Edmund W. (1985), 'Vaccines and Product Liability: A Case of Contagious Litigation', *Regulation*, 9, 11–18.
- Kitch, Edmund W. (1988), 'American Law and Preventive Vaccination Programs', in Stanley A. Plotkin and Edward A. Mortimer (eds), *Vaccines*, Philadelphia, W.B.: Saunders Company, pp. 612 ff.
- Kitch, Edmund W. and Edward A. Mortimer, Jr (1994), 'American Law, Preventive Vaccine Programs, and the National Vaccine Injury Compensation Program', in Stanley A. Plotkin and Edward A. Mortimer (eds), *Vaccines*, Philadelphia, W.B.: Saunders Company, pp. 93 ff.
- Klein, Benjamin and Keith B. Leffler (1981), 'The Role of Market Forces in Assuring Contractual Performance', *Journal of Political Economy*, 89, 615–41.
- Klevorick, Alvin K. (1998), 'Comment on the Link between Liability Reforms and Productivity: Some Evidence', *Brookings Papers on Economic Activity: Microeconomics*, 139–48.
- Knoll, Michael S. (1997), 'Products Liability and Legal Leverage: The Perverse Effect of Stiff Penalties', *UCLA Law Review*, 45, 99–141.
- Kolstad, Charles D., Thomas S. Ulen and Gary V. Johnson (1990), 'Ex Post Liability for Harm vs. Ex Ante Safety Regulation: Substitutes or Complements?', *American Economic Review*, 80, 888–901.
- Komesar, Neil K. (1990), 'Injuries and Institutions: Tort Reform, Tort Theory, and Beyond', *New York University Law Review*, 65, 23–77.
- Krauss, Michael I. (2002), 'Product Liability and Game Theory: One More Trip to the Choice-of-Law Well', *Brigham Young University Law Review*, 2002, 759–828.
- Kunreuther, Howard, Robin M. Hogarth and Jacqueline Meszaros (1993), 'Insurer Ambiguity and Market Failure', *Journal of Risk and Uncertainty*, 7, 71–88.
- Kysar, Douglas A. (2003), 'The Expectations of Consumers', *Columbia Law Review*, 103, 1700–1804.
- Kysar, Douglas A. (2004), 'Preferences for Processes: The Process/Product Distinction and the Regulation of Consumer Choice', *Harvard Law Review*, 118, 526–642.

- Lacey, N.J. (1988), 'Recent Evidence on the Liability Crisis', *Journal of Risk and Insurance*, 55, 499–508.
- Lamken, Jeffrey A. (1989), 'Note: Efficient Accident Prevention as a Continuing Obligation: The Duty to Recall Defective Products', *Stanford Law Review*, 42, 103–62.
- Landes, William M. and Richard A. Posner (1984), 'Tort Law as a Regulatory Regime for Catastrophic Personal Injuries', *Journal of Legal Studies*, 13, 417–34.
- Landes, William M. and Richard A. Posner (1985), 'A Positive Economic Analysis of Products Liability', *Journal of Legal Studies*, 14, 535–67.
- Landes, William M. and Richard A. Posner (1986), 'New Light on Punitive Damages', *Regulation*, 10, 33–6.
- Landes, William M. and Richard A. Posner (1987), *The Economic Structure of Tort Law*, Cambridge, MA: Harvard University Press.
- Larsen, Kim D. (1984), 'Note: Strict Products Liability and the Risk-Utility Test for Design Defect: An Economic Analysis', *Columbia Law Review*, 84, 2045–67.
- Lasagna, Louis (1991), 'The Chilling Effect of Product Liability on New Drug Development', in Peter W. Huber and Robert E. Litan (eds), *The Liability Maze: The Impact of Liability Law on Safety and Innovation*, Washington, DC: The Brookings Institution, pp. 334–59.
- Latin, Howard (1994), "'Good" Warnings, Bad Products, and Cognitive Limitations', *UCLA Law Review*, 41, 1193–295.
- Lawrence, B.A., T.R. Miller, A.F. Jensen, D.A. Fisher and W.W. Zamula (2000), 'Estimating the Costs of Non-fatal Consumer Product Injuries in the United States', *Injury Control and Safety Promotion*, 7, 97–113.
- Lawrence, William H. and John H. Minon (1984), 'The Effect of Abrogating the Holder-in-due-course Doctrine on the Commercialization of Innovative Consumer Products', *Boston University Law Review*, 64, 325–74.
- Letsoy, Peter V. (1986), 'A Time-Dependent Model of Products Liability', *University of Chicago Law Review*, 53, 209–31.
- Litan, Robert E. (1991a), 'The Safety and Innovation Effects of U.S. Liability Law: The Evidence', *American Economic Review. Papers and Proceedings*, 81, 59–64.
- Litan, Robert E. (1991b), 'The Liability Explosion and American Trade Performance: Myths and Realities', in Peter H. Schuck (ed.), *Tort Law and the Public Interest: Competition, Innovation, and Consumer Welfare*, New York: W.W. Norton & Co., pp. 127–50.
- Litan, Robert E. and Clifford Winston (1988), 'Policy Options', in Robert E. Litan and Clifford Winston (eds), *Liability: Perspectives and Policy*, Washington, DC: The Brookings Institution, pp. 223–41.
- Lopucki, Lynn (1996), 'The Death of Liability', *Yale Law Journal*, 106, 1–92.
- Lutter, Randall and Elizabeth Mader (2002), 'Litigating Lead-based Paint Hazards', in W. Kip Viscusi (ed.), *Regulation through Litigation*, Washington, DC: AEI-Brookings Joint Center for Regulatory Studies, pp. 106–35.
- Lutz, Nancy A. (1989), 'Warranties as Signals under Consumer Moral Hazard', *Rand Journal of Economics*, 20, 239–54.
- Lyndon, Mary L. (1995), 'Tort Law and Technology', *Yale Journal on Regulation*, 12, 137–76.
- MacKay, Murray (1991), 'Liability, Safety, and Innovation in the Automotive Industry', in Peter W. Huber and Robert E. Litan (eds), *The Liability Maze: The Impact of Liability Law on Safety and Innovation*, Washington, DC: The Brookings Institution, pp. 191–223.
- MacMinn, R.D. and P.L. Brockett (1995), 'Corporate Spin-Offs as a Value Enhancing Technique when Faced with Legal Liability', *Insurance: Mathematics and Economics*, 16, 63–8.
- Madden, M. Stuart (1998), 'The Products Liability Restatement Warning Obligations: History, Corrective Justice and Efficiency', *Kansas Journal of Law and Public Policy*, 8, 50–53.
- Magat, Wesley A. and W. Kip Viscusi (1992), *Informational Approaches to Regulation*, Cambridge, MA: The MIT Press.
- Magat, Wesley A., W. Kip Viscusi and Joel Huber (1988), 'Consumer Processing of Hazard Warning Information', *Journal of Risk and Uncertainty*, 1, 201–32.

- Manne, Henry G. (1970), 'Edited Transcript of AALS-AEA Conference on Products Liability', *University of Chicago Law Review*, 38, 117–41.
- Manning, Richard L. (1994), 'Changing Rules in Tort Law and the Market for Childhood Vaccines', *Journal of Law and Economics*, 37, 247–75.
- Manning, Richard L. (1996), 'Is the Insurance Aspect of Producer Liability Valued by Consumers? Liability Changes and Childhood Vaccine Consumption', *Journal of Risk and Uncertainty*, 13, 37–51.
- Manning, Richard L. (1997), 'Products Liability and Prescription Drug Prices in Canada and the United States', *Journal of Law and Economics*, 40, 203–43.
- Mantell, Edmund H. (1984), 'Allocative and Distributive Efficiency of Products Liability Law in a Monopolistic Market', *Journal of Products Liability*, 7, 143–52.
- Marino, Anthony M. (1988a), 'Products Liability and Scale Effects in a Long-run Competitive Equilibrium', *International Review of Law and Economics*, 8, 97–107.
- Marino, Anthony M. (1988b), 'Monopoly, Liability and Regulation', *Southern Economic Journal*, 54, 913–27.
- Marino, Anthony M. (1991), 'Market Share Liability and Economic Efficiency', *Southern Economic Journal*, 57, 667–75.
- Martin, Robert (1991), 'General Aviation Manufacturing: An Industry under Siege', in Peter W. Huber and Robert E. Litan (eds), *The Liability Maze: The Impact of Liability Law on Safety and Innovation*, Washington, DC: The Brookings Institution, pp. 478–99.
- Mason, Robin (2004), 'Dividends, Safety and Liquidation When Liabilities are Long-Term and Stochastic', *European Economic Review*, 48, 1179–210.
- Mathios, Alan D. (2000), 'The Impact of Mandatory Disclosure Law on Product Choices: An Analysis of the Salad Dressing Market', *Journal of Law and Economics*, 43, 651–77.
- Matthews, Steven and John Moore (1987), 'Monopoly Provision of Quality and Warranties: An Exploration in the Theory of Multidimensional Screening', *Econometrica*, 55, 441–67.
- Matthews, Steven and Andrew Postlewaite (1985), 'Quality Testing and Disclosure', *Rand Journal of Economics*, 16, 328–40.
- Maxwell, John W. (1998), 'Minimum Quality Standards as a Barrier to Innovation', *Economics Letters*, 58, 355–60.
- McFadden, Daniel L. and Kenneth E. Train (1996), 'Consumers' Evaluation of New Products: Learning from Self and Others', *Journal of Political Economy*, 104, 683–703.
- McGuire, E. Patrick (1988), *The Impact of Product Liability*, New York: Conference Board.
- McKean, Roland N. (1970a), 'Products Liability: Trends and Implications', *University of Chicago Law Review*, 38, 3–63.
- McKean, Roland N. (1970b), 'Products Liability: Implications of some Changing Property Rights', *Quarterly Journal of Economics*, 84, 611–26.
- Merolla, A. Todd (1998), 'The Effect of Latent Hazards on Firm Exit in Manufacturing Industries', *International Review of Law and Economics*, 18, 13–24.
- Milgrom, Paul R. and John Roberts (1986), 'Price and Advertising Signals of Product Quality', *Journal of Political Economy*, 94, 796–821.
- Mitchell, Mark L. and Michael T. Maloney (1989), 'Crisis in the Cockpit? The Role of Market Forces in Promoting Air Travel Safety', *Journal of Law and Economics*, 32, 329–55.
- Moore, Michael J. and W. Kip Viscusi (1990), *Compensation Mechanisms for Job Risks: Wages, Workers' Compensation, and Product Liability*, Princeton: Princeton University Press.
- Moore, Michael J. and W. Kip Viscusi (2001), *Product Liability Entering the Twenty-first Century*, Washington, DC: AEI-Brookings Joint Center for Regulatory Studies.
- Moorhouse, John C. (1992), 'Joint Torts and Interfirm Contracting', *Atlantic Economic Journal*, 20, 10–20.
- Moorthy, S. and H. Zhao (2000), 'Advertising Spending and Perceived Quality', *Marketing Letters*, 11, 221–33.
- Murthy, D.N.P. and I. Djmaludin (2002), 'New Product Warranty: A Literature Review', *International Journal of Production Economics*, 79, 231–60.
- Nakao, Takeo (1982), 'Product Quality and Market Structure', *Bell Journal of Economics*, 13, 133–42.

- Neely, Richard (1988), *The Product Liability Mess: How Business can be Rescued from the Politics of the State Courts*, New York: Free Press/Macmillan.
- Nelson, Phillip (1970), 'Information and Consumer Behavior', *Journal of Political Economy*, 78, 311–29.
- Nelson, Phillip (1974), 'Advertising as Information', *Journal of Political Economy*, 82, 729–54.
- Noah, Lars (2000), 'Rewarding Regulatory Compliance: The Pursuit of Symmetry in Products Liability', *Georgetown Law Journal*, 88, 2147–66.
- Noll, Juergen (2004), 'Comparing Quality Signals as Tools of Consumer Protection: Are Warranties Always Better than Advertisements to Promote Higher Quality?', *International Review of Law and Economics*, 24, 227–39.
- O'Connell, Jeffrey (1988), 'Neo-no-fault: A Fair Exchange Proposal for Tort Reform', in Walter Olson (ed.), *New Directions in Liability Law*, New York: The Academy of Political Science, pp. 186–95.
- O'Reilly, James T. (1987), 'The Risks of Assumptions: Impacts of Regulatory Label Warning upon Industrial Products Liability', *Catholic University Law Review*, 37, 85–117.
- Oi, Walter Y. (1973), 'The Economics of Product Safety', *Bell Journal of Economics*, 4, 3–28.
- Oi, Walter Y. (1974), 'The Economics of Product Safety: A Rejoinder', *Bell Journal of Economics*, 5, 3–28.
- Olson, Walter (1988), 'Overdeterrence and the Problem of Comparative Risk', in Walter Olson (ed.), *New Directions in Liability Law*, New York: The Academy of Political Science, pp. 42–53.
- Ordober, Janusz A. (1979), 'Products Liability in Markets with Heterogeneous Consumers', *Journal of Legal Studies*, 8, 505–25.
- Ordober, Janusz A. and Andrew Weiss (1981), 'Information and the Law: Evaluating Legal Restrictions on Competitive Contracts', *American Economic Review: Papers and Proceedings*, 71, 399–404.
- Owen, David G. (1985), 'The Intellectual Development of Modern Products Liability Law: A Comment on Priest's View of the Cathedral's Foundations', *Journal of Legal Studies*, 14, 529–33.
- Owen, David G. (1997), 'Risk-utility Balancing in Design Defect Cases', *University of Michigan Journal of Law Reform*, 30, 239–60.
- Page, Joseph A. (1990), 'Deforming Tort Reform (book review of Peter Huber, 'Liability: The Legal Revolution and Its Consequences')', *Georgetown Law Journal*, 78, 649–97.
- Palfrey, Thomas R. and Thomas Romer (1983), 'Warranties, Performance, and the Resolution of Buyer-Seller Disputes', *Bell Journal of Economics*, 14, 97–117.
- Png, Ivan Paak-Liang and David Reitman (1995), 'Why are Some Products Branded and Others Not?', *Journal of Law and Economics*, 38, 207–24.
- Polinsky, A. Mitchell (1980), 'Strict Liability Versus Negligence in a Market Setting', *American Economic Review*, 70, 363–7.
- Polinsky, A. Mitchell and Yeon-Koo Che (1991), 'Decoupling Liability: Optimal Incentives for Care and Litigation', *Rand Journal of Economics*, 22, 562–70.
- Polinsky, Mitchell A. and William P. Rogerson (1983), 'Products Liability, Consumer Misperceptions, and Market Power', *Bell Journal of Economics*, 14, 581–9.
- Polinsky, A. Mitchell and Daniel L. Rubinfeld (1988), 'The Welfare Implications of Costly Litigation for the Level of Liability', *Journal of Legal Studies*, 17, 151–64.
- Polinsky, A. Mitchell and Steven Shavell (1989), 'Legal Error, Litigation, and the Incentive to Obey the Law', *Journal of Law, Economics, and Organization*, 5, 99–108.
- Prasad, Ravi (1992), 'Amendments to the New Australian Products Liability Laws', *Office of Regulation Review*.
- Price, L.J. and N. Dawar (2002), 'The Joint Effects of Brands and Warranties in Signalling Product Quality', *Journal of Economic Psychology*, 23, 165–90.
- Priest, George L. (1981), 'A Theory of the Consumer Product Warranty', *Yale Law Journal*, 90, 1297–352. Partially reprinted in Victor P. Goldberg (ed.) (1989), *Readings in the Economics of Contract Law*, Cambridge: Cambridge University Press, pp. 174–84.

- Priest, George L. (1982), 'The Best Evidence of the Effect of Products Liability Law on the Accident Rate: Reply', *Yale Law Journal*, 91, 1386–401.
- Priest, George L. (1985), 'The Invention of Enterprise Liability: A Critical History of the Intellectual Foundations of Modern Tort Law', *Journal of Legal Studies*, 14, 461–527.
- Priest, George L. (1987), 'The Current Insurance Crisis and Modern Tort Law', *Yale Law Journal*, 96, 1521–90.
- Priest, George L. (1988a), 'Products Liability Law and the Accident Rate in Liability: Perspectives and Policy', in Robert E. Litan and Clifford Winston (eds), *Liability: Perspectives and Policy*, Washington, DC: The Brookings Institution, pp. 184–222.
- Priest, George L. (1988b), 'The Disappearance of the Consumer from Modern Products Liability Law', in E. Scott Maynes and ACCI Research Committee (eds), *The Frontier of Research in the Consumer Interest: Proceedings of the International Conference on Research in the Consumer Interest*, Columbia: American Council on Consumer Interests, pp. 771–91.
- Priest, George L. (1988c), 'Understanding the Liability Crisis', in Walter Olson, (ed.), *New Directions in Liability Law*, New York: The Academy of Political Science, pp. 196–211.
- Priest, George L. (1989), 'Strict Products Liability: The Original Intent', *Cardozo Law Review*, 10, 2301–27.
- Priest, George L. (1991), 'The Modern Expansion of Tort Liability: Its Sources, its effects, and its Reform', *Journal of Economic Perspectives*, 5 (3), 31–50.
- Priest, George L. (1992), 'Can Absolute Manufacturer Liability be Defended?', *Yale Journal on Regulation*, 9, 237–63.
- Priest, George L. (1993), 'Economic Problems of Accidents and Compensation', *University of Hawaii Law Review*, 15, 544–52.
- Prince, David W. and Paul H. Rubin (2002), 'The Effects of Product Liability Litigation on the Value of Firms', *American Law and Economics Review*, 4, 44–87.
- Rabin, Robert L. (2000), 'Reassessing Regulatory Compliance', *Georgetown Law Journal*, 88, 2049–84.
- Ramseyer, J. Mark (1996), 'Products Liability through Private Ordering: Notes on a Japanese Experiment', *University of Pennsylvania Law Review*, 1823–40.
- Rea, Samuel A., Jr (1982), 'Nonpecuniary Loss and Breach of Contract', *Journal of Legal Studies*, 11, 35–53.
- Rea, Samuel A., Jr (1984), 'Contingent Damages, Negligence and Absolute Liability: A Comment on Graham and Peirce', *Journal of Legal Studies*, 13, 469–74.
- Rea, Samuel A., Jr (1985), 'Comments on Epstein', *Journal of Legal Studies*, 14, 671–4.
- Rice, David A. (1985), 'Product Quality Laws and the Economics of Federalism', *Boston University Law Review*, 65, 1–64.
- Riley, John G. (2001), 'Silver Signals: Twenty-five Years of Screening and Signaling', *Journal of Economic Literature*, 39, 432–78.
- Ringleb, Al. H. and Steven N. Wiggins (1990), 'Liability and Large-Scale, Long-term Hazards', *Journal of Political Economy*, 98, 574–95.
- Riordan, Michael H. (1986), 'Monopolistic Competition with Experience Goods', *Quarterly Journal of Economics*, 101, 265–79.
- Risa, Alf Erling (1994), 'Preference Revelation in Strict Liability Product Safety Markets', *International Review of Law and Economics*, 14, 41–52.
- Rogerson, Carol and Michael J. Trebilcock (1986), 'Products Liability and the Allergic Consumer: A Study in the Problems of Framing an Efficient Liability Regime', *University of Toronto Law Journal*, 36, 52–103.
- Rogerson, William P. (1983), 'Reputation and Product Quality', *Bell Journal of Economics*, 14(2), 508–16.
- Rose-Ackerman, Susan (1990), 'Market-share Allocations in Tort Law: Strengths and Weaknesses', *Journal of Legal Studies*, 19, 739–46.
- Rose-Ackerman, Susan (1991a), 'Tort Law in the Regulatory State', in Peter H. Schuck (ed.), *Tort Law and the Public Interest: Competition, Innovation, and Consumer Welfare*, New York: W.W. Norton & Co., pp. 80–104.

- Rose-Ackerman, Susan (1991b), 'Regulation and the Law of Torts', *American Economic Review: Papers and Proceedings*, 81, 54–8.
- Rose-Ackerman, Susan (1994), 'Product Safety Regulation and the Law of Torts', in Janet R. Hunziker and Trevor O. Jones (eds), *Product Liability and Innovation: Managing Risk in an Uncertain Environment*, Washington, DC: National Academy Press, pp. 151–8.
- Rothschild, Michael and Joseph E. Stiglitz (1976), 'Equilibrium in Competitive Insurance Markets: An Essay on the Economics of Imperfect Information', *Quarterly Journal of Economics*, 90, 629–49.
- Rubin, Paul H. (1993), *Tort Reform by Contract*, Washington, DC: American Enterprise Institute for Public Policy Research.
- Rubin, Paul H. and Martin J. Bailey (1994), 'The Role of Lawyers in Changing the Law', *Journal of Legal Studies*, 23, 807–31.
- Rubin, Paul H., Dennis Murphy and Gregg A. Jarrell (1988), 'Risky Products, Risky Stocks', *Regulation*, 1, 35–9.
- Rubin, Paul H. and Joanna M. Shepherd (2007), 'Tort Reform and Accidental Deaths', *Journal of Law and Economics*, 50, 221–38.
- Rubinfeld, Daniel L. (1984), 'On Determining the Optimal Magnitude and Length of Liability in Torts', *Journal of Legal Studies*, 13, 551–63.
- Rustad, Michael (1992), 'In Defense of Punitive Damages in Products Liability', *Iowa Law Review*, 78, 1–88.
- Sage, William M. (1988), 'Drug Product Liability and Health Care Delivery Systems', *Stanford Law Review*, 40, 989–1026.
- Satterthwaite, Mark A. (1979), 'Consumer Information, Equilibrium Industry Price, and the Number of Sellers', *Bell Journal of Economics*, 10, 483–502.
- Saving, Thomas R. (1995), 'Comment: Legal Implications of Imperfect Information in Consumer Markets', *Journal of Institutional and Theoretical Economics*, 151, 52–7.
- Schlee, Edward E. (1996), 'The Value of Information about Product Quality', *RAND Journal of Economics*, 27, 803–15.
- Schmitz, Patrick W. (2000), 'On the Joint Use of Liability and Safety Regulation', *International Review of Law and Economics*, 20, 371–82.
- Schwartz, Alan (1985), 'Products Liability, Corporate Structure, and Bankruptcy: Toxic Substances and the Remote Risk Relationship', *Journal of Legal Studies*, 14, 689–736.
- Schwartz, Alan (1988), 'Proposals for Products Liability Reform: A Theoretical Synthesis', *Yale Law Journal*, 97, 353–419.
- Schwartz, Alan (1989a), 'Commentary on "Towards a Market in Unmatured Tort Claims": A Long Way Yet to Go', *Virginia Law Review*, 75, 423–30.
- Schwartz, Alan (1989b), 'Views of Addiction and Duty to Warn', *Virginia Law Review*, 75, 509–60.
- Schwartz, Alan (1990), 'The Myth that Promisees Prefer Supracompensatory Remedies: An Analysis of Contracting for Damage Measures', *Yale Law Journal*, 100, 369–407.
- Schwartz, Alan (1992), 'The Case against Strict Liability', *Fordham Law Review*, 60, 819–42.
- Schwartz, Alan (1995), 'Legal Implications of Imperfect Information in Consumer Markets', *Journal of Institutional and Theoretical Economics*, 151, 31–48.
- Schwartz, Alan and Louis L. Wilde (1979a), 'Intervening in Markets on the Basis of Imperfect Information: A Legal and Economic Analysis?', *University of Pennsylvania Law Review*, 127, 630–82.
- Schwartz, Alan and Louis L. Wilde (1979b), 'Equilibrium Comparison Shopping', *Review of Economic Studies*, 46, 543–53.
- Schwartz, Alan and Louis L. Wilde (1982), 'Competitive Equilibria in Markets for Heterogeneous Goods under Imperfect Information: A Theoretical Analysis with Policy Implications', *Bell Journal of Economics*, 13, 181–93.
- Schwartz, Alan and Louis L. Wilde (1983a), 'Imperfect Information in Markets for Contract Terms: The Examples of Warranties and Security Interests', *Virginia Law Review*, 69, 1387–485.

- Schwartz, Alan and Louis L. Wilde (1983b), 'Warranty Markets and Public Policy', *Information Economics and Policy*, 1, 55–67.
- Schwartz, Alan and Louis L. Wilde (1985), 'Product Quality and Imperfect Information', *Review of Economic Studies*, 52, 251–62.
- Schwartz, Gary T. (1979), 'Foreword: Understanding Products Liability', *California Law Review*, 67, 435–96.
- Schwartz, Gary T. (1983), 'New Products, Old Products, Evolving Law, Retroactive Law', *New York University Law Review*, 58, 796–852.
- Schwartz, Gary T. (1985), 'Directions in Contemporary Products Liability Scholarship', *Journal of Legal Studies*, 14, 763–78.
- Schwartz, Gary T. (1986), 'Economic Loss in American Tort Law: The Examples of J'Aire and of Products Liability', *San Diego Law Review*, 23, 37–78.
- Schwartz, Gary T. (1990), 'The Ethics and the Economics of Tort Liability Insurance', *Cornell Law Review*, 75, 313–65.
- Schwartz, Gary T. (1991a), 'The Myth of the Ford Pinto Case', *Rutgers Law Review*, 43, 1013–68.
- Schwartz, Gary T. (1991b), 'Products Liability and Medical Malpractice in Comparative Context', in Peter Huber and Robert Litan (eds), *Liability Maze: The Impact of Liability Law on Innovation and Safety*, pp. 28–80.
- Schwartz, Gary T. (1993), 'The A.L.I. Reporters' Study', *University of Hawaii Law Review*, 15, 529–43.
- Schwartz, Gary T. (1994a), 'Reality in the Economic Analysis of Tort Law: Does Tort Law Really Deter?', *University of California Los Angeles Law Review*, 42, 377–444.
- Schwartz, Gary T. (1994b), 'A National Health Program: What its Effect Would be on American Tort Law and Malpractice Law', *Cornell Law Review*, 79, 1339–81.
- Schwartz, Victor (1983), 'The Post-sale Duty to Warn: Two Unfortunate Forks in the Road to a Reasonable Doctrine', *New York University Law Review*, 58, 892–905.
- Schwartz, Victor E. (1992), 'Innovation and Our Product Liability System: Let us End the Conflict on Incentives', *Business Economics*, 27 (4), 15–18.
- Shapiro, Carl (1982), 'Consumer Information, Product Quality, and Seller Reputation', *Bell Journal of Economics*, 13, 20–35.
- Shapiro, Carl (1983), 'Consumer Information, Product Quality, and Seller Reputation', *Quarterly Journal of Economics*, 98, 659–79.
- Shavell, Steven (1979), 'Risk Sharing and Incentives in the Principal and Agent Relationship', *Bell Journal of Economics*, 10, 55–73.
- Shavell, Steven (1980), 'Strict Liability versus Negligence', *Journal of Legal Studies*, 9, 1–25.
- Shavell, Steven (1982), 'On Liability and Insurance', *Bell Journal of Economics*, 13, 120–32.
- Shavell, Steven (1984a), 'A Model of the Optimal Use of Liability and Safety Regulation', *Rand Journal of Economics*, 15, 271–80.
- Shavell, Steven (1984b), 'Liability for Harm versus Regulation of Safety', *Journal of Legal Studies*, 13, 357–74.
- Shavell, Steven (1987), *Economic Analysis of Accident Law*, Cambridge, MA: Harvard University Press.
- Shavell, Steven (1992), 'Liability and the Incentives to Obtain Information about Risk', *Journal of Legal Studies*, 21, 259–70.
- Shieh, Shiou (1993), 'Incentives for Cost-Reducing Investment in a Signaling Model of Product Quality', *Rand Journal of Economics*, 24, 466–77.
- Siliciano, John A. (1987), 'Corporate Behavior and the Social Efficiency of Tort Law', *Michigan Law Review*, 85, 1820–64.
- Simon, Marilyn J. (1981), 'Imperfect Information, Costly Litigation, and Product Quality', *Bell Journal of Economics*, 12, 171–84.
- Simon, Marilyn J., Robert G. Wolf and Jeffrey M. Perloff (1985), 'Product Safety, Liability Rules and Retailer Bankruptcy', *Southern Economic Journal*, 51, 1130–41.
- Sloan, Frank A., Justin G. Trogdon and Carrie A. Mathews (2005), 'Litigation and the Value of Tobacco Companies', *Journal of Health Economics*, 24, 427–47.

- Smallwood, Dennis E. and John Conlisk (1979), 'Product Quality in Markets Where Consumers are Imperfectly Informed', *Quarterly Journal of Economics*, 93, 1–23.
- Smithson, Charles W. and Christopher R. Thomas (1988), 'Measuring the Cost to Consumers of Product Defects: The Value of "Lemon Insurance"', *Journal of Law and Economics*, 31, 485–502.
- Sowle, Kathryn Dix (1991), 'Toward a Synthesis of Product Liability Principles: Schwartz's Model and the Cost-minimization Alternative', *University of Miami Law Review*, 46, 1–110.
- Speir, John P. (1990), 'Efficiency Implications of the Sindell-Rexall Rule', *Cato Journal*, 10, 603–7.
- Spence, A. Michael (1975), 'Monopoly, Quality and Regulation', *Bell Journal of Economics*, 6, 417–29.
- Spence, A. Michael (1977), 'Nonprice Competition', *American Economic Review*, 67, 255–9.
- Spence, A. Michael (1978), 'Consumer Misperception, Product Failure and Product Liability', *Review of Economic Studies*, 44, 561–72.
- Spulber, Daniel F. (1989), *Regulation and Markets*, Cambridge, MA: MIT Press.
- Stapleton, Jane (1994), *Product Liability*, London: Butterworths.
- Sunding, David L. and David Zilberman (1998), 'Allocating Product Liability in a Multimarket Setting', *International Review of Law and Economics*, 18, 1–11.
- Swazey, Judith P. (1991), 'Prescription Drug Safety and Product Liability', in Peter W. Huber and Robert E. Litan (eds), *The Liability Maze: The Impact of Liability Law on Safety and Innovation*, Washington, DC: The Brookings Institution, pp. 291–333.
- Sykes, Alan O. (1989), 'Reformulating Tort Reform (Book Review of Peter Huber, "Liability: The Legal Revolution and Its Consequences")', *University of Chicago Law Review*, 56, 1153–70.
- Symposium (1970), 'Products Liability: Economic Analysis and the Law', *University of Chicago Law Review*, 38, 1–141.
- Takaoka, Sumiko (2005), 'The Effects of Product Liability Costs on R&D with Asymmetric Information', *Japan and the World Economy*, 17, 59–81.
- Takaoka, Sumiko (2006), 'Product Defects and the Value of the Firm in Japan: The Impact of the Product Liability Law', *Journal of Legal Studies*, 35, 61–84.
- Thoman, Lynda (1994), 'Strict Liability and Negligence Rules when the Product is Information', *Economic Letters*, 44, 205–13.
- Tietz, Gerald F. (1993), 'Strict Products Liability, Design Defects and Corporate Decisionmaking: Greater Deterrence Through Stricter Process', *Villanova Law Review*, 38, 1361–460.
- Tirole, Jean (1990), *The Theory of Industrial Organization*, Cambridge, MA: The MIT Press.
- Trebilcock, Michael J. (1987), 'The Social-insurance-deterrence Dilemma of Modern North American Tort Law: A Canadian Perspective on the Liability Insurance Crisis', *San Diego Law Review*, 24, 929–1002.
- Trebilcock, Michael J. (1990), 'Comment (on Viscusi, "The Performance of Liability Insurance in States with Different Products-liability statutes")', *Journal of Legal Studies*, 19, 845–9.
- Twerski, Aaron D. (1983), 'The Role of the Judge in Tort Law: From Risk-utility to Consumer Expectations: Enhancing the Role of Judicial Screening in Product Liability Litigation', *Hofstra Law Review*, 11, 861–936.
- Twigg-Flesner (2005), 'Innovation and EU Consumer Law', *Journal of Consumer Policy*, 28, 409–32.
- US Department of Justice Tort Policy Working Group (1986), *Report on the Causes, Extent, and Policy Implications of the Current Crisis in Insurance Affordability and Availability*, Washington, DC: Government Printing Office.
- Utaka, Atsuo (2006), 'Durable-Goods Warranties and Social Welfare', *Journal of Law, Economics, and Organization*, 22, 508–22.
- van't Veld, Klaus (2006), 'Hazardous-Industry Restructuring to Avoid Liability for Accidents', *International Review of Law and Economics*, 26, 297–322.

- Venezian E.C. (1975), 'Insurer Capital Needs under Parameter Uncertainty', *Journal of Risk and Insurance*, 42, 19–32.
- Viscusi, W. Kip (1984a), 'The Lulling Effect: The Impact of Child-Resistant Packaging on Aspirin and Analgesic Ingestions', *American Economic Review*, 74, 324–7.
- Viscusi, W. Kip (1984b), *Regulating Consumer Product Safety*, Washington, DC: American Enterprise Institute for Public Policy Research.
- Viscusi, W. Kip (1985), 'Consumer Behavior and the Safety Effects of Product Safety Regulation', *Journal of Law and Economics*, 28, 527–53.
- Viscusi, W. Kip (1986), 'The Determinants of the Disposition of Product Liability Claims and Compensation for Bodily Injury', *Journal of Legal Studies*, 15, 321–46.
- Viscusi, W. Kip (1988a), 'Product Liability and Regulation: Establishing the Appropriate Institutional Division of Labor', *American Economic Review. Papers and Proceedings*, 78, 300–304.
- Viscusi, W. Kip (1988b), 'Product Liability Litigation with Risk Aversion', *Journal of Legal Studies*, 17, 101–21.
- Viscusi, W. Kip (1988c), 'Pain and Suffering in Product Liability Cases: Systematic Compensation or Capricious Awards?', *International Review of Law and Economics*, 8, 203–20.
- Viscusi, W. Kip (1989a), 'Toward a Diminished Role for Tort Liability: Social Insurance, Government Regulation, and Contemporary Risks to Health and Safety', *Yale Journal on Regulation*, 6, 65–107.
- Viscusi, W. Kip (1989b), 'The Interaction between Product Liability and Workers' Compensation as Ex Post Remedies for Workplace Injuries', *Journal of Law, Economics and Organization*, 5, 185–210.
- Viscusi, W. Kip (1989c), 'Prospective Reference Theory: Toward an Explanation of the Paradoxes', *Journal of Risk and Uncertainty*, 2, 235–64.
- Viscusi, W. Kip (1990a), 'The Performance of Liability Insurance in States with Different Products-Liability Statutes', *Journal of Legal Studies*, 19, 809–36.
- Viscusi, W. Kip (1990b), 'Wading through the Muddle of Risk-Utility Analysis', *American University Law Review*, 39, 573–614.
- Viscusi, W. Kip (1991a), 'The Dimensions of the Product Liability Crisis', *Journal of Legal Studies*, 20, 147–77.
- Viscusi, W. Kip (1991b), *Reforming Products Liability*, Cambridge, MA: Harvard University Press.
- Viscusi, W. Kip (1991c), 'Product and Occupational Liability', *Journal of Economic Perspectives*, 5 (3), 71–91.
- Viscusi, W. Kip (1993a), 'The Risky Business of Insurance Pricing', *Journal of Risk and Uncertainty*, 7, 117–39.
- Viscusi, W. Kip (1993b), *Product-Risk Labelling: A Federal Responsibility*, Washington, DC: American Enterprise Institute for Public Policy Research.
- Viscusi, W. Kip (1996), 'Alternative Institutional Responses to Asbestos', *Journal of Risk and Uncertainty*, 12, 147–70.
- Viscusi, W. Kip (2000), 'Corporate Risk Analysis: A Reckless Act?', *Stanford Law Review*, 52, 547–97.
- Viscusi, W. Kip (2001), 'The Challenge of Punitive Damages Mathematics', *Journal of Legal Studies*, 30, 313–50.
- Viscusi, W. Kip (2002), 'Tobacco: Regulation and Taxation through Litigation', in W. Kip Viscusi (ed.), *Regulation through Litigation*, Washington, DC: AEI-Brookings Joint Center for Regulatory Studies, pp. 22–51.
- Viscusi, W. Kip and Joni Hersch (1990), 'The Market Response to Product Safety Litigation', *Journal of Regulatory Economics*, 2, 215–30.
- Viscusi, W. Kip and Wesley A. Magat (1987), *Learning about Risk: Consumer and Worker Responses to Hazard Information*, Cambridge, MA: Harvard University Press.
- Viscusi, W. Kip, Wesley A. Magat and Joel Huber (1987), 'An Investigation of the Rationality of Consumer Valuations of Multiple Health Risks', *Rand Journal of Economics*, 18, 465–79.

- Viscusi, W. Kip and Michael J. Moore (1991a), 'Rationalizing the Relationship between Product Liability and Innovation', in Peter H. Schuck (ed.), *Tort Law and the Public Interest: Competition, Innovation, and Consumer Welfare*, New York: W.W. Norton & Co., pp. 105–26.
- Viscusi, W. Kip and Michael J. Moore (1991b), 'An Industrial Profile of the Links between Product Liability and Innovation', in Peter W. Huber and Robert E. Litan (eds), *The Liability Maze: The Impact of Liability Law on Safety and Innovation*, Washington, DC: The Brookings Institution, pp. 81–119.
- Viscusi, W. Kip and Michael J. Moore (1993), 'Product Liability, Research and Development, and Innovation', *Journal of Political Economy*, 101, 161–84.
- Viscusi, W. Kip, Richard J. Zeckhauser, Patricia Born and Glenn Blackmon (1993), 'The Effect of 1980s Tort Reform Legislation on General Liability and Medical Malpractice Insurance', *Journal of Risk and Uncertainty*, 6, 165–86.
- Wade, John W. (1983), 'On the Effect in Product Liability of Knowledge Unavailable Prior to Marketing', *New York University Law Review*, 58, 734–64.
- Wagner, Wendy E. (1997), 'Choosing Ignorance in the Manufacture of Toxic Products', *Cornell Law Review*, 82, 773–855.
- Wagner, Wendy E. (2007), 'When All Else Fails: Regulating Risky Products through Tort Litigation', *Georgetown Law Journal*, 95, 693–732.
- Ward, John O. (1988), 'Origins of the Tort Reform Movement', *Contemporary Policy Issues*, 6, 97–107.
- Weber, Nathan (1987), *Product Liability: The Corporate Response*, New York: Conference Board.
- Weicher, John C. (1981), 'Product Quality and Value in the New Home Market: Implications for Consumer Protection Regulation', *Journal of Law and Economics*, 24, 365–97.
- Weinrib, Ernest J. (1985), 'The Insurance Justification and Private Law', *Journal of Legal Studies*, 14, 681–87.
- Welling, Linda (1991), 'A Theory of Voluntary Recalls and Product Liability', *Southern Economic Journal*, 57, 1092–111.
- Wheeler, Malcolm E. (1984), 'The Use of Criminal Statutes to Regulate Product Safety', *Journal of Legal Studies*, 13, 593–618.
- White, Michelle J. (2004), 'Asbestos and the Future of Mass Torts', *Journal of Economic Perspectives*, 18, 183–204.
- Wickelgren, Abraham L. (2005), 'The Inefficiency of Contractually-based Liability with Rational Consumers', *Journal of Law, Economics, and Organization*, 22, 168–83.
- Wiggins, Steven N. and A.H. Ringleb (1992), 'Adverse Selection and Long-term Hazards: The Choice between Contract and Mandatory Liability Rules', *Journal of Legal Studies*, 21, 189–215.
- Wilde, Louis L. (1992), 'Comparison Shopping as a Simultaneous Move Game', *Economic Journal*, 102, 562–9.
- Wilhelmsson, Thomas (2006), 'The Abuse of the "Confident Consumer" as a Justification for EC Consumer Law', *Journal of Consumer Policy*, 27, 317–37.
- Williams, Stephen F. (1993), 'Second Best: The Soft Underbelly of Deterrence Theory in Tort', *Harvard Law Review*, 106, 932–44.
- Williamson, Oliver E. (1995), 'Legal Implications of Imperfect Information in Consumer Markets: Comment', *Journal of Institutional and Theoretical Economics*, 151, 49–51.
- Winston, Clifford and Fred Manninger (1984), 'Consumer Demand for Automobile Safety', *American Economic Review*, 74, 316–19.
- Winter, Ralph A. (1988), 'The Liability Crisis and the Dynamics of Competitive Insurance Markets', *Yale Journal on Regulation*, 5, 455–99.
- Winter, Ralph A. (1991), 'The Liability Insurance Market', *Journal of Economic Perspectives*, 5(3), 115–36.
- Wolinsky, Asher (1983), 'Prices as Signals of Product Quality', *Review of Economic Studies*, 50, 647–58.
- X (1987), 'Note: Designer Genes that Don't Fit: A Tort Regime for Commercial Releases of Genetic Engineering Products', *Harvard Law Review*, 100, 1086–105.

- X (P.M.K. and W.J.S.) (1983), 'Note: Enforcing Waivers in Products Liability', *Virginia Law Review*, 69, 1111–52.
- Yun, John M. (2004), 'Publicity and the Optimal Punitive Damage Multiplier', *International Review of Law and Economics*, 24, 15–27.

Other references

- Binswanger, Hans P. (1974), 'A Microeconomic Approach to Induced Innovation', *Economic Journal*, 84, 940–58.
- Cross, Gary (2000), *An All-Consuming Century: Why Commercialism Won in Modern America*, New York: Columbia University Press.
- Popp, David, Tamara Hafner and Nick Johnstone (2007), 'Policy vs. Consumer Pressure: Innovation and Diffusion of Alternative Bleaching Technologies in the Pulp Industry', *NBER Working Paper Series*, Working Paper 13439, National Bureau of Economic Research, Cambridge, MA.
- Schmookler, Jacob (1966), *Invention and Economic Growth*, Cambridge, MA: Harvard University Press.
- Thirtle, Colin G. and Vernon W. Ruttan (1987), *The Role of Demand and Supply in the Generation and Diffusion of Technical Change*, Chur, Switzerland: Harwood Academic Publishers.
- Waldman, Steven (1988), 'Do Warning Labels Work?', *Newsweek*, July 18, p. 40.

Cases

- Anderson v. Hedstrom Corporation*, 76 F.Supp.2d 422 (SDNY 1999).

12 Medical malpractice

*Steve Boccara**

12.1 Introduction

Medical malpractice, according to the Harvard Medical Practice Study (1990), is defined as an adverse event related to an unintended injury caused by medical management. Although most scholars agree with this definition, it is important to point out that an adverse event can be the result of a medical error (a doctor who failed to observe a standard of care) or the result of a medical mishap (an adverse event that occurred even if treatment was properly given). This distinction between medical error and medical mishap will obviously play an important role in the determination of the liability of the parties in the doctor–patient relationship. Indeed, a medical error leads to the liability of a doctor whereas a medical mishap does not. However, in spite of the fundamental aspect of this distinction, it is commonly difficult to identify clearly if the patient was injured by a medical error or by a medical mishap.

In this context, when a patient is injured by a doctor, from a law and economics perspective an externality emerges. In order to correct this externality, the law and economics literature holds a basic idea according to which legal rules can provide sufficient incentives to the doctor to prevent damages. Thus, the choice among the various legal rules will have strong consequences for the doctors' incentives and, in the end, for the health quality delivered.

From a law and economics perspective, legal rules aim to internalize the externalities stemming from human action. In medical malpractice, legal rules must give appropriate incentives to doctors in order to internalize the risk of medical practice. Consequently, legal rules can be viewed as a price mechanism which informs both parties (doctor and patient) about the division of risk and motivates them to take due care. Obviously, the assumption that the doctor and his patient are well-informed is a strong hypothesis in the law and economics model, especially from the patient's perspective.

In this chapter we will focus mainly on the medical malpractice literature from both a theoretical and an empirical point of view. We refer to the

* Université Paul Cézanne Aix Marseille III, Centre d'Analyse Economique.

preliminary works of the American Medical Association (1963, 1983), the American Insurance Association (1976), Epstein (1976, 1978, 1988), Feldman (1979), Danzon (1985a, 1988), Viney and Markesinis (1985), Trebilcock (1987), Blair and Dewar (1988) and to this we add recent work, in alphabetical order, by Arlen and Bentley McLeod (2003, 2004), Arlen (1993, 2005), Baicker and Chandra (2005), Baker (2005a), Brennan et al. (1996), Cohen (1997–8), Danzon (1990b, 1991), DeVille (1990), Dewees, Trebilcock, and Coyte (1991), Dewees, Duff, and Trebilcock (1996), Farber and White (1990, 1994), Faure (2004), Kessler and McClellan (1996, 1997, 2002), Liang (1999, 2001), Mello and Brennan (2002), Peeples, Harris and Metzloff (2003), and Sage (1997, 2004b). Of course, for an analysis of medical malpractice using the law and economics literature with respect to accident law, we also refer to Brown (1973), Burrows and Veljanovski (1981), Calabresi and Melamed (1972), Calabresi (1970), Coase (1960), Epstein (1973), Landes and Posner (1981), Polinsky (1980), Posner (1977) and Shavell (1980).

12.2 The development of medical malpractice liability

From a historical point of view, medical malpractice liability first appeared in the fourteenth century in England and since the late eighteenth century in the United States (Danzon, 1985a). In Italy, medical practitioners were supervised by the Protomedicato (Pomata, 1998) which played the role of both price controller and guarantor of the quality of care delivered, from the late sixteenth century to the eighteenth century. However, where doctors were held liable if they did not cure their patients (considering the contract concluded between the parties), lawyers' focus was on how to penalize illegal practice and not on how to compensate victims of a licensed practitioner's misdeeds (Pomata, 1998). Finally, in France, medical practice was for a long time subjected to mockery by Molière (*Le médecin malgré lui*, 1666; *Le malade imaginaire*, 1673), who pointed out the limits of an archaic, pretentious, and motionless medicine. In France, and more generally, before the eighteenth century, medical malpractice liability was a rather unimportant field. It is only towards the end of the eighteenth century that medical malpractice liability began to be taken seriously.

Consideration of medical malpractice liability starts with the overhaul of the law and economics movement initiated by the works of Coase (1960), Calabresi (1970), Posner (1972) and Brown (1973). Indeed, during the twentieth century, western countries were faced with a rise in the number of accidents in several areas: workplace, products, marketplace, environment, automobile, and medical practice. In response to these issues, law and economics scholars developed major tools and pointed out especially the efficiency of tort law to correct externalities or damages through the use of liability rules.

Let us remember the context of medical malpractice liability: from the 1960s in the United States, patients began to file more malpractice cases and, as a consequence, physicians' liability increased (Olsen, 1996). The American Medical Association (AMA, 1963) reported that from 1956 to 1963, claim frequency was about 1.6 claims per 100 physicians, by 1968 claim frequency was about 2.7 claims, an increase of 76 percent with regard to the previous period. Averaging over the decade 1975–84, the number of claims per physician has increased at roughly 10 percent a year (Danzon, 1987, 1991). This situation has had several consequences: first, damage awards increased in response to the growth of claims frequency. Secondly, insurance carriers sought an increase in premiums of up to 500 percent in some states. Surgeons in southern California, for example, saw their rates jump from \$12,000 to \$36,000 a year (Danzon, 1985a). Finally, as a third consequence, which is a continuation of the second one, physicians had difficulties finding an insurer insofar as medical practice is perceived to be a risky activity.

In this context, the first law and economics contribution to the medical malpractice debate was provided by Epstein (1976). According to him, it would be more efficient for both the physician and patient to contract over liability directly together rather than rely on tort law. Epstein supposes that private agreements lead to an optimal solution because the different parties are able to contract in their own interests. From this perspective, contract law would be superior to tort law. Next, Feldman (1979) used an econometric model of medical malpractice incidents by examining an expected utility model of a plaintiff's decision making. He showed, among other things, that high income, exposure to surgical operations and a favorable legal system encourage incidents. In the same way, according to Mueller (1976), claims per capita depend positively on average awards, exposure to injury, propensity to litigate and legal doctrines favoring the plaintiff. Lastly, Danzon (1985a) draws up a particularly complete inventory of medical malpractice issues.

In conclusion, we can say that medical malpractice arises, first of all, with increasing expectations by citizens regarding medical progress throughout the twentieth century, and evidently, that seems to be a reaction towards a real requirement *vis-à-vis* medicine in general and their doctor in particular, shown by a refusal to accept medical errors.

12.3 The economic analysis of medical malpractice liability

12.3.1 The nature of the doctor–patient relationship

There are various legal features of the doctor–patient relationship. If they vary according to countries, we can say that in most of them the basic commitment of the parties is characterized by an obligation of means and not

by an obligation of result. In France, this relationship is of a contractual nature, led by the arrêt Mercier of 1936. According to this judgment, the terms of this contract impose a duty of care upon the doctor, and impose an obligation for payment on the patient. But although this relationship is contractual, the liability is not qualified as such; indeed, and paradoxically, the physician bears a delictual liability and not a contractual liability with respect to the negligence criteria. In Germany, there is a 'service contract' between the parties, in Italy we speak about a 'contract of intellectual performance', and in Switzerland there is a 'contract of mandate'. Finally, in England, if the patient is cured by the National Health Service (NHS) we speak about a delictual liability, and in contrast, if he is cured by a private health care provider, we refer to a contractual liability.

Furthermore, what can we say about the physician–patient relationship? In other words, must this relationship be seen as a relationship between a health care provider and his customer, or as a relationship between an injurer and a victim? Obviously, and most of the time in the doctor–patient relationship, if an accident occurs, it occurs after a first meeting between the parties. That means that both the doctor and patient have together established a cure agreement, in contrast to the case of an automobile accident, for example, where the injurer and the victim are strangers to each other before the accident. Nevertheless, the fact that the parties have already seen each other before the accident does not have consequences for the determination of the physician's liability. Indeed, the liability of the doctor is not a function of an *ex ante* or an *ex post* perspective, but rather of the two issues in medical malpractice: the question of the standard of care and the question of causation.

Moreover, from an economic point of view, the doctor–patient relationship was for a long time explained by the agency theory, in which the patient and doctor played respectively the role of the principal and the role of the agent. According to this theory, the doctor behaves in order to cure the patient without giving him any information on his work. Today, changes in the patient mentality lead us to point out that the doctor–patient relationship overcomes basic agency theory and moves between an archaic paternalism and a patient's decision maker/consumer of health services.

12.3.2 *Incentive and compensation*

Where economists believe in the deterrent function of tort law, lawyers, on the other hand, seem to accord more importance to the compensatory function of tort law (Faure and Ogus, 2002; Laroque, 2001). Economists and lawyers thus have a different perception about the role the liability system plays. On the one hand, economists look at the tort problem from an *ex ante* perspective, whereas, on the other hand, lawyers look at the

tort problem from an *ex post* perspective. Looking at the tort problem from an *ex ante* perspective means establishing incentives for doctors in order to prevent damages, while looking at the tort problem in an *ex post* perspective means determining to what extent a victim can be indemnified. The dichotomy *ex ante*–*ex post* leads to the two main functions of civil liability: the deterrent function and the compensatory function. But which of the two functions does civil liability have to serve? The first? The second, or both at the same time?

When a patient is injured by a physician, he bears a welfare loss. The situation of the patient is characterized by a welfare imbalance between the new situation (after the accident) and the past situation (before the accident). The compensation theory thus mainly aims to restore the patient's welfare as it was before the medical accident, that is, to correct the patient's welfare imbalance. In this view, the compensation function can be understood through the corrective justice approach of Aristotle insofar as a wrong event has to be made right when the patient has been wrongfully hurt by the physician and, as a consequence, it is assumed that the patient must be compensated according to legal arguments.

Nevertheless, if the only goal of tort law is to compensate victims, a victim's first-party insurance is to be preferred over tort liability. Insurance is much cheaper and quicker than tort law (Shavell, 1987). Moreover, as Danzon (1991) reported, if the sole function of liability is to provide compensation, it is extremely inefficient and, to quote Veljanovski (2006, p. 45), 'the law is seen as a method of reallocating losses to provide incentives to people to reduce harm and use resources more efficiently'.

From a law and economics perspective, the major goal of liability rules is to provide incentives for the physician to adopt optimal care (Danzon, 1985a) through preventive measures (Faure, 2004). Incentives are important in the medical malpractice debate insofar as they influence the quality of care delivered by the health care providers (Hyman and Silver, 2005, 2006). Physicians have to adopt in this case a standard of care which guarantees this quality of care.

Hence, for economists, both incentives and compensation are established to play a preventive role against the negligent physician. In this way, compensation is seen as an instrument to provide incentives to the doctor, in contrast to lawyers, who see compensation solely as a way to restore the patient's wealth. In medical malpractice, an optimal liability rule would of course at the same moment succeed in indemnifying the victim and motivating the injurer, but the problem is that a compensation system may negatively affect the incentives for prevention (Trebilcock, 1987) as for example in the case of a no-fault compensation scheme (discussed below in Section 12.6.2).

12.3.3 *Medical malpractice and the law and economics approach*

The medical malpractice debate aims to emphasize to what extent the quality of care can be improved. The response is widely accepted: by minimizing medical errors. To this end, the law and economics literature adopts precious tools like legal rules as an instrument for promoting efficiency (Posner, 1972; Shavell, 1987). According to the literature, six major liability rules exist:

- No liability
- Strict liability
- Strict liability with a defense of contributory negligence
- Simple negligence
- Negligence with a defense of contributory negligence
- Comparative negligence

Thus, legal rules must promote efficiency, that is, maximizing social welfare, by minimizing the social cost of accidents (Calabresi, 1970) and in the context of this chapter, by minimizing the social cost of medical accidents (the cost of accidents consists in precaution costs and damage costs). Generally, economists use a cost/benefit analysis to determine the level of care which will lead to this normative objective. The aim is to find a level of care at which the marginal costs of care-taking equal the marginal benefit of accident reduction (Shavell, 1987). Through tort liability, the physician must internalize the benefits of his precaution (the reduction in expected liability) insofar as tort rules are designed to incite the injurer (the doctor) to internalize the external costs of his activity, and to adopt an optimal level of precaution as the standard of care.

Let us remember that, according to Shavell's classification (1987), four main situations exist in tort law: unilateral accidents with or without consideration of the level of activity and bilateral accidents with or without consideration of the level of activity. In the medical malpractice literature, only unilateral accidents are considered (with or without consideration of the level of activity) because it is assumed that only the doctor can influence the risk; the victim is supposed to be 'passive'. As a consequence, both the simple negligence and strict liability rules are retained in economic analysis. Furthermore, the law and economics literature assumes that both the doctor and the patient are risk neutral.

In addition, a liability rule appears to remedy a lack of or imperfect information. Indeed, such imperfect information could create distortions in physicians' incentives and thus could call into question the quality of care. As a result, the use of a legal rule is legitimate insofar as it corrects such distortions (Danzon, 1985a). Tort law is viewed in the literature as

a system meant to deter behavior that could lead to accidents, because it provides sufficient information to the physician to avoid medical errors.

As a matter of fact, tort rules are also an answer to the Coase theorem. Let us remember that according to the Coase theorem, in the absence of transactions costs, the legal position does not affect the efficiency of resources allocation. This means that when parties (doctor and patient) are fully informed, the liability rule will have no effect on the preventive measures to be taken (Faure, 2004). In other words, the content of liability rules does not affect the level of prevention. In the medical malpractice case, it is unrealistic to suppose that both the doctor and patient are fully informed. On the one hand, medicine is not a perfect science and on the other hand, the patient is not well-informed about the various risks and cannot alone evaluate these risks. Thus, liability rules appear to be necessary in order to provide some information to the doctor and to the patient but, in any case, two main problems emerge: first, liability rules, made by the judiciary, can award too much protection to the patient (victim) or to the doctor (injurer), and secondly, the parties cannot freely negotiate on price to pass on the tort rules because the prices of health care services are regulated by the social security department in many countries.

12.3.4 *Tort law, regulation and insurance*

Tort law operating via the use of liability rules is not the only way to provide incentives. We might also add regulation and insurance.

Let us examine first to what extent *ex ante* regulation (public or private) can promote incentives and lead to appropriate care in health care. According to Shavell (1984a), the choice between regulation and tort law can be influenced by four main factors: information asymmetry, insolvency risk, threat of a liability suit and administrative costs. The author underlines the fact that in some situations regulation is preferred to tort law. This is the case for insolvency risk and the threat of a liability suit. In the medical malpractice area, a health care provider can cause losses with a magnitude that can be higher than their own assets (insolvency risk) and the causal link between the damage and the fault is very hard to prove (threat of a liability suit). On the other hand, tort law would be preferred to regulation for reasons of information asymmetry and administrative costs. Indeed, it is supposed that doctors have better information about the accident risk than the regulatory body – information about costs and benefits of their medical activity and the optimal way to prevent accidents (information asymmetry) and finally, the liability system seems cheaper than regulation because the administrative costs of the liability system are incurred only if a medical malpractice happens while the costs of regulation are continuous, independently of an accident's occurrence.

We can also speak of self-regulation. Self-regulation is carried out by physicians and based on the idea that they hold better information than the governmental regulations in order to provide incentives and due care. Doctors establish their own optimal standard of care through disciplinary rules, for example. Unfortunately, here there is a major problem of moral hazard. Indeed, self-regulation can lead to inefficiency because physicians can be attracted to protect themselves by determining a standard of care that facilitates their profession, for example, by keeping a low standard of care.

Next, an insurance mechanism can promote incentives for doctors to take care. According to insurance principles, the injurer (physician) will purchase an insurance liability policy in order to obtain a financial security if an accident occurs because he is assumed to be risk averse. Thereby, the insurer charges a premium which depends on the probability that an accident occurs multiplied by its magnitude. We assume that the insurer has perfect information for the premium calculation. Therefore, the premium will play an incitative role for the doctor. Indeed, the premium has a positive effect on the doctor as far as it reflects a signal about due care. The premium leads the doctor to adopt an optimal care level in order to prevent a medical accident.

Nevertheless, two problems emerge in the insurance area: adverse selection and moral hazard. Adverse selection concerns the average premium calculated by the insurer in the risk pool. This premium must correspond with the risk of most of the insured in the pool and if this is not the case, two situations arise: the premium is too low and high risks (bad doctors) enter the pool or the premium is too high and low risks (good doctors) leave the pool. These factors explain why a phenomenon of adverse selection could emerge. Next, moral hazard deals with the monitoring of the insured. When the doctor subscribes to a liability insurance policy, there is a major risk that he cannot take sufficient care to avoid a medical accident. Hence, in order to provide incentives to the injurer, insurance has developed insurance excess, coinsurance and *bonus-malus* principles. Insurance excess aims at charging to the injurer the first portion of the cost of the damage, but in the medical malpractice area this idea is not applied. Coinsurance consists of a risk-sharing mechanism between both doctor and patient. The doctor takes on the cost of the damage up to the point of a cap on damage fixed in the insurance contract. Beyond this cap, it is the victim who takes on the cost. There is coinsurance only if the cost of damage exceeds the cap on damage. Lastly, the *bonus-malus* mechanism aims to reward or punish a doctor according to his behavior. The *bonus-malus* principle directly acts upon the premium, so if the doctor adopts due care the premium will decrease (*bonus*) and if he is negligent the premium will increase (*malus*). This mechanism provides incentives to the doctor to take care.

Nevertheless, it is important to point out that insurance mechanisms, especially in the medical malpractice area, are relevant only when risk differentiation, such as, for example, an experience rating, is applied. Experience rating is a method for adjusting premium rates to reflect a doctor's (or a hospital's) claim history, providing incentives for emphasizing safety and injury prevention in the medical malpractice area. Thus, premiums more accurately reflect a doctor's accident experience. Hence, doctors may receive discounts off their premium for good claims records or may be surcharged for their poor claims records. According to Sloan (1990), although there is statistical evidence that experience rating reduces claims frequency and injury rates, such a mechanism faces 'considerable resistance' in the medical malpractice sector.

12.4 The main topics of medical malpractice

12.4.1 Negligence versus strict liability

In the law and economics literature and particularly in tort law, the negligence versus strict liability debate is as old as it is fascinating. The contributions of Brown (1973), Epstein (1973), Posner (1977) and Polinsky (1980) introduced decades of theoretical confrontations. The starting point, applied to medical malpractice, is that under a negligence rule, the physician is held liable if he spends less than the optimal – or due – care level required by the legal system, whereas under a strict liability regime, the physician must pay for losses whenever he is involved in a medical accident.

Economic analysis of tort law has shown that, in unilateral accidents, both negligence and strict liability rules are efficient (Shavell, 1987). But if we consider the activity level of the injurer, the rule of strict liability is more efficient than the negligence rule (Shavell, 1980). Indeed, according to Shavell (1980), the injurer will choose his level of activity in accordance with the benefits so derived, hence, an increase in his level of activity will raise expected accident losses. Thus, the injurer will choose too high a level of activity and the rule of negligence will not be efficient. By contrast, a strict liability rule is efficient because the injurer must pay for losses regardless of fault. As a result, he will be induced to minimize the social costs of an accident by considering the effect of his level of activity on accident losses; his decision will be efficient.

Thus, Shavell's normative conclusions do not lead to unanimity (Sher, 2006). For Hylton (2008), the choice between both rules depends on the degree to which there is a reciprocal exchange of risk among the parties and, according to him, strict liability is more efficient than negligence when the risk between the parties is asymmetric. Arlen and McLeod (2003) and

Arlen (2005) are in favor of a negligence rule, whereas Epstein (1973, 1976) insists on the properties of the strict liability rule as a causation theory.

The crucial question is why, to provide incentives, it is better to choose the negligence rule than the strict liability rule or vice versa. Let us first consider the role of information. The negligence rule requires from the judge accurate information about the due care that doctors have to adopt. The judge sets the optimal care standard. Nevertheless, the judiciary can make mistakes by elaborating this, leading doctors to underdeterrence, so this is an argument in favor of strict liability, where the judge will only have to decide on the amount of damages. But, if it is easier for the judge to set the standard of care rather than the amount of damages, the rule of negligence will be preferred to strict liability.

Secondly, we take into account the role of insurance. Without liability insurance, it is commonly accepted that strict liability plays the role of an automatic insurance mechanism for the victim (Epstein, 1973). The victim does not need first-party insurance, and damages are directly paid by the doctor or by the hospital regardless of a medical fault. Automatic insurance thus leads the doctor to take optimal care by minimizing the social cost of accidents. Strict liability is efficient. On the other hand, under the negligence rule, compensation to the victim is guaranteed only if the doctor is held liable. In that case, the physician indemnifies the victim. Conversely, if the doctor is not held liable, the victim does not receive compensation and as a result, she has to suffer the damages alone. But if we assume that a negligence rule works well, it is obvious that the victim will never receive compensation. In sum, without insurance, both the negligence rule and strict liability provide incentives to the doctor, but only strict liability guarantees compensation to the victim.

Let us now consider an insurance mechanism with effective risk differentiation (as discussed in Section 12.3.3). Under a strict liability rule, the doctor may take out a liability insurance in order to protect himself against insolvency risk (liability insurance may be compulsory, as in France for instance). Insurance liability is thus called 'third-party insurance' because the doctor's insurer will have to compensate a third party, the victim, if a medical accident occurs. Therefore, strict liability still provides incentives to the doctor and leads to compensation for the victim. We can also add that the victim may take out first-party insurance, but only if a 'Designated Compensable Event' (DCE) exists. Indeed, let us imagine that the doctor is strictly liable for such DCE. If a medical accident occurs and figures in this list of DCE, the victim will be compensated and does not need first-party insurance. If this is not the case, the victim will not be compensated so the victim will have to take out first-party insurance (we assume that from an efficiency perspective, first-party and third-party insurance are

equivalent). Under a negligence rule, finally, the doctor purchases liability insurance or third-party insurance and the victim subscribes to first-party insurance because compensation is not guaranteed. Thus, the negligence rule provides incentives to the doctor to adopt optimal care (if the judge holds accurate information to set an optimal standard of care), but does not provide compensation to the victim.

12.4.2 *Standard of care*

The way in which the standard of care is determined represents another major topic in medical malpractice. It is usually admitted that the standard of care is described in terms of medical custom, locality rule and informed consent (Danzon, 1985a). In other words, the standard of care appears to be an accepted practice in a given specialty (Miller, 2003; Peeples, Harris and Metzloff, 2003). It is thus referred to as a behavioral norm which induces physicians to provide due care.

The standard of care is the heart of the negligence theory. Let us remember that according to this theory, the physician is negligent if the loss caused by the medical accident, multiplied by the probability of the medical accident's occurring, exceeds the cost of preventing this medical accident. This is Judge Learned Hand's formula.

The standard, also called *bonus pater familias*, is viewed as a criterion which retains the fault principle in order to bound the liability of the parties, and particularly the liability of the physician. As a result, in the law and economics model, the standard of care, generally denoted y^* , has important consequences.

Indeed, in negligence theory, the standard of care only has an effect on the incentive function. In the French Civil Code, for example, article 1382 defines the liability between the parties in an accident setting from a negligence perspective. If the doctor is held liable, he must compensate the patient and on the other hand, if he is not held liable, the victim will receive no compensation. The standard of care in the fault system and from an economic perspective aims first at influencing the behavior of the doctor and not at providing compensation. It is finally important to know how the standard of care must be determined: if too low, it will favour the physician; if too high, it will favour the victim.

12.4.3 *Is the tort system relevant?*

Considering that medical malpractice liability can be dealt with via tort law leads us to reflect on a major question: does the malpractice system deter medical negligence and provide appropriate compensation to injured patients? Let us first examine the data concerning adverse events. The first contribution was provided by the California Medical Association and

the California Hospital Association study (1977), which examined 21,000 records of patients who stayed in 23 California hospitals in 1974 (see also White, 1994). This study concluded that 4.65 percent of these patients were injured as a result of medical care and 0.79 percent from negligence. Similar results were found by the Harvard Medical Practice Study – HMPS (1990), which indicates that approximately 4 percent of all hospitalizations result in adverse events, of which 25 percent involve substandard care. Dewees, Duff and Trebilcock (1996) underlined a 1981 report in the *New England Journal of Medicine*, which identified a 36 percent rate of iatrogenic injury among 815 consecutive patients of a general medical service in a university hospital; 9 percent of them reported suffering ‘major complications’. Overall, it is admitted that nearly 1 percent of all hospital patients in the United States suffer harm because of substandard care, and according to White (1994), 25 percent (84,000) of these die and 6 percent (20,000) suffer permanent disability every year; a result supported by the HMPS study. Indeed, the researchers found that in New York state, nearly 99,000 patients suffered disabling injuries, of which nearly 13,000 resulted in death. Alongside the findings of Dewees, Duff, and Trebilcock (1996), extrapolating these results as a whole suggests that 1.5 million patients suffer some kind of disabling injury. Of these, 180,000 die as a result of medical treatment and over a half of these deaths (90,000) are due to negligence. From this, we can add that in the United States, in comparison with both motor vehicle accidents (40,000) and workplace accidents (6,000), mortality from medical injury (180,000) is far more important. Hyman and Silver (2005) reported that in the United Kingdom, the Chief Medical Officer of the National Health Service estimated, for the year 2000, that 850,000 ‘serious adverse health care events’ occur in NHS hospitals each year and that half of these are thought to be preventable. The situation in France appears to be similar, with 600,000 adverse events each year, of which 200,000 are thought to be preventable according to the *Etude nationale sur les événements indésirables graves liés au processus de soins* (2006). Finally, it is also worth pointing out that between 80 and 90 percent of all malpractice claims in the United States originate from a hospital setting.

Nevertheless, although adverse events are numerous, it seems that few patients sue. Indeed, the HMPS stresses that only one malpractice claim was filed for every eight negligent injuries – that is, approximately 2 percent of patients who were negligently injured filed a claim (Hyman and Silver, 2006), while Danzon estimated that one malpractice was filed for every ten potentially valid claims (Danzon, 1985a; Dewees, Trebilcock, and Coyte, 1991) – let us clarify that the growth of claims will be discussed in Section 12.5. As a result, various studies show that more than 90 percent of all malpractice claims are settled out of court (Avraham, 2006b; Dewees, Duff,

and Trebilcock, 1996) because the tort system is seen as being random, providing 'jackpot justice' and 'lawsuit lottery'. It is also costly and slow (we do not discuss either malpractice settlements or the cost of the malpractice system in this chapter). All these features, and particularly the weakness of the suits, remind us that the malpractice system fails to deter negligent injuries.

However, several studies were seen to prove the effectiveness of the tort system in the malpractice area when patients sue. The aim of these studies was to underline that a strong correlation exists between the likelihood of receiving payment and the merits of malpractice claims. As major contributions, we can refer to the works of Ogburn et al. (1988), Cheney et al. (1989), Rosenblatt and Hurst (1989), Farber and White (1990, 1994), the Harvard Medical Practice Study (1990), Sloan and Hsieh (1991), Taragin et al. (1992), Sloan et al. (1993), Peeples, Harris and Metzloff (2003) and Studdert et al. (2006). We can also refer to Baker (2005a) and to Hyman and Silver (2006).

In sum, Ogburn et al. found that the plaintiff receives payment when the physician is judged to be negligent, in 91 percent of the cases, Cheney et al., 82 percent, Rosenblatt and Hurst, 95 percent, Farber and White, 89 percent, Taragin et al., 91 percent, Peeples, Harris and Metzloff, 86 percent, and Studdert et al., 77 percent. The Harvard Medical Practice Study found a different result: according to the researchers, the plaintiff receives payment when the physician is negligent in 56 percent of the cases. All these results are so-called 'true positives' (that is, when patients entitled to payments receive them). We can also add that Cheney et al. found that the median damage payment for a disabling injury was \$469,000 when care was negligent. Hence, these results lead the researchers to conclude that the malpractice system works well and that the negligence rule leads to patients being compensated. But the conclusions are mixed.

Indeed, it is also important to focus on the 'false positives' events (that is, when patients not entitled to payments receive them). Ogburn et al. found that the victim receives payment without negligence on the part of the physician in 55 percent of cases, Cheney et al., 42 percent, Rosenblatt and Hurst, 0 percent, Farber and White, 25 percent, Taragin et al., 21 percent, Peeples, Harris and Metzloff, 11 percent, Studdert et al., 34 percent, and the Harvard Medical Practice Study, 43 percent. If the malpractice system worked really well, such results would never occur.

In addition, the Ogburn et al. study found for example (this remark is also valid for the other studies) that victims do not receive compensation in spite of the negligence of the physician. Indeed, they do not receive payment in 9 percent of cases, a so-called 'false negative' result. As a result, Dewees, Duff and Trebilcock (1996, p. 100) pointed out the 'considerable overdeterrence'

of the malpractice system. According to them, '42 percent of nonnegligently injured plaintiffs recovered some damages while 10 percent of negligently injured patients who initiated malpractice claims recovered nothing'. Last, but not least, only 2 percent of injured patients receive any compensation through the tort system, and, according to the Insurance Information Institute study, provider-defendants won in trials approximately 81 percent of the time (Hyman and Silver, 1996).

To conclude, although some authors, such as Farber and White (1994), believe that the malpractice system creates a financial incentive for health care providers to provide nonnegligent medical care, others, such as Sage (2004b), emphasize that the malpractice system fails both to deter negligent medical injuries and to provide appropriate compensation to patients. The major problems in the malpractice liability system are that few patients sue, 'false positive' and 'false negative' events occur, which point to juries' mistakes, and the system is expensive (program administration accounts for 60 percent of total malpractice costs).

12.4.4 Defensive medicine

Most doctors try to protect themselves from liability by practicing defensive medicine. A major issue in medical malpractice consists in defining this concept. Hence, according to the Congressional Office of Technology Assessment (OTA), quoted by Sclar and Housman (2003):

Defensive medicine occurs when doctors order tests, procedures or visits, or avoid high-risk patients or procedures, primarily (but not necessarily solely) to reduce their exposure to malpractice liability. (Sclar and Housman, 2003, p. 76)

Moreover, Hershey (1972), reported by Danzon (1985a), says:

Defensive medicine has been defined as deviation from what the physician believes is sound practice, and is generally so regarded, induced by a threat of liability . . . Not all practices motivated for liability considerations result in poor-quality care. It is, therefore, difficult to draw the line between where good medicine stops and defensive medicine practice begins. (Danzon, 1985a, p. 146)

As a result, defensive medicine can be separated into two entities: good and bad. Good (or positive) defensive medicine refers to acts like spending more time with patients, carrying out additional tests or procedures, whereas bad (or negative) defensive medicine refers to omissions, such as refusing to treat patients who pose a high risk of suit, or using x-rays excessively and unnecessary hospitalization (Danzon, 1985a).

Although it is commonly admitted that the costs of defensive medicine are difficult to quantify, Baicker and Chandra (2004) point out that 5

percent of the \$1.5 trillion that the United States spends on health care may be attributed to defensive medicine.

Consequently, the defensive medicine debate aims to underline to what extent the fear of lawsuits can influence the practice of physicians. One of the first studies undertaken by the American Medical Association (AMA, 1983) relates to a survey of 1,240 physicians and is summarized by Danzon (1985a). In response to the threat of liability, 41 percent of physicians prescribe additional diagnostic tests, 27 percent provide additional treatment procedures, 36 percent spend more time with patients, 45 percent refer more cases to other physicians, 35 percent do not accept certain types of cases, 57 percent maintain more detailed patient records and 2.6 percent drop their liability insurance (see also Zuckerman, 1984). In the same way, the OTA sponsored a series of clinical scenario surveys in the early 1990s (Baker, 2005a) concerning cardiologists, surgeons, and obstetricians and gynecologists. Scenarios illustrate clinical situations in which physicians would expect the fear of a malpractice suit to have a major influence on their or their colleagues' clinical decisions. Scenarios included a list of possible responses by physicians in order to avoid a malpractice suit: to do nothing, to order procedures or to order standard tests. The results contradict the forecasts. Indeed, the doctors chose 'to do nothing' rather than adopt the possible responses listed in the scenario 95 percent of the time and procedures or tests (5 percent) are decided upon for medical reasons and not in response to medical malpractice. Nevertheless, as Baker stresses, there are some situations where defensive medicine is more important: in cases of risk of heart attack, risk of brain injury and risk of breast cancer. As a consequence, doctors double-check malpractice concerns and, in respective of each risk, cardiologists chose procedures or tests 14 percent of the time, neurosurgeons, 29 percent, and obstetrician-gynecologists, 10 percent. Researchers from the Harvard Medical Practice Study studied cesarian delivery rates in New York (Baker, 2005a). They found some differences between hospitals. Indeed, a woman who entered a hospital with a high medical malpractice risk was about 30 percent more likely to have a cesarian section than a woman who entered hospital with a low malpractice claim risk. Thus, the claim history of the hospital made a 'significant difference'. The study assumes that factors like risk factors, region or doctor are equal between hospitals. Moreover, Dewees, Duff and Trebilcock (1996) pointed out that two econometric studies (respectively by Greenwald and Mueller in 1978 and by Reynolds et al. in 1987) found significant correlations between increases in malpractice premium levels and the frequency of specific diagnostic procedures. According to the authors, these studies both 'showed that a 10 percent increase in malpractice premiums was associated with a 3.6 percent increase in a weighted average of lab-tests, x-ray, and consultations', and pointed to

the existence of ‘an elasticity of 0.073 relating malpractice premiums and the volume of electrocardiogram utilization’.

In addition, Kessler and McClellan (1996) stress a direct link between tort reforms and a reduction of health care expenditures for heart diseases. According to them, direct tort reforms reduce the growth of medical expenditures by approximatively 5 to 9 percent. Tort reforms then reduce provider liability pressure. Moreover, Kessler and McClellan (1997) point out that mechanisms such as frequency and severity of claims may play an important role in fostering defensive medical practices. Hence, Baicker and Chandra (2005) note that a 10 percent increase in malpractice cases increases total medical expenditures by 1.3 percent but increases spending on imaging procedures by 2.9 percent. Continuing these observations, Klick and Stratmann (2003, 2007) demonstrate that tort reforms such as caps on non-economic damages or caps on damage awards have important consequences on limiting liability.

Nevertheless, the finding of a systematic improvement of health care in response to a threat of medical malpractice is not shared by Sloan et al. (1995). In this study, the authors examine the variations in claim frequency and payment per exposure year for various indicators of birth outcomes, fetal deaths, low Apgar score, death within five days of birth, infant death, and death or permanent impairment at five years of age, in response to the threat of medical malpractice. The authors conclude that no systematic improvement in birth outcomes in response to an increased threat of medical malpractice litigation was obtained, except for fetal deaths.

12.5 The medical malpractice crisis

12.5.1 The context

The medical malpractice crisis appears in the middle of the 1970s in the United States (most developed countries will also have experienced an equivalent situation with some nuances) and it is characterized by an increase in the number of claims per physician, damage awards and insurance premiums. This crisis is repeated approximately every ten years since the 1970s. Indeed, the 1970s were described as a crisis of availability, the 1980s as a crisis of affordability, the 1990s as a ‘perfect storm’. Since the year 2000, the malpractice crisis has reappeared again.

As a result, claims frequency and severity increased sharply. In the United States, the number of claims filed per 100 physicians increased from 4.5 in 1970 to 17.8 in 1985. Prior to 1978, the annual rate of claims filed was 3.3 per 100 physicians, then 8.0 per 100 physicians between 1978 and 1983. The annual mean cases per state has increased from about 258 cases a year in 1991 to about 264 in 1998, a 2.3 percent growth. Moreover,

Deweese, Duff and Trebilcock (1996) found that between 1970 and 1985 the coverage value of paid malpractice claims in the United States tripled from \$37,000 to \$110,000. According to Avraham (2006b), the annual mean settlement payment between 1991 and 1998 increased from about \$210,000 to about \$280,000, an overall increase of 33 percent and a 4 percent annual increase. In addition, the annual mean total settlement payments per state have increased from about \$46 million in 1991 to \$64 million in 1998, an increase of about 39 percent. Thorpe (2004) reported that, according to the Physicians Insurers Association of America (PIAA), nearly 8 percent of all awards now exceed \$1 million. Data from Illinois reveal that the average indemnity of paid claims for adults with grave permanent injuries has risen from \$960,000 in 1990–1994 to nearly \$1.6 million in 1995–99. Thorpe (2004), again, stresses that median malpractice awards per paid claim have doubled in real terms between 1990 and 2001. In Canada, claims filed per 100 physicians increased from 0.55 in 1970 to 1.7 in 1990. During this period, the average compound annual growth rate in claims filed per 100 physicians was 6.1 percent. The average value of paid malpractice claims increased from \$25,700 in 1971 to \$145,700 in 1990. According to Dewees, Trebilcock and Coyte (1991), the number of claims paid per 100 physicians grew at an average compound annual growth rate of 4.9 percent between 1971 and 1990. These results represent a 150 percent increase over the period, and according to the researchers, it is five times greater in the United States than in Canada. Dewees, Trebilcock and Coyte also found that the mean paid claim for all closed claims cases, between 1976 and 1987 was \$102,450. They underline a ‘considerable variation’ across six specialties; the mean period claim involving anesthesiologists is over 60 percent greater than that for all Canadian Medical Protective Association (CMPA) members, while obstetricians and gynecologists record a mean severity that is 34 percent less than for all members. Finally, in the United Kingdom, the number of claims filed per 100 physicians rose by 17.2 percent between 1978 and 1988.

Next, insurance premiums also grew, but at spectacular rates. In the United States, Dewees, Duff and Trebilcock (1996) found that the average annual real cost of malpractice coverage for physicians tripled from \$6,350 in 1974 to \$17,000 in 1988. Viscusi et al. (1993) speak of medical malpractice premiums increasing by 56 percent from 1984 to 1985, and an additional 26 percent from 1985 to 1986. According to them, this two-year period accounted for 62 percent of the total growth in medical malpractice premiums from 1981 to 1990. For Danzon et al. (2004), the median premium increase for internists, general surgeons, and obstetrician-gynecologists increased from 0–2 percent in 1996–97 to 17–18 percent in 2003, ‘climbing’ to 60 percent in some states in 2001–02. In

1994, the median annual premium rates were \$6,075 for internal medicine, \$22,269 for general surgery and \$39,122 obstetrician-gynecologists. The situation radically changed in 2003, where the median premium rates were \$9,000 for internal medicine, \$33,297 for general surgery and \$53,630 for obstetrician-gynecologists. That represents respectively a 52, 47 and 35 percent growth. Thorpe (2004) also illustrates this evolution, underlining that depending on the specialty and the state, the median increase in malpractice premiums ranged from 15 to 30 percent. Pennsylvania recorded for instance a premium increase from 26 to 73 percent in 2003. Moreover, Thorpe (2004) reported that according to the National Association of Insurance Commissioners (NAIC), total medical malpractice premiums earned increased by 23 percent in 2002. More exactly, for internists, medical malpractice premiums earned increased by 50 percent in Florida, 60 percent in Ohio, while California records small premium increases. In Canada, the results showed the same trend. The average real cost of malpractice coverage for physicians increased from \$400 in 1971 to \$2100 in 1990. Dewees, Trebilcock and Coyte (1991) reveal that the annual rate of growth of insurance fees per physician between 1976 and 1990 was 12.6 percent, with the bulk of the increase between 1982 and 1988 (40 percent in 1987).

Therefore, the medical malpractice crisis can be summarized in the following way: the increasing number of claims entail increasing damage awards which entail increased malpractice premiums. Thereby, according to Dewees, Trebilcock and Coyte (1991), a substantial portion of the 1971–90 crisis in claims (one third) in Canada is attributable to a change in legal doctrine; the researchers focused on the importance of the compensation rules in order to explain the claims increases. In the same way, Zuckerman (1984) tries to understand the regional variation in the United States concerning claims and according to her, ‘the low rate of claims in the southern states is partially due to a preponderance of state legal systems which makes plaintiff recovery more difficult’. Danzon has shown that pro-plaintiff laws contributed significantly to the growth in both the frequency and severity of malpractice claims (Dewees, Trebilcock and Coyte, 1991). Finally, according to Dewees, Trebilcock and Coyte (1991), informed consent, which was an important legal change in Canada in 1980, has significantly increased the claims frequency. Liability law seems therefore to play an important role in both the frequency and the severity of malpractice claims.

Hence, it is crucial to identify whether the increases in malpractice premiums are also related to the contents of the liability law. Sloan (1985), for instance, found no effect or perverse effects of legislative changes in premiums. As a consequence, if malpractice premiums have grown sharply and in

a spectacular way since the middle of the 1970s, maybe this situation results from the framework and the features of the malpractice insurance system.

12.5.2 Malpractice insurance and the underwriting cycle

The medical malpractice crisis presented above underlines the skyrocketing of malpractice premiums through various periods. As a fatal consequence, several insurance companies took the decision to leave the market. Indeed, one of the largest malpractice insurers in the United States, the St-Paul Travelers Companies, announced its decision to withdraw from the medical malpractice market in December 2001, followed by two other companies, Frontier Insurance Group (FIG) and PHICO, which were ordered into liquidation in November 2001, and in February 2002 respectively. Thereby, the withdrawal of several insurance companies entailed a rise in market concentration which has contributed to higher medical malpractice premiums. Hence, physicians had difficulty obtaining insurance coverage. Therefore, they chose to retire from certain high-litigation specialties like obstetrics or left high-litigation geographic areas. Indeed, according to Miller (2003), a direct link can be found between malpractice insurance costs and the number of practicing physicians. In other words, at the state level, higher premiums for instance reduce the number of physicians and can, as a consequence, have a negative impact on the quality of care.

Nevertheless, as Baker showed (2005b), the insurance premium increases are not significantly related to litigation. To understand this, let us consider three periods: 1970–75, 1981–86 and 1996–2001. According to Baker, both litigation and malpractice claim payments did not change in a significant way during these periods, whereas insurance premiums grew sharply in the years 1975, 1986 and 2001. The author explains these situations by the fact that ‘insurers that had offered low prices based on rosy scenarios in 1970, 1981, and 1996 switched to high prices based on pessimistic scenarios in 1975, 1986, and 2001’. These situations underline the major roles of insurance market conditions and the investment climate that can strongly influence premium increases, as for instance the post-oil-shock recession (1973) or terrorist attacks (2001). See also Sage (2004b).

Hence, the successive malpractice insurance crises are presented as the result of alternating periods of ‘soft market’ and ‘hard market’, commonly called the underwriting cycles. Soft markets are characterized by intense competition and low premiums, while hard markets are characterized by insurer withdrawals and high premiums (Danzon et al., 2004). The succession of soft market and hard market is thus typical of insurance cycles. Moreover, investment returns are also important in the underwriting cycle. Indeed, higher investment returns, for instance, offset the need for

an insurer to raise premiums. As Thorpe (2004) reported, a 1-percentage-point increase in expected returns is associated with a reduction in premiums of 2 to 4 percentage points.

To understand the functioning of the malpractice insurance underwriting cycle, Baker (2005b, p. 422) provides several suggestions: first of all, according to him, the insurance underwriting cycle is influenced as a whole by:

1. Interest rate cycles
2. The length of the liability insurance tail
3. Others factors affecting loss expense uncertainty
4. Moral hazard
5. Capacity constraint
6. Greed and fear
7. Institutional incentives
8. The winner's curse and herd behavior

Applied to medical malpractice, Baker found that elements 2, 3 (such as injury development risk, injury cost development risk, standard of care development risk, legal development risk and claiming development risk), 4, 5, 6, and 7 played an important role in the underwriting cycle whereas elements 1 and 8 did not affect medical malpractice insurance.

Next, Danzon et al. (2004) also found some relevant explanations concerning the malpractice insurance underwriting cycle. According to them, the malpractice insurance crisis (the hard market) originated in the prior soft market period. Indeed, they found that 'state-specific premium rate increases are not significantly related to prior increases in state-specific losses paid'. On the contrary, the researchers found that 'premium increases were positively related to upward revisions of reserves following initial under-reserving and that firms with large prior forecast errors were likely to exit the market'. Their thesis consists therefore in pointing out that the malpractice insurance crisis is the consequence of under-reserving during a soft market period.

In sum, as Sage reported (2004b, p. 10), 'the malpractice crisis seems to be first and foremost an insurance crisis'.

12.6 Some proposals to end the medical malpractice crisis

12.6.1 Tort reforms

The first idea is to end the medical malpractice crisis via the principles of the tort law. Indeed, proponents of the tort system proclaim that tort law, and particularly the negligence rule, have to be the object of some refinements.

As a result, several studies considered tort reform measures and examined their effects on the frequency, average size and total payments of malpractice claims and insurance premiums. On the whole, since the first medical malpractice crisis in the 1970s, the following tort reforms were adopted or enacted:

- caps on non-economics damages (pain and suffering)
- caps on punitive damages
- limitation on joint-and-several liability
- limitation on the collateral source rule
- allowing periodic payments of awards
- shrinking the limitation period following the negligent event or its discovery limiting legal fees.

First of all, let us examine the effects of these reforms on claims. Dewees, Trebilcock and Coyte (1991) reported that Danzon found that reductions in awards reduced in a significant way both the frequency and severity of malpractice claims. Frequency decreased by 14 percent and severity decreased by 11–18 percent. Danzon also found that caps on awards have reduced the severity of malpractice claims by 23 percent on average (see also Danzon, 1985a; Sharkey, 2005) and Sloan et al. (1989) found that damages caps reduce the plaintiffs' recovery by 31 percent. Moreover, Viscusi et al. (1993) examined the influence of joint and several liability, limits in liability coverage, limits on non-economic damages, and limits on punitive damages for the years 1985, 1986 and 1987 in the United States. The researchers found that joint and several liability was the most prominent measure adopted in 1986. It was adopted by 16 states, comprising more than half of all premiums for general liability and medical malpractice. Still in 1986, limits on liability and on non-economic damages were adopted in at least ten states. In 1987, joint and several liability rules were adopted in an additional 16 states and 15 states that represented two-fifths of all premiums imposed caps on punitive damages 'in an effort to limit liability costs'. In the same way, Avraham (2006b) presented recent results and found that collateral source was established in 35 states by 2004, periodic payment with a threshold of \$200,000 in 23 states, caps on non-economic damages in 23 states, and punitive damages in 27 states. As a consequence, empirical results show that only caps on non-economic damages sometimes decreased the number of payments and the magnitude of the payment. They also reduced the number of cases per doctor as a limitation of joint and several liability. According to Avraham, caps on non-economic damages reduced the number of cases by 13 percent and total payments by 15–20 percent, joint and several liability reduced the number of cases by 8–9 percent and total

payments by 36 percent. Finally, periodic payments reduced the number of cases by 5–7 percent.

Next, tort reforms as caps on non-economic damages seem also to have reduced premiums. Thorpe (2004) found that empirical results reported that premiums were 17 percent lower in states with a cap on awards than in states without such caps. Nevertheless, although some results suggest that capping awards may reduce premiums, prior studies underline that there is no consensus on the impact of tort reform on insurance premiums. Although it is obvious that additional research must be achieved in this domain, the major question is to what extent tort rules provide incentives to deter negligent care and lead to the victim being compensated. As we noted above in Section 12.4.3, tort law fails to achieve these goals.

12.6.2 Shifting toward a no-fault system

One of the main proposals to end the medical malpractice crisis consists in adopting a no-fault system. The major idea of the no-fault theory is that victims are not adequately compensated. As a result, proponents of a no-fault system point out the necessity of changing liability rules such that victims need not prove fault to receive compensation (McEwin, 2000). Thus, in the medical malpractice area, the patient need not prove that the physician was negligent in order to receive an indemnity. The no-fault system is based on the principles of workers' compensation and automobile accidents. In this way, no-fault appears to establish compulsory self-insurance for the parties insofar as the victim receives compensation with or without fault. Let us note that although no-fault appears to save administrative costs (Deweese, Duff and Trebilcock, 1996; Cooter and Ulen, 2000), we will not discuss this topic further here.

In medical malpractice, no-fault schemes were established in the middle of the 1970s, principally in New Zealand (1974) and Sweden (1975). In New Zealand, no-fault systems were global, financed by employers, workers, motor vehicle owners, and taxes. They were designed to cover all accidental injuries, including medical ones. Sweden and New Zealand were followed by Finland (1987), Denmark (1991), Iceland (2000) and Norway (2002). Moreover, the United States, and more precisely the states of Florida and Virginia (1989 and 1988), have replaced medical malpractice liability with a no-fault system, but only for children who suffer neurological trauma during birth. France, with the Act of 4 March 2002, established a scheme of compensation of the 'aléa thérapeutique,' which adopted a more restrictive conception of the fault of the physicians.

In sum, in those systems, when a patient is injured by a physician, he will automatically receive compensation regardless of fault. Nevertheless, no-fault must not be confused with a strict liability rule. Both rules are

different. Indeed, strict liability requires a causal relationship, so the physician is held liable regardless of fault. Under the strict liability rule, the physician undertakes the precaution costs and the damage costs. What about a no-fault rule? Since the victim is automatically compensated as in the strict liability rule, the physician will therefore bear the cost of precaution and no other cost. Indeed, in most countries, there exists a social insurance system (as in France and the Nordic countries) or private funds which propose payments for victims. The physicians do not pay for the damages.

No-fault was established, first of all, in order to restore the imbalance of the victim between his *ex ante* situation (before the accident) and his *ex post* situation (after the accident). One can explain this theoretical conception by understanding the limits of the negligence approach. As we have seen, the negligence rule is a fault-based system in which the victim receives compensation (we assume that the negligence system works well, that is, there is no false negative) if and only if the physician was negligent, and of course, if there exists a damage and a causal relationship between the damage and the fault. However, in several cases, a patient injured by a physician does not receive compensation. Hence, various voices rose to denounce the unfairness of the negligence rule. In this context, the no-fault theory emerged as a system which guarantees compensation for the victim in an automatic way. According to Dewees, Duff and Trebilcock (1996), the no-fault compensation scheme 'would be expected to compensate between 45 and 94 times as many injured patients as does the existing tort system'. The researchers found that in Sweden, the no-fault compensation scheme increased the number of patients who obtain compensation, from 100 per year before the scheme to nearly 4,000 per year in 1986.

Furthermore and paradoxically, the no-fault system was lobbied in some cases by physicians in order to protect themselves from attacks, and not by families in distress (Van Boom and Pinna, 2007). In fact, although the no-fault system seems to be a better solution to compensating the victims than the negligence rule, it is especially a system which procures immunity for physicians insofar as they are protected if they injure a patient. This situation also underlines the net difference with a strict liability system in which the physician is held liable whenever he is involved in a medical accident because he bears all the accident costs. This is not the case in a no-fault system. In fact, the compensation system negatively affects incentives to provide due care.

As a result, the major limit of the no-fault rule is clearly identified: there are no incentives for physicians to adopt careful behavior in order to avoid medical errors. Moreover, in the case of this liability rule, two other main limits appear: causation and funding. If the decision to adopt a no-fault rule is adopted, what kind of adverse events should be compensated,

and what about their financing? Havighurst and Tancredi, reported by Danzon (1985b), have proposed a limited no-fault plan, Medical Adversity Insurance (MAI), in order to compensate victims for a list of Designated Compensable Events (DCE). In France, the Act of 4 March 2002 created a nationwide compensation organism (ONIAM) in order to indemnify victims of medical mishaps with a national funding system and in Sweden, the no-fault compensation plan is financed from general tax revenue.

In any case, the crucial issue in adopting a no-fault system concerns the question of incentives and indemnity. In other words, the relevance of this system depends on whether the victim is compensated or not, and whether the financing is risk related or not. If the financing is risk related, effects on incentives will be positive and the quality of care will improve.

12.7 Conclusions

The medical malpractice debate focuses on the extent to which we can provide optimal incentives for physicians to adopt due care to avoid medical accidents while guaranteeing optimal compensation for victims. As has been seen throughout this work, the incentive–compensation dilemma reflects a central topic in medical malpractice. Hence, economists stress the relevance of the incentive function of tort law in avoiding accidents and protecting patients, while lawyers stress the compensation function as a way of restoring the patient’s welfare to what it was before the medical accident. Therefore, incentives can be provided by tort law and liability rules as negligence or strict liability, by regulation, or by insurance. On the other hand, compensation can be achieved through various mechanisms like no-fault schemes, for instance. Nevertheless, let us note that for economists and from a law and economics perspective, compensation can also have a preventive effect. Indeed, compensation can be considered as a financial penalty for health care providers that results in the deterrence of negligent behavior.

Thus, the law and economics literature underlines to what extent tort rules are relevant to achieving both the incentive and compensation goals of medical malpractice. Considering unilateral accidents, theoretical conclusions revealed that both negligence and strict liability rules provide incentives to physicians to avoid accidents (under some assumptions), while only strict liability provides appropriate compensation if we consider that the negligence rule works well. Nonetheless, empirical evidence demonstrated mixed and nuanced results. Indeed, if we consider trial verdicts, several studies show that the victim receives compensation when the physician is negligent in between 80 and 90 percent of the cases, with a median damage payment of nearly \$400,000. But, on the other hand, these studies also revealed several ‘false negative’ and ‘false positive’ results. As

a consequence, the malpractice liability system faces various problems: few injured patients sue, few injured patients receive compensation, the malpractice liability system is costly and slow, and, above all, provides considerable overdeterrence.

In addition, medical malpractice liability has been in crisis since the 1970s, and this crisis is repeated every decade. Although it is characterized by an increase in claims frequency and severity, this crisis seems to be above all an insurance crisis, particularly due to insurance cycles that are also called 'underwriting cycles'. To resolve the malpractice crisis, two major proposals were adopted: making tort reforms and establishing a no-fault compensation scheme. On the one hand, among the various tort reforms enacted, only capping damages has a positive effect on both the frequency and severity of claims and insurance premiums, and on the other hand, a no-fault compensation scheme does not really solve the deterrence problem.

As a consequence, further research was elaborated and must be extended to provide incentives and compensation, such as, for instance, innovations in risk bearing. First, Baker (2005a) proposed to establish 'enterprise insurance'; based on enterprise liability, which reflects the idea that the best entity to bear the legal liability for medical injuries is the 'enterprise' (hospitals) that employs doctors, enterprise insurance offers many of these benefits but without asking doctors to give up liability as in enterprise liability for instance. In sum, the hospital provides insurance and physicians bear the burden of liability. Physicians, in this context, would not be agents or employees of the hospital but independent and accountable for their errors.

Finally, we refer to the relevance of contract in medical malpractice. According to Epstein (1976), it would be more efficient for both the physician and the patient to contract over liability directly together rather than to rely on tort law. If this argument appears attractive, two main problems emerge: first, there is an information problem. Indeed, if we suppose that the physician and his patient can contract together, it is obvious that the physician holds more information than the patient. Secondly, if both parties want to contract together, they can do so only through a free price system with free negotiations. Nevertheless, in the majority of countries, the prices of health care services are under the control of a national social security system as Faure reported (2004).

Bibliography

- American Insurance Association (1976), *Special Malpractice Review: 1974 Closed Claim Survey*, New York: Insurance Services Office.
- American Medical Association (1963), *Professional-Liability Survey*. Reprinted in *Medical Malpractice: The Patient vs. the Physician*, Washington, DC: GPO: US Congress, Senate (1969).

- American Medical Association (1983), *Report of the Board of Trustees: Study of Professional Liability Costs*, Chicago: American Medical Association.
- American Medical Association (1987), *A Proposed Alternative to the Civil Justice System for Resolving Medical Liability Disputes: A Fault-based, Administrative System*, Report of the Specialty Society Medical Liability Project, Chicago: American Medical Association.
- Arlen, Jennifer (2005), *Private Contractual Alternatives to Malpractice Liability*, New York University Law and Economics Working Paper No. 05-07, May, 1-32.
- Arlen, Jennifer (1993), 'Compensation Systems and Efficient Deterrence', *Maryland Law Review*, 52 (4), 1093-136.
- Arlen, Jennifer and W. Bentley MacLeod (2003), 'Medical Malpractice for Physicians and Managed Care Organizations', *New York University Law Review*, 78 (30), 101-74.
- Arlen, Jennifer and W. Bentley MacLeod (2004), *Beyond Master-Servant: A critique of Vicarious Liability*, New York University, Law and Economics Research Paper Series, Working Paper No. 04-28, 111-40.
- Arrow, Kenneth J. (1963), 'Uncertainty and the Welfare Economics of Medical Care', *American Economic Review*, 53 (5), December, 941-73.
- Avraham, Ronen (2006a), 'Putting a Price on Pain-and-suffering Damages: A Critique of the Current Approaches and a Primary Proposal to Change', *Northwestern University Law Review*, 100, 87-119.
- Avraham, Ronen (2006b), *An Empirical Study of the Impact of Tort Reforms on Medical Malpractice Payments*, Northwestern Law and Economics Research Paper, No. 05-02.
- Baicker, Katherine and Amitabh Chandra (2004), *The Effects of Malpractice Liability on the Delivery of Health Care*, NBER Working Paper 10709, August.
- Baicker, Katherine and Amitabh Chandra (2005), 'Defensive Medicine and Disappearing Doctors?', *Regulation*, 28 (3), 24-31.
- Baker, Tom (2005a), *The Medical Malpractice Myth*, Chicago: The University of Chicago Press.
- Baker, Tom (2005b), 'Medical Malpractice and the Insurance Underwriting Cycle', *DePaul Law Review*, 54, 393-438.
- Baker, Tom (2005c), 'Reconsidering the Harvard Medical Malpractice Study Conclusions about the Validity of Medical Malpractice Claims', *Journal of Law, Medicine and Ethics*, 33, 501-14.
- Baker, Tom, Patricia Born and W. Kip Viscusi (2006), *The Effects of Tort Reform on Medical Malpractice Insurers' Ultimate Losses*, Harvard Law and Economics Discussion Paper No. 554, 1-24.
- Baldwin, Laura-Mae, L. Gary Hart, Michael Lloyd, Meredith Fordyce and Roger A. Rosenblat (1995), 'Defensive Medicine and Obstetrics', *Journal of the American Medical Association*, 274, 20, 1606-10.
- Beider, Perry and Stuart Hagen (2004), *Limiting Tort Liability for Medical Malpractice*, Washington, DC: Congressional Budget Office.
- Bernstein, Anita (2004), 'The Enterprise of Liability', *Valparaiso University Law Review*, 39, 27-63.
- Bernstein, Anita (2005), 'Whatever Happened to Law and Economics?', *Maryland Law Review*, 64, 101-33.
- Blair, Roger D. and Marvin Dewar (1988), 'How to End the Crisis in Medical Malpractice Insurance?', *Challenge*, March/April, 36-41.
- Blomqvist, Ake (1991), 'The Doctor as a Double Agent: Information Asymmetry, Health Insurance and Medical Care', *Journal of Health Economics*, 10, 411-32.
- Blumstein, James F. (2004), 'Health Care Law and Policy: Whence and Whither?', *Health Matrix*, 14, 35-41.
- Born, Patricia H. and W. Kip Viscusi (1998), *The Distribution of the Insurance Market Effects of Tort Liability Reforms*, Brookings Papers on Economic Activity: Microeconomics, 55-100.
- Bovbjerg, Randall R. (1995), *Medical Malpractice: Problems and Reforms*, Washington, DC: The Urban Institute.

- Brennan, Troyen A., Colin M. Sox and Helen R. Burstin (1996), 'Relation between Negligent Adverse Events and the Outcomes of Medical Malpractice Litigation', *New England Journal of Medicine*, 335, 1963–7.
- Bridgeman, Curtis (2005), *Strict Liability and the Fault Standard in Corrective Justice Accounts of Contract*, Florida State University, College of Law, Public Law and Legal Theory, Working Paper No. 146, February, 1–69.
- Brown, John P. (1973), 'Toward an Economic Theory of Liability', *Journal of Legal Studies*, 2, 323–49.
- Burrows, Paul (1994), 'Products Liability and the Control of Product Risk in the European Community', *Oxford Review of Economic Policy*, 68–83.
- Burrows, Paul and Cento G. Veljanovski (1981), *The Economic Approach to Law*, London: Butterworths.
- Calabresi, Guido (1961), 'Some Thoughts on Risk Distribution and the Law of Tort', *Yale Law Journal*, 70, 499–553.
- Calabresi, Guido (1965), 'The Decision for Accidents: An Approach to Nonfault Allocation of Costs', *Harvard Law Review*, 85 (6), 1089–128.
- Calabresi, Guido (1970), *The Cost of Accidents: A Legal and Economic Analysis*, New Haven and London: Yale University Press.
- Calabresi, Guido (1975), 'Optimal Deterrence and Accidents', *Yale Law Journal*, 84, 657–71.
- Calabresi, Guido and Douglas A. Melamed (1972), 'Property Rules, Liability Rules and Inalienability Rules, One View of the Cathedral', *Harvard Law Review*, 85 (6), 1089–128.
- Calfee, John E. and Richard Craswell (1986), 'Deterrence and Uncertain Legal Standards', *Journal of Law, Economics and Organizations*, 2, 279–303.
- California Medical Association and California Hospital Association (1977), *Report on the Medical Insurance Feasibility Study*, San Francisco, CA: Sutter Publications.
- Cascao, Rui and Ruud Hendrickx (2005), *Shifts in the Compensation of Medical Adverse Events*, Working Paper, 1–31.
- Cascao, Rui and Ruud Hendrickx (2007), 'Shifts in the Compensation of Medical Adverse Events', in W. Van Boom and M. Faure (eds), *Tort and Insurance Law*, vol. 22, Springer, Wien, New York: European Centre of Tort and Insurance Law.
- Cheney, F.W., K. Posner, R.A. Caplan and R.J. Ward (1989), 'Standard of Care and Anesthesia Liability', *Journal of American Medical Association*, 261, 1599–1603.
- Chiappori, Pierre-André, Franck Durand and Pierre-Yves Geoffard (1998), 'Moral Hazard and the Demand for Physicians: First Lesson from a French Natural Experiment', *European Economic Review*, 42, 499–551.
- Coase, Ronald H. (1960), 'The Problem of Social Cost', *Journal of Law and Economics*, 3 (1), 1–44.
- Coase, Ronald H. (1993), 'Law and Economics at Chicago', *Journal of Law and Economics*, 36, April, 239–54.
- Cohen, George M. (1997–8), 'Legal Malpractice Insurance: A Comparative Analysis of Economic Institutions', *Connecticut Insurance Law Journal*, 4, 305–50.
- Cohen, Jonathan R. (2000), 'Apology and Organizations: Exploring an Example from Medical Malpractice', *Fordham Urban Law Journal*, 27, 1447–8.
- Commission des Affaires Culturelles, Familiales et Sociales (1993), *L'organisation interne de l'hôpital*, Rapport d'information, disponible sur www.assemblee-nationale.fr.
- Commission Européenne (2006), 'Les erreurs médicales ('The Medical Errors')', *Eurobaromètre*, special 241/roam 64.1 and 64.3 – TNS Opinion and Social, January, 1–66.
- Coombs, Marie Irene (2006), 'The Medical Malpractice Myth', *Journal of Legal Medicine*, 27, 243–53.
- Cooter, Robert D. (1987), 'Tort as the Union of Liberty and Efficiency: An Essay on Causation', *Chicago Kent Law Review*, 63, 522–51.
- Cooter, Robert D. (1991), 'Economic Theories of Legal Liability', *Journal of Economic Perspectives*, Summer, 5 (3), 11–30.
- Cooter, Robert D. (1993), 'The Hand Rule Damages for Incompensable Losses', *San Diego Law Review*, 40, 1097–121.

- Cooter, Robert D. and Thomas Ulen (1986), 'An Economic Case for Comparative Negligence', *New York University Law Review*, 61, 1067–110.
- Cooter, Robert D. and Thomas Ulen (2000), *Law and Economics*, Reading, MA: Addison-Wesley, 3rd edition.
- Danzon, Patricia M. (1985a), 'Liability and Liability Insurance for Medical Malpractice', *Journal of Health Economics*, 4, 309–31.
- Danzon, Patricia M. (1985b), *Medical Malpractice: Theory, Evidence and Public Policy*, Harvard, MA: Harvard University Press.
- Danzon, Patricia M. (1987), 'The Effects of Tort Reforms on the Frequency and Severity of Medical Malpractice Claims', *Ohio State Law Journal*, 48, 413–17.
- Danzon, Patricia M. (1988), *The Political Economy of Workers' Compensation: Lessons for Product Liability*, American Economic Association, Papers and Proceedings, May, 305–10.
- Danzon, Patricia M. (1990a), 'Alternative Liability Regimes for Medical Injuries', *Geneva Paper on Risks and Insurance*, 3–22.
- Danzon, Patricia M. (1990b), 'The "Crisis" in Medical Malpractice: A Comparison of Trends in the United States, Canada, the United Kingdom and Australia', *Law, Medicine & Health Care*, 18 (1–2), Spring–Summer, 48–58.
- Danzon, Patricia M. (1991), 'Liability for Medical Malpractice', *Journal of Economic Perspectives*, Summer, 5 (3), 51–69.
- Danzon, Patricia M., Andrew J. Epstein and Scott J. Johnson (2004), *The Crisis in Medical Malpractice Insurance*, Brookings-Wharton Papers on Financial Services, 55–96.
- Danzon, Patricia M. and Lee A. Lillard (1983), 'Settlement out of Court: The Disposition of Medical Malpractice Claims', *The Journal of Legal Studies*, 12 (2), 345–77.
- Danzon, Patricia M. and Grant D.H. McLaine (1994), 'Health Care Reform: An International Perspective', *The Australian Economic Review*, 2nd quarter, 81–88.
- Danzon, Patricia M., Mark V. Pauly and Reynard S. Kington (1990), *The Effects of Malpractice Litigation on Physicians' Fees and Income*, American Economic Association, Papers and Proceedings, 80 (2), May, 122–7.
- Davis, Peter, Roy Lay-Lee, Julie Fitzjohn, Phil Hider, Robin Briant and Stephan Shug (2002), 'Compensation for Medical Injury in New Zealand: Does No-Fault Increase the Level of Claims Making and Reduce Social and Clinical Selectivity?', *Journal of Health Politics, Policy and Law*, 27 (5), October, 833–54.
- Demsetz, Harold (1967), 'Toward a Theory of Property Rights', *American Economic Review*, No. 2, May, 347–59.
- DeVille, Kenneth Allen (1990), *Medical Malpractice in Nineteenth-Century America*, New York: New-York University Press.
- Deweese, Donald N. and Michael J. Trebilcock (1992), 'The Efficacy of the Tort System and its Alternatives: A Review of Empirical Evidence', *Osgoode Hall Law Journal*, 30, 57–138.
- Deweese, Don, David Duff and Michael Trebilcock (1996), *Exploring the Domain of Accident Law: Taking the Facts Seriously*, New York and Oxford: Oxford University Press.
- Deweese, Donald N., Michael J. Trebilcock and Peter C. Coyte (1991), 'The Medical Malpractice Crisis: A Comparative Empirical Perspective', *Law and Contemporary Problems*, 54 (1), 217–51.
- Dhankhar, Praveen, M. Mahmud Khan and Shalini Bagga (2007), 'Effect of Medical Malpractice on Resource Use and Mortality of AMI patients', *Journal of Empirical Legal Studies*, 4, 163–83.
- Dranove, David (1988), 'Demand Inducement and the Physician/Patient Relationship', *Economic Inquiry*, 24, 281–98.
- Dubay, Lisa, Robert Kaestner and Timothy Waidman (1999), 'The Impact of Malpractice Fears on Cesarean Section Rates', *Journal of Health Economics*, 18, 491–522.
- Dubay, Lisa, Robert Kaestner and Timothy Waidman (2001), 'Medical Malpractice Liability and its Effect on Prenatal Care Utilization and Infant Health', *Journal of Health Economics*, 20, 591–611.
- Ecole Nationale de la Magistrature (1995), *La responsabilité médicale: de la faute au risque*, Essais et recherches judiciaires AER, session de formations continues, 29 mai–2 juin.

- Edlin, Aaron (1994), 'Efficient Standard of Due Care: Should Courts Find More Parties Negligent under Comparative Negligence?', *International Review of Law and Economics*, 14, 21–34.
- Edlin, Aaron (1998), *Due Care*, The New Palgrave Dictionary of Economics and the Law (Peter Newman ed.), London: Macmillan Press.
- Eisenberg, Theodore, John Goerd, Brian Ostrom, David Rottman and Martin T. Wells (1997), 'The Predictability of Punitive Damages', *Journal of Legal Studies*, 26 (2), 623–61.
- Epstein, Richard A. (1973), 'A Theory of Strict Liability', *Journal of Legal Studies*, 2 (1), 151–221.
- Epstein, Richard A. (1976), 'Medical Malpractice: The Case for Contract', *American Bar Foundation Research Journal*, 1 (1), 119–413.
- Epstein, Richard A. (1978), *Medical Malpractice: Its Cause and Cure*, in Simon Rottenberg (ed.), *The Economics of Medical Malpractice*, Washington: American Enterprise Institute.
- Epstein, Richard A. (1988), 'Market and Regulatory Approaches to Medical Malpractice: The Virginia Obstetrical No-Fault Statute', *Virginia Law Review*, 1451–74.
- Epstein, Richard A. and Alan O. Sykes (2000), *The Assault of Managed Care: Vicarious Liability, Class Actions and the Patient Bills' of Rights*, University of Chicago Law and Economics, Online Working Paper No. 112, 1–59.
- Estryn-Behar, Madeleine (1997), *Stress et souffrance des soignants à l'hôpital*, Paris: Edition ESTEM.
- Estryn-Behar, Madeleine (2002), *Santé et risques professionnels des médecins*, Edition Masson.
- Estryn-Behar, Madeleine, Olivier Le Nezet, Béatrice Van Der Heuden, Esther Van Der Schoot, Donatella Camerino, Paul Maurice Conway and Hans-Martin Hasselhorn (2006), 'Interactions entre qualité et facteurs humains dans les soins. Facteurs liés à la crainte des erreurs parmi les infirmiers', *Gestions Hospitalières*, 198, 364–72.
- Etude nationale sur les événements indésirables graves liés au processus de soins – ENEIS (2006), Report, DREES and CCECQA.
- Ewald, François (1992), *Le problème français des accidents thérapeutiques: enjeux et solutions*, Ministère de la santé et de l'action humanitaire, September–October.
- Farber, Henry S. and Michelle J. White (1990), 'Medical Malpractice: An Empirical Examination of the Litigation Process', *RAND Journal of Economics*, 22, 199–217.
- Farber, Henry S. and Michelle J. White (1994), 'A Comparison of Formal and Informal Dispute Resolution in Medical Malpractice', *Journal of Legal Studies*, 23, 777–806.
- Faure, Michael (2004), 'Economic Observations concerning Optimal Prevention and Compensation of Damage Caused by Medical Malpractice', in J. Dute, M. Faure and H. Koziol, *No-Fault Compensation in the Health Care Sector*, Vienna and New York: Springer, pp. 5–87.
- Faure, Michael and Anthony Ogus (2002), *Economie du droit: Le cas français*, Paris: Editions Panthéon Assas.
- Feldman, Roger (1979), 'The Determinant of Medical Malpractice Incidents: Theory of Contingency Fees and Empirical Evidence', *Atlantic Economic Journal*, 7, 59–65.
- Friedell, Steven (2006), 'Medical Malpractice in Jewish Law: Some Parallels to External Norms and Practices', *Chicago-Kent Journal of International and Comparative Law*, 1, Spring, 1–24.
- Furrow, Barry R. (2004), 'From the Doctor to the System: The New Demands on Health Law', *Health Matrix*, 14, 67–90.
- Gawande, Atul (2002), *Complications: A Surgeon's Notes on Imperfect Science*, New York: Henry Holt.
- Geistfeld, Mark (2005), 'Medical Malpractice Insurance and the (il)Legitimate Interest of the Medical Profession in Tort Reform', *De Paul Law Review*, 54, 439–62.
- General Accounting Office (2003a), *Medical Malpractice: Implications of Rising Premiums on Access to Health Care*, GAO-03-836, August.
- General Accounting Office (2003b), *Medical Malpractice Insurance: Multiple Factors Have Contributed to Increased Premium Rates*, GAO-03-702, June.

- Goldberg, John C.P. (2006), 'What Are We Reforming? Tort Theory's Place in Debates over Malpractice Reform', *Vanderbilt Law Review*, 59, 1075–84.
- Greenwald, Bruce C.N. and Marnie W. Mueller (1978), 'Medical Malpractice and Medical Costs', in S. Rottenberg (ed.), *The Economics of Medical Malpractice*, Washington, DC: American Enterprise Institute, 65–86.
- Grossman, Sanford J. and Olivier D. Hart (1983), 'An Analysis of the Principal–Agent Problem', *Econometrica*, 51, 7–45.
- Harrant, Valérie and Nicolas Vaillant (2006), 'Compensation and Wrongful Life: A Positive Economic Perspective', *Journal of Legal Economics*, 13 (2), 1–18.
- Harvard Medical Practice Study (1990), *Patients, Doctors, and Lawyers: Medical Injury, Malpractice Litigation, and Patients' Compensation in New York: The Report of the Harvard Medical Practice Study to the State of New York*, Cambridge, MA: Harvard University.
- Havighurst, Clark C. (2000), 'Vicarious Liability: Relocating Responsibility for the Quality of Medical Care', *American Journal of Law and Medicine*, 26 (1), 1–30.
- Hershey, Nathan (1972), 'The Defensive Practice of Medicine: Myth or Reality', *Milbank Memorial Quarterly*, 1, 69–98.
- Holmstrom, Bengt and Paul R. Milgrom (1991), 'Multitask Principal–Agent Analysis: Incentives Contracts, Asset Ownership and Job Design', *Journal of Law and Organization*, 7, 24–52.
- Huberfeld, Nicole (2004), 'Be Not Afraid of Change: Time to Eliminate the Corporate Practice of Medicine Doctrine', *Health Matrix*, 12, 243–88.
- Hurney, Thomas J. Jr and Rob J. Aliff (2003), 'Medical Professional Liability in West Virginia', *West Virginia Law Review*, No. 105, 1–80.
- Hylton, Keith N. (2008), 'A Positive Theory of Strict Liability', *Review of Law and Economics*, 4 (1), Article 9.
- Hyman, David A. and Charles M. Silver (2005), 'The Poor State of Health Care Quality in the U.S.: Is Malpractice Liability Part of the Problem or Part of the Solution?', *Cornell Law Review*, 90, 893–993.
- Hyman, David A. and Charles M. Silver (2006), 'Medical Malpractice Litigation and Tort Reform: It's the Incentives, Stupid', *Vanderbilt Law Review*, 59 (4), 1085–135.
- Inspection Générale des Finances, Inspection Générale des Affaires Sociales, IGAS (2006), *Conclusion du rapport d'enquête sur l'assurance de responsabilité civile médicale*, January.
- Kessler, Daniel and Mark McClellan (1996), 'Do Doctors Practice Defensive Medicine?', *Quarterly Journal of Economics*, 111, 353–90.
- Kessler, Daniel and Mark McClellan (1997), 'The Effects of Malpractice Pressure and Liability Reforms on Physicians' Perceptions of Medical Care', *Law and Contemporary Problems*, 60 (1), Medical Malpractice: External Influences and Controls: [Part 1] Winter, 81–106.
- Kessler, Daniel and Mark McClellan (2002), 'Malpractice Law and Health Care Reform: Optimal Liability Policy in a Era of Managed Care', *Journal of Public Economics*, 84, 175–97.
- Klick, Jonathan and Thomas Stratmann (2003), *Does Medical Malpractice Reforms Help States Retain Physicians and Does it Matter?*, Florida State University College of Law and George Mason University – Buchanan Center Political Economy, Working Paper, 1–35.
- Klick, Jonathan and Thomas Stratmann (2007), *Medical Malpractice Reform and Physicians in High Risk Specialties*, Working Paper.
- Kohn, Linda T., Janet M. Corrigan and Molla S. Donaldson (2000), *To Err is Human: Building a Safer Health System*, Washington, DC: National Academy Press.
- Lamb, Rae M., David M. Studdert, Richard M.J. Bohmer, Donald M. Berwick and Troyen A. Brennan (2003), 'Hospital Disclosure Practices: Results of a National Survey', *Health Affairs*, 22 (2), 73–83.
- Lambert-Faivre, Yvonne (1998), 'L'éthique de la responsabilité', *Revue Trimestrielle de Droit Civil – RTDC*, January–March, 1–22.
- Lambert-Faivre, Yvonne (2003), *L'indemnisation du dommage corporel*, Rapport remis au Garde des Sceaux, Ministre de la Justice, D. PERBEN, July, 1–14.
- Landes, William M. and Richard A. Posner (1981), 'The Positive Economic of Tort Law', *Georgia Law Review*, 15, 851–924.

- Landes, William M. and Richard A. Posner (1984), 'Tort Law as a Regulatory Regime for Catastrophic Personal Injuries', *Journal of Legal Studies*, 13, 417–34.
- Laroque, François (2001), 'La dissuasion et le No-Fault', *Health Law Journal*, 9, 172–81.
- Les documents de travail du Sénat (2000), *L'indemnisation des victimes d'accidents thérapeutiques*, Série législation comparée, November, 1–35.
- Liang, Bryan A. (1999), 'Error in Medicine: Legal Impediments to U.S. Reform', *Journal of Health Politics, Policy and Law*, 24 (1), 1–26.
- Liang, Bryan A. (2001), 'The Adverse Event of Unaddressed Medical Error: Identifying and Filling the Holes in the Health-Care and Legal System', *Journal of Law, Medicine & Ethics*, 29, 346–68.
- Localio, A. Russell, Troyen A. Brennan, Joseph P. Newhouse, Lucian L. Leape, Nan M. Laird, Howard H. Hiatt, Liesi Hebert, Ann G. Lawthers and Paul C. Weifer (1991), 'Relation between Malpractice Claims and Adverse Events due to Negligence, Results of the Harvard Medical Malpractice Study III', *New England Journal of Medicine*, 325, 245–51.
- Localio, A. Russell, Troyen A. Brennan, Liesi E. Hebert, J. Richard Landis, Joan M. Bengtsan, Ann G. Lawthers, Susan L. Weaver (1993), 'Relationship between Malpractice Claims and Cesarean Delivery', *JAMA*, 269, 366–73.
- Logue, Kyle (1996), 'Toward a Tax-Based Explanation of the Liability Insurance Crisis', *Virginia Law Review*, 82, 895–959.
- Marquis, M. Susan and Stephen H. Long (1995), 'Worker Demand for Health Insurance in the Non-group Market', *Journal of Health Economics*, 14 (1), 47–63.
- Mattiacci, Giuseppe D. (2003), 'Tort Law and Economics', in Richard A. Posner and Aristidis N. Hatzis (eds), *Economic Analysis of Law: A European Perspective*, Cheltenham, UK and Northampton, MA, USA: Edward Elgar, Hatzis Aristidis, pp. 1–47.
- McEwin, R. Ian (2000), 'No-fault Compensation Systems', *Encyclopedia of Law and Economics*, No. 3600, 735–63.
- Mello, Michelle and Troyen A. Brennan (2002), 'Deterrence of Medical Errors: Theory and Evidence for Malpractice Reform', *Texas Law Review*, 80, 1595–637.
- Merritt, Deborah J. and Kathryn A. Barry (1999), 'Is the Tort System in Crisis? New Empirical Evidence', *Ohio State Law Journal*, 60 (2), 315–93.
- Miller, Dan (2003), *Liability For Medical Malpractice: Issues and Evidence*, Joint Economic Committee, May, 1–30.
- Mills, Don H. (1977), *Report on the Medical Insurance Feasibility Study*, Sacramento: California Medical Association and California Hospital Association.
- Mills, Don H. (1978), 'Medical Insurance Feasibility Study: A Technical Summary', *Western Journal of Medicine*, 128, 360–65.
- Mishan, Ezra J. (1952), 'The Principle of Compensation Reconsidered', *Journal of Political Economy*, August, 60, 312–22.
- Moore, Philip J., Nancy E. Adler, Patricia A. Robertson, Lee H. Hilborne and Steven I. Kwon (2004), 'Medical Malpractice: The Effect of Doctor-Patient Relations on Medical Patient Perceptions and Malpractice Intentions', *Western Journal of Medicine*, 173 (4), 244–50.
- Mueller, Marnie (1976), 'The Economics of Medical Malpractice: Claims, Awards, and Defensive Medicine', paper presented at American Economic Association meetings, Atlantic City, New Jersey, 18 September.
- Ogburn, Paul L., T.M. Juhan, D.C. Brooker, M.S. Joseph, J.C. Burler, P.P. Williams, M.L. Andersson, A.C. Shepard, S.L. Ogburn, W.C. Preisler and M.D. Wood (1988), 'Perinatal Medical Negligence Closed Claims from the St. Paul Company, 1980–1982', *Journal of Reproductive Medicine*, 53, 608–11.
- Office National d'Indemnisation des Accidents Médicaux – ONIAM (2005), *Référentiel indicatif d'indemnisation par l'ONIAM*, Report, 1–11.
- Office National d'Indemnisation des Accidents Médicaux – ONIAM (2005), *L'indemnisation des accidents médicaux en Europe: une approche comparée*, April, 1–59.
- Office National d'Indemnisation des Accidents Médicaux – ONIAM (2006), *Rapport d'activité: 1er semestre 2006*, 1–32.

- Olsen, Reed Neil (1996), 'The Reform of Medical Malpractice Law: Historical Perspectives', *The American Journal of Economics and Sociology*, 55 (3), 257-75.
- Pauly, Mark (1968), 'The Economics of Moral Hazard: Comment', *American Economic Review*, 531-45.
- Peeples, Ralph, Catherine T. Harris and Thomas B. Metzloff (2003), 'The Process of Managing Medical Malpractice Cases: The Role of Standard of Care', *Wake Forest Law Review*, 37, 877-902.
- Peters, Philip G. Jr (2007), 'What We Know About Malpractice Settlements', *Iowa Law Review*, 92, 1785-831.
- Polinsky, Mitchell (1980), 'Strict Liability versus Negligence in a Market Setting', *American Economic Review*, 70 (2), 362-8.
- Pomata, Gianna (1998), *Contracting a Cure: Patients, Healers, and the Law in Early Modern Bologna*, Baltimore and London: The Johns Hopkins University Press.
- Porat, Ariel (2003), 'The Many Cases of Negligence', *Theoretical Inquiries in Law*, 4, 1-32.
- Posner, Richard A. (1972), *Economic Analysis of Law*, Boston: Little Brown.
- Posner, Richard A. (1977), 'Strict Liability: A Comment', *Journal of Legal Studies*, 2 (1), 205-21.
- Quinn, Robert (1998), 'Medical Malpractice Insurance: The Reputation Effect and Defensive Medicine', *The Journal of Risk and Insurance*, 65 (3), 467-84.
- Reder, Melvin W. (1976), 'Medical Malpractice: An Economist's View', *American Bar Foundation Research Journal*, No. 2, 511-63.
- Reinker, Kenneth S. and David Rosenberg (2006), *Improving Medical Malpractice Liability by Allowing Insurers to Take Charge*, Harvard Law School, Discussion Paper No. 556, 1-40.
- Reynolds, Roger A., J.A. Rizzo and M.L. Gonzalez (1987), 'The Costs of Medical Professional Liability', *Journal of the American Association*, May, 257, 2776-2781.
- Robinson, Glen (1986), 'Rethinking the Allocation of Medical Malpractice Risks between Patients and Providers', *Law and Contemporary Problems*, 173-99.
- Rosenblatt, Roger A. and Andy Hurst (1989), 'An Analysis of Closed Obstetric Malpractice Claims', *Obstetric and Gynecology*, 74, 710-14.
- Rubin, Paul H. (1995), 'Fundamental Reform of Tort Law', *Regulation*, no. 4, 26-33.
- Rubin, Robert J. and Daniel N. Mendelson (1994), 'How Much Does Defensive Medicine Cost?', *Journal of American Health Policy*, 7-15.
- Sage, William M., (1997), 'Enterprise Liability and the Emerging Managed Health Care System', *Law and Contemporary Problems*, 60 (1, 2), 159-210.
- Sage, William M., (2004a), 'Reputation, Malpractice Liability and Medical Error', in Virginia A. Sharpe (ed.), *Accountability: Patient Safety and Liability Reform*, Georgetown: Georgetown University Press.
- Sage, William M., (2004b), 'Understanding the First Malpractice Crisis of the 21st Century', in Alice G. Gosfield (ed.), *Health Law Handbook*, I, Minneapolis: West, 1-32.
- Sage, William M., Bernard Black, Charles Silver and David A. Hyman (2005), 'Stability Not Crisis: Medical Malpractice Claim Outcomes in Texas, 1988-2002', *Journal of Empirical Legal Studies*, July, 207-59.
- Saks, Michael (1994), 'Medical Malpractice: Facing Real Problems and Finding Real Solutions', *William and Mary Law Journal*, 35, 693-726.
- Schmitz, Patrick W. (2000), 'On the Joint Use of Liability and Safe Regulation', *International Review of Law and Economics*, 20 (3), 371-82.
- Sclar, David and Michael Housman (2003), 'Medical Malpractice and Physician Liability: Examining Alternatives to Defensive Medicine', *Harvard Health Policy Review*, 1 (1), Spring, 75-84.
- Sharkey, Catherine M. (2005), 'Unintended Consequences of Medical Malpractice Damages Caps', *New York University Law Review*, May, 80 (2), 391-512.
- Shavell, Steven (1979), 'Risk-sharing and Incentives in the Principal and Agent Relationship', *Bell Journal of Economics*, 10 (1), 55-73.
- Shavell, Steven (1980), 'Strict Liability versus Negligence', *Journal of Legal Studies*, 9 (1), 1-25.

- Shavell, Steven (1982), 'On Liability and Insurance', *Bell Journal of Economics*, 13, 120–32.
- Shavell, Steven (1984a), 'Liability for Harm versus Regulation for Safety', *Journal of Legal Studies*, 13, June, 357–74.
- Shavell, Steven (1984b), 'The Judgment-Proof Problem', *International Review of Law and Economics*, 6, 45–58.
- Shavell, Steven (1984c), 'A Model of the Optimal Use of Liability and Safety regulation', *The RAND Journal of Economics*, 15 (2), 271–80.
- Shavell, Steven (1985), 'Uncertainty over Causation and the Determination of Civil Liability', *Journal of Law and Economics*, 28 (3), 587–609.
- Shavell, Steven (1987), *Economic Analysis of Accident Law*, Harvard, MA: Harvard University Press.
- Sher, Noam (2006), *New Differences between Negligence and Strict Liability and their Implications on Medical Malpractice Reform*, New York University School of Law Working Paper and in *University of Southern California Interdisciplinary Law Journal*, 16 (2007), 1–64.
- Shoenbaum, Stephen and Randall R. Bovbjerg (2004), 'Malpractice Reform Must Include Steps to Prevent Medical Injury', *Annals of Internal Medicine*, 140, 51–3.
- Sloan, Frank A. (1985), 'State Responses to the Malpractice Insurance "Crisis" of 1970s: An Empirical Assessment', *Journal of Health Politics, Policy and Law*, 9 (4), 629–46.
- Sloan, Frank A. (1990), 'Experience Rating: Does it Make Sense for Medical Malpractice Insurance?', *American Economic Review Papers and Proceedings*, 80 (2), 128–33.
- Sloan, Frank A., Randall R. Bovbjerg and Penny B. Githens (1991), *Insuring Medical Malpractice*, New York: Oxford University Press.
- Sloan, Frank A., Penny B. Githens, Ellen Wright Clayton, Gerald B. Hickson, Douglas A. Gentile and David F. Partlett (1993), *Suing for Medical Malpractice*, Chicago: University of Chicago Press.
- Sloan, Frank A. and Chee Ruey Hsieh (1991), 'Variability in Medical Malpractice Payments: Is the Compensation Fair?', *Law and Society Review*, 24, 997–1040.
- Sloan, Frank A., Paula M. Merghenaghen and Randall R. Bovbjerg (1989), 'Effects of Tort Reforms on the Value of Closed Medical Malpractice Claims: A Microanalysis', *Journal of Health Politics, Policy and Law*, 14 (4), 663–89.
- Sloan, Frank A., Kathryn Whetten-Goldstein, Stephen S. Entman, Elisabeth S. Kulas and Emily M. Stout (1997), 'The Road from Medical Injury to Claims Resolution: How No-fault and Tort Differ', *Law and Contemporary Problems*, 60 (2), 35–70.
- Sloan, Frank A., Kathryn Whetten-Goldstein, Penny B. Githens and Stephen S. Entman (1995), 'Effects of the Threat of Medical Malpractice Litigation and Other Factors on Birth Outcomes', *Medical Care*, 33 (7), 700–14.
- Studdert, David M. and Troyen A. Brennan (2001), 'Toward a Workable Model of "No-fault" Compensation for Medical Injury in the United States', *American Journal of Law and Medicine*, 27, 225–52.
- Studdert, David M. and Troyen A. Brennan and Eric J. Thomas (2000), 'Beyond Dead Reckoning: Measures of Medical Injury Burden, Malpractice Litigation, and Alternative Compensation Models from Utah and Colorado', *Indiana Law Review*, 33, 1643–60.
- Studdert, David M., Michelle M. Mello, Atul A. Gawande, Tejal K. Gandhi, Allen Kachalia, Catherine Yoon, Anne Louise Puopolo and Troyen A. Brennan (2006), 'Claims, Errors, and Compensation Payments in Medical Malpractice Litigation', *New England Journal of Medicine*, 354, 2024–33.
- Studdert, David M., Eric J. Thomas, Helen R. Burstin, Brett I.W. Abar, E. John Orav and Troyen A. Brennan (2000), 'Negligent Care and Malpractice Claiming Behavior in Utah and Colorado', *Medical Care*, 38, 250–60.
- Tancredi, Laurence R. and Jeremiah A. Barondness (1978), 'The Problem of Defensive Medicine', *Science*, 200, 879–82.
- Taragin, Mark I., Laura R. Willett, Adam P. Wilceck, Richard Trout and Jeffrey L. Carson (1992), 'The Influence of Standard of Care and Severity of Injury on the Resolution of Medical Malpractice Claims', *Annals of Internal Medicine*, 117, 780–84.

- Thorpe, Kenneth E. (2004), 'The Medical Malpractice "Crisis": Recent Trends and the Impact of State Tort Reforms', *Health Affairs, Web Exclusive*, 20–30.
- Trebilcock, Michael J. (1987), 'The Social Insurance-Deterrence Dilemma of Modern North American Tort Law: A Canadian Perspective on the Liability Insurance Crisis', *San Diego Law Review*, 24, 929–1002.
- Trebilcock, Michael J. (1989), 'Incentive Issues in the Design of "No-fault" Compensation System', *University of Toronto Law Journal*, 39, 19.
- Université de Droit, d'Economie et des Sciences d'Aix-Marseille (1993), *La responsabilité civile médicale du médecin*, Actes du colloque du 19–20 juin 1992, Aix-en-Provence: Presse Universitaire d'Aix-Marseille.
- Van Boom, William H. and Andrea Pinna (2007), 'Shifts from Liability to Solidarity: The Example of Compensation of Birth Defects', in Willem H. Van Boom and Michael Faure (eds), *Tort and Insurance Law*, vol. 22, Springer, Wien, New York: European Centre of Tort and Insurance Law.
- Veljanovski, Cento (2006), *The Economics of Law*, 2nd edition, London: The Institute of Economics Affairs.
- Vidmar, Neil, Kara MacKillop and Paul D. Lee (2006), *Million Dollar Medical Malpractice Cases in Florida: Post-verdict and Pre-Suit Settlements*, Duke Law School, Research Paper No. 99, February, 1–24, and *Vanderbilt Law Review*, (2006), 59, 1343–82.
- Viney, Geneviève (1963), 'Le déclin de la responsabilité individuelle', Thèse de Doctorat, Université de Paris, Faculté de Droit et de Sciences-Economiques.
- Viney, Geneviève (1995), *Introduction à la responsabilité*, Librairie Générale de Droit et de Jurisprudence – LGDJ.
- Viney, Geneviève and Basile Markesinis (1985), *La réparation du dommage corporel*, Paris: Economica.
- Viscusi, W. Kip (2004), 'The Blockbuster Punitive Damages Awards', *Emory Law Journal*, 53, 1405–56.
- Viscusi, W. Kip and Patricia H. Born (2005), 'Damages Caps, Insurability, and the Performance of Medical Malpractice Insurance', *Journal of Risk and Insurance*, 72, 23–43.
- Viscusi, W. Kip, Richard J. Zeckhauser, Patricia Born and Glenn Blackmon (1993), 'The Effect of 1980s Tort Reform Legislation on General Liability and Medical Malpractice Insurance', *Journal of Risk and Uncertainty*, 6 (2), 165–86.
- Weiler, Paul C., Howard H. Hiatt, Joseph P. Newhouse, William G. Johnson and Troyen A. Brennan (1993), *A Measure of Malpractice*, Cambridge, MA: Harvard University Press.
- White, Michelle J. (1994), 'The Value of Liability in Medical Malpractice', *Health Affairs*, 13 (4), 75–87.
- White, Michelle J. and Yu-Ping Liao (1999), *No-fault for Motor Vehicles: An Economic Analysis*, University of Michigan, Dept. Of Economics, Paper No. 99–016, 1–38.
- Zeckhauser, Richard (1970), 'Medical Insurance: A Case Study of the Tradeoff between Risk Spreading and Appropriate Incentives', *Journal of Economic Theory*, 2, 10–26.
- Zeiler, Kathryn (2004), 'Medical Malpractice and Contract Disclosure: An Equilibrium Model of the Effects of Legal Rules on Behavior in Health Care Markets', Georgetown University Law Center, April, 1–76.
- Zuckerman, Stephen (1984), 'Medical Malpractice: Claims, Legal Costs, and the Practice of Defensive Medicine', *Health Affairs*, 3 (3), 128–33.

PART V

ALTERNATIVE COMPENSATION SYSTEMS

13 Tort law and liability insurance

Gerhard Wagner

13.1 Introduction

Insurance is a form of risk transfer, allowing the party initially bearing risk to shift it to another party more willing or able to bear it. Parties who are in the business of taking on risk initially borne by others are insurers, those who are relieved of such a burden are the insured. In return for the transfer of risk, insurers demand a price, namely the premium due under the insurance contract. Where the risk in question is harm to the body, health or property of the insured herself, the contract is for first-party insurance. Here, the person injured and the person insured are identical. Third-party insurance is a contract that covers potential harm suffered by others than the insured, that is, third parties. The third-party loss is not insured against out of benevolence or other altruistic motives but because the insured party may be liable in damages towards a third party. Expressed in the language of tort law, third-party insurance covers claims of victims against injurers who are liable in damages.¹

13.2 The economic rationale of insurance

13.2.1 *The demand for insurance*

13.2.1.1 Risk aversion From the insured's perspective, insurance is 'an exchange of money now for money payable contingent on the occurrence of certain events' (Arrow, 1971, p. 134). Insurance owes its existence to risk-aversion and the declining marginal utility of wealth. If the utility derived from financial resources were constant, there would be no risk-aversion, and without risk-aversion the insurance industry would not exist. Risk-aversion denotes the fact that an individual who is presented with a choice between a small, but certain loss and a higher, but uncertain loss of equal expected value prefers the certain outcome over the uncertain one (Shavell, 2004, p. 258; for a more thorough treatment, cf. Zweifel and Eisen, 2003, pp. 59 ff). A risk-averse individual would choose a certain loss

¹ For an overview of the state of the law and the discussion in a number of European jurisdictions cf. Wagner (2005a).

of 1,000 rather than a lottery with a 50 percent chance of losing 2,000.² The insurance contract transforms the contingency of a relatively large future loss into the certainty of a stream of small losses, that is, the premiums due under the contract. Imagine a case where an individual runs a 10 percent risk of incurring a loss of 100,000 within the next ten years. Leaving interest aside for the moment, this risk may be transformed into a stream of ten payments of 1,000, one due in each of the ten years.

The stream of ten payments of 1,000 each represents the actuarially fair insurance premium. The total payment of 10,000 equals the value of the risk accepted by the insurance carrier, that is, the expected value of the untoward event. However, the insurance industry would not be able to thrive on actuarially fair premiums, even if one ignores the possibility of investing premiums in the capital markets and earning returns on these investments. Running an insurance business involves administrative costs, which must be covered by the sum of premiums earned. Thus, premiums charged in insurance contracts may well be at a level above the actuarially fair premium. Obviously, the mark-up added to the premium for coverage of administrative costs does not destroy the demand for insurance. In the example above, individuals are apparently willing to pay more than 1,000 per year, for example, a premium amounting to 1,200, in exchange for ridding themselves of a 10 percent risk of suffering a loss of 100,000. The 'surcharge' of 2,000 to be paid within ten years over and above the actuarially fair premium reflects the strength of risk-aversion and the associated willingness to pay to transform risk into certainty.

Although individuals are different, it is fair to assume risk-aversion as a general attitude of human beings. The marginal utility of money declines, and as a consequence, large losses weigh heavy on the individual, more heavily than is warranted by their expected value. Even individuals who are modestly wealthy and earn well above average would be ruined financially if confronted by an obligation to compensate victims for severe personal injuries. As an ordinary traffic accident suffices to cripple a human being, such mischief may well trigger damages of an amount far too high for individuals to manage. This is the reason why, at least in countries in the

² This statement is in contrast to prospect theory which established, with the help of experiments in the laboratory, that individuals are risk-averse with respect to gains but risk-preferring with respect to losses; cf. Kahneman and Tversky (1984). Therefore, the example given above may not be borne out in reality as it may be that the lottery with the 50 percent chance of a loss of the order of 2,000 may be preferred over the certain loss of 1,000. However, if the certain loss is 10 and the lottery involves a 0.05 percent chance of losing 2,000, the certain outcome will be preferred.

Western world, most families carry liability insurance, either as a part of household contents insurance, or in the form of a separate policy.

However, liability insurance is also pervasive among firms (cf. the data reported by Mayers and Smith, 1982, p. 281). Obviously, most business entities are risk-averse as well. This is puzzling because it is generally assumed that the public corporation owned by a multitude of shareholders with diversified portfolios is risk-neutral in its dealings (Easterbrook and Fischel, 1991, pp. 43 f, 119 ff). Thus, one would expect that corporations choose the option of self-insurance instead of costly market insurance, and to live with whatever risk remained. In reality, however, even large firms favour market insurance over self-insurance. The reasons for this business strategy are manifold (Mayers and Smith, 1982, pp. 281, 283 ff; Zweifel and Eisen, 2003, pp. 156 ff). For one thing, the involvement of insurance companies allows firms to take advantage of the claims management expertise accumulated by insurers. Liability insurers are 'born' defendants and repeat players in the arenas of tort litigation. Firms may avail themselves of the expert knowledge of liability insurers by referring claims and cases to them via an insurance contract rather than defending and processing them themselves. This explains why insurance is sometimes bought (and sold) even after the accident has occurred, taking advantage of the claims management or restoration capacities of the insurer and relieving the insured of the risk associated with unforeseen developments *ex post* (Smith and Witt, 1985, p. 379; Mayers and Smith, 1982, pp. 281, 285 f). Other reasons for the involvement of insurers are that liability insurance reduces the variance in the performance of business enterprises, and that market insurance may be cheaper in terms of administrative costs than the full diversification of investment portfolios. Finally, corporate officers, in contrast to shareholders, are not diversified with their investment of human capital and thus have an adverse attitude towards the risk of loss in general, and the insolvency risk in particular (Easterbrook and Fischel, 1991, pp. 29 f). Liability insurance helps to keep the business alive and to keep managers in their jobs.

13.2.1.2 Consequences for the deterrence function of tort law The inability of a risk-averse party to transfer the risk to an insurer constitutes a welfare loss in itself. The utility of an individual who has a demand for the equalization of the marginal utility of money but cannot satisfy that demand is lower than in a state of the world where satisfaction is possible.

However, this is not the only disutility flowing from a dearth of insurance. A liability rule that operates *in solidum*, without insurance cover being available, distorts the very incentives it was designed to create (Shavell, 1987, p. 209; Endres and Schwarze, 1991, pp. 8 f). At least in the

area of strict liability, a risk-averse individual faced with the risk of becoming liable in potentially large amounts will take excessive care, that is, spend more on precautions than efficiency requires. In addition, the individual will also shun dangerous activities to an extent that is undesirable from a social point of view.

13.2.1.3 Insuring liability for fault The standard assumption in economic analyses of negligence liability is that the standard of care is set at an efficient level by the courts, and that potential tortfeasors act accordingly (Shavell, 2004, p. 180). A regime of negligence liability presents agents with a choice between foregoing the taking of safety measures and thus saving the associated costs in return for becoming liable towards victims, and taking the precautions required by the law in return for ridding themselves of responsibility for any damage caused. Within the economic model, it is always rational to follow the second strategy because, by definition, the duty of care is set at an efficient level where the marginal costs of a unit of care equal the marginal costs of any damage that is prevented.

Knowing all this, agents see to it that care is taken and liability avoided (Shavell, 2004, pp. 180 f). This raises the question why anybody should need insurance coverage for liability in negligence. It would seem that demand for liability should only flourish in areas of strict liability, where the taking of due care does not isolate the potential tortfeasor from damage claims.

The conclusions drawn from the economic model of tortious liability are in conflict with empirical evidence. Liability insurance is a strong line of the insurance industry everywhere, and nowhere is it confined to strict liability but always it includes negligence liability within its scope. In most jurisdictions, liability for negligence still forms the core of the law of torts or delict such that demand for insurance is largely driven by the risk of becoming liable in negligence.

The explanation for this outcome involves the behaviour of both courts and agents (Shavell, 2000, pp. 171 f). One reason why tortfeasors are being found negligent in court is that judges make errors in defining the level of due care and applying it to the facts of a given case. Real-life judges may feel sorry for the plaintiff and think that imposing liability would not overburden the defendant – perhaps precisely because he does not have to meet the judgment out of his own pocket anyway, but will shift the costs onto a liability insurer. Judges may suffer from hindsight bias and thus overestimate the possibility of foreseeing the harm *ex ante*. They may err in applying the economic calculus to the facts of the case at hand, or they may even reject the economic approach altogether and impose liability whenever any precaution available at the time of action was not taken, instead of asking whether such precaution was cost-effective or not.

Secondly, even where the standard of care is calculated and applied in the correct way, it might not have been observed by the agent who later becomes the defendant. Individuals may act irrationally because they lack the time to think things through and to plan their actions, because they lack information or rely on distorted information, because they are overwhelmed by emotion or for other reasons. The best chance for the standard of care to be observed is where firms make informed decisions within a well-designed planning process for safety measures of a technical or organizational nature. Outside this area, decision processes are often-times simple, brutish and short.

13.2.1.4 Non-pecuniary losses It is received wisdom within the economic analysis of law that non-pecuniary losses generate no demand for insurance because such losses do not cause a shift in the utility function of money (Rea, 1982, pp. 35, 36 ff; Danzon, 1984, p. 521; Priest, 1987, p. 1546; Schwartz, 1988, pp. 363 ff; Shavell, 1987, pp. 228 f, 2004, pp. 269 ff; Ott and Schäfer, 1990, pp. 567 f). Because the marginal utility of money does not change from the *status quo ante* to the state of injury, it does not make sense to transfer money from the *status quo ante* to the state of injury through the means of insurance.

Simple and clear as this argument may be, the reality is more complicated. For one thing, many non-pecuniary losses create an additional demand for money because oftentimes compensation for monetary loss is incomplete. Secondly, the individual may be able to compensate for the non-pecuniary loss by engaging in expensive forms of consolation, such as sea cruises and the like (Croley and Hanson, 1995, pp. 1813 ff). Thirdly, the fact that there is no or very little first-party insurance for non-pecuniary loss may be due not to lack of demand but to lack of supply. Insurers may shun such policies because of adverse selection, moral hazard and high administrative costs (cf. Section 13.4; cf. also Schwartz, 1988, p. 365; Croley and Hanson, 1995, pp. 1848 ff). Sometimes, however, the high costs of measuring the non-pecuniary loss may be overcome by agreeing on a lump sum due once an injury is diagnosed. Life insurance essentially works this way.

Be that as it may, in the case of liability insurance, coverage for non-pecuniary loss is indispensable. A potential tortfeasor has a demand for coverage irrespective of whether the harm for which he may become liable is of a pecuniary or a non-pecuniary nature. Therefore, the problem – if it is one – must be solved by legislation in the area of tort law and not within the sphere of insurance law. In theory, it would be possible to exclude tortious liability for non-pecuniary harm, but such a move would destroy incentives to take care and to adjust activity to the efficient level (Shavell,

2004, p. 272). Again, it is suggested that the government should be left to monitor care levels and activity levels in order to levy fines on agents that diverge from the efficient standard (Shavell, 2004, pp. 272 ff). If this suggestion were followed through, society would have to finance a system of tort liability and liability insurance for pecuniary losses, and a system of fines to deter the infliction of non-pecuniary losses. It seems highly questionable that such a duplication of deterrence systems would really lead to the desired savings in administrative costs (see, Section 13.3).

13.2.2 The supply of insurance

Insurers never cover risks as such and as a whole. Rather, they use definitions, exclusions, deductibles and ceilings in order to carve out a well-defined portion of total risk, leaving the rest in the lap of the insured. To the extent that the insurer has taken on risk from the insured, he does not remain idle and simply 'bear' the risk but works to make it disappear, as far as this is possible. The tools employed to this end are pooling and subdivision of risks.

13.2.2.1 Pooling: the law of large numbers Insurers assemble pools of risks that are similar but independent from one another in the sense that the realization of one risk does not increase the probability that another risk may materialize at the same time or during the same period. In compiling a pool of homogeneous and independent risks, the insurer avails himself of the workings of the Law of Large Numbers. The Law of Large Numbers says that, in repeated, independent trials, with the same probability of a particular outcome in each trial, the actual incidence of that particular outcome will converge more closely with the probability of that outcome as the number of trials increases, or, expressed slightly differently, the average of the observed outcomes approaches the expected outcome of a single trial as the number of trials gets larger.

A common illustration is the rolling of a die. The probability that any of the six numbers will result is $1/6$, and the expected value of one trial is 3.5. Predictions of the outcomes of one or a small set of trials are impossible to make with a reasonable degree of certainty. However, if the number of trials is increased dramatically to, say, 60,000, the accuracy of predictions increases as well. It is highly likely that around 10,000 of the 60,000 rolls will result in a 1, another 10,000 in a 2, and so on.

Now imagine an insurer selling a policy covering the risk associated with rolling dice. The insurer charges a premium equal to the expected outcome, that is, 3.5, in return for the promise to pay the amount of the outcome, that is, 1, 2, 3, 4, 5 or 6. If the portfolio consists of a single contract, the maximum loss to the insurer is 2.5 ($6 - 3.5$) and its maximum gain is

again 2.5 (3.5 – 1). What the outcome is – 1, 2, 3, 4, 5 or 6 – is a matter of chance. The risk of loss or gain must be borne by the insurer. If, however, the insurer has a portfolio of 60,000 contracts, the Law of Large Numbers predicts that the ratio between the sum of the outcomes of the 60,000 trials, divided by the number of trials, will equal 3.5. If this is true, then the sum of all outcomes must be 210,000, and the risk has disappeared. The pooling together of the 60,000 independent contracts seems to have transformed the uncertainty of outcome in every single trial into a certainty with regard to the sum of all trials. The risks have cancelled each other out. Simple as it is, the Law of Large Numbers forms the backbone of the insurance business (Stapleton, 1995, p. 821).

13.2.2.2 Subdivision of risk It would still be wrong to conclude that it is the whole story. What must not be overlooked is that the creation of a large pool reduces the risk associated with every single policy (so-called relative risk) but it increases the degree to which a possible outcome may diverge from aggregate expected loss (so-called absolute risk). While it is true that a high number of trials reduces the likelihood that the aggregate outcome diverges from the expected loss, it tends to increase the range for the absolute difference between the amount of the expected outcome and the amount of any given real outcome (Samuelson, 1963; see also Hellwig, 1995). This is the reason why it would be too simplistic to assume that insurers eliminate risk by creating large pools. Even after having done this, insurers carry a residual risk characterized by a combination of low probabilities and high stakes.

Furthermore, the concept of a large pool of similar but independent risks is an idealistic abstraction. In reality, although risks often differ from one another in certain respects, they are not fully independent of each other, and the risk pool may not be large enough to eliminate even the relative risk of the pool (Borch, 1990, pp. 112 f.; Arrow, 1963, pp. 941–73). Obviously, insurance is able to function even without the Law of Large Numbers. It is possible to insure against single events. A famous example is an insurance cover provided by Lloyd's against the risk that a Scottish Whisky distillery would have to pay £1 million to the person able to capture the monster in Loch Ness, as it had promised to do in public. Although there are many lochs in Scotland, the particular risk in question was of a stand-alone nature. This did not deter Lloyd's from granting coverage in return for a premium of £2,500. Within Lloyd's, a relatively large group of underwriters took the risk on their books, with each underwriter covering no more than 7.5 percent of total risk, and many less than this share. Thus, instead of pooling the risk, Lloyd's divided it among a group of underwriters.

The same mechanism – division and subdivision of risk – is employed by

the insurance industry, not only for the purpose of being able to sign ‘freak’ policies like the one in the Loch Ness case but in an effort to protect against the residual risk inherent in ordinary portfolios including a large number of homogeneous risks. The classic tool for the purpose of subdivision is re-insurance, that is, the transfer of some part of the residual risk inherent in a particular pool to another insurer. An alternative strategy chosen in the Loch Ness example would be co-insurance. In the world of liability insurance, it is not uncommon that the insurance industry of a local market pulls together in order to cover a particular class of risk, with the German ‘Pharma-Pool’ providing an example. The Pharma-Pool aggregates the capacity of the German insurance industry in order to cover liability risks associated with the marketing of drugs.

13.3 Compensation of victims as a purpose of liability insurance?

Lawyers and politicians tend to believe that liability insurance protects victims. For example, it is thought that in the area of motor accidents victims must not be burdened with the risk of being injured by a driver lacking the financial means to pay compensation. The political aim of guaranteeing that compensation be paid was the dominant motive behind the European convention that made liability insurance for motor cars compulsory (European Convention on Compulsory Insurance against Civil Liability with Regard to Motor Vehicles, signed 20 April 1959).

In contrast, most of the economic literature rejects the objective of victim compensation (Shavell, 2004, pp. 267 ff). The tandem of tort law and liability insurance is said to be a tool too clumsy and too costly to funnel compensation to victims. The better alternative would be first-party accident insurance, which comes at a much lower price in terms of administrative costs. Thus, victim compensation should not be counted among the purposes of liability insurance.

The economic argument may well be called into question (the discussion is summarized in Dewees, Duff and Trebilcock, 1996, pp. 6 ff). On the one hand, the administrative costs of first-party insurance are not negligible. Under current market conditions, it requires a whole set of policies in order to protect oneself from financial losses caused by bodily injury and damage to property of any kind. Personal disability insurance, which guarantees the level of income prior to the event, is expensive even for modest income levels. This is true even under the current institutional framework, where first-party insurance does little more than fill the interstices between tort law and third-party insurance on the one hand and social security benefits on the other. In a world where tortfeasors did not have to compensate victims, premiums would have to be much higher. One reason why first-party insurance for lost income is so expensive is the moral hazard inherent

in a policy that offers full protection. Such a policy promises the current living standard without the need to labour, and this is a very attractive offer for many. As a consequence, such a system would attract many false positives, and it would require resources of considerable magnitude to isolate those from the group of the truly needy without creating too many false negatives.

On the other side of the balance, the abolition of tort law and liability insurance would leave potential injurers without a private law-type incentive to take care and to adjust their activity levels to the efficient mark. As it would be undesirable to leave things at that, policymakers would have to prop up alternative instruments to influence the behaviour of potential injurers. In particular, one would have to resort to administrative sanctions and criminal punishment in order to achieve the level of deterrence formerly achieved with the help of tort law. However, the procedural guarantees which must be observed before levying a fine or imposing punishment are even more demanding than the safeguards of the civil justice system that have to be overcome for a tort claim to succeed. Therefore, there might be less to gain in terms of administrative costs than is commonly thought by disconnecting the deterrence function from the compensation function. It might even be the case that the sum of administrative costs of the substitute systems of deterrence – administrative and criminal sanctions – and of the substitute systems of compensation – health insurance, disability insurance, property insurance – would be greater than the sum of the administrative costs of the tort system and third-party insurance. Empirical research suggests that the combination of tort law and liability insurance might be preferable in certain areas, for example products liability, and the conjunction of public law sanctions with a layer of first-party insurance in others (Deweese, Duff and Trebilcock, 1996, pp. 412 ff, 427 ff).

When comparing the current system of tort law and liability insurance to other institutional options, it must be taken into account that the costs of the civil justice system in the US are much higher than in any other country. In the special field of tort law and liability insurance, European jurisdictions like France, England and Germany have developed systems of lump-sum compensation, not of victims themselves but of ‘collateral sources’ (*tiers payeurs*), that is, third parties who compensate victims in their capacity as employer or health insurer. The most important institutions here are social insurance carriers, which pay for the immediate needs of the victim in terms of health care and financial assistance. After this has been done, they then turn to the liability insurers in order to recoup their costs. As both the social insurance carriers and the liability insurers are repeat players, these parties have devised schemes that allow for the efficient processing of claims and for their disposal on the basis of statistically

informed estimates (for a comparative account, cf. Wagner, 2003, pp. 306 ff, 2006, pp. 1039 f). Such systems work smoothly and consume but few resources for their own administration.

In sum, even from an economic point of view, the tandem of tort law and liability insurance beats the alternative of distinct systems, one for the purpose of deterrence and another for the compensation goal. The joint administrative costs of distinct institutions will be higher, not lower, than the administrative costs of tort law and liability insurance, which achieve deterrence and compensation in one step.

13.4 Economic problems of liability insurance

13.4.1 Asymmetric information and imperfect insurance

If insurance simply allowed risk-averse individuals to transfer the risk of becoming liable towards third parties on to insurers against a premium that reflected the actuarial value of the particular risk in question plus administrative costs, the solution would be first-best (Shavell, 2004, p. 262, 2000, 2 B; Graf von der Schulenburg, 2005, pp. 285 f). Individuals would be relieved of risk, and insurance carriers would diversify it away and subdivide the remainder. The insured would still do everything efficiency requires in order to reduce the combined costs of precautions and of residual damages to their optimal level, that is, they would take cost-effective precautions and they would engage in a dangerous activity only if the utility generated outweighed either the sum of the costs of precautions and of residual damages or the insurance premium. An insurance contract which rates the risk at its true value and which leaves the incentives of the insured unimpaired is a perfect insurance contract.

In reality, however, insurance contracts – like any other human institution – are imperfect. The source of imperfection is asymmetry of information between the insurer and the insured. Inefficiencies caused by an asymmetric distribution of information between the parties are not peculiar to insurance contracts but represent a general problem in principal/agent relationships (Arrow, 1985, pp. 37 ff; cf. also Kotowitz, 1987, pp. 207 ff; Graf von der Schulenburg, 2005, pp. 282 ff; Hellwig, 1988, pp. 1065 ff). In the case of insurance, it is not confined to the stage of contract formation and the initial calculation of the premium but continues to haunt the insurance relationship during the currency of the contract.

At the stage of contract formation, the insurer is confronted with the task of calculating the correct premium. In order to do so, the insurer would have to be able to fully identify the factors that bear on the value of the risk represented by a particular insured individual. In reality, the insurer does not have access to the information needed because the

relevant facts are within the sphere of the person insured (hidden characteristics). In life insurance, it is impossible to predict with accuracy the date of death of a particular person. In liability insurance, it is equally impossible to fully appreciate the types of damage the insured will cause during the currency of the insurance contract, to identify potential grounds for liability, to calculate damage levels and to estimate the likelihood that suit will be brought and either settled or litigated successfully. Even if it were feasible to anticipate likely scenarios and to estimate outcomes, it will not be worthwhile doing so in many cases. The effort required perfectly to risk-rate policies comes at a high price in terms of transaction costs. Every dollar or euro spent by insurance companies for the purpose of risk-rating must be earned back in the particular market. Where average premiums are modest, there is very little to be gained by costly efforts at risk-rating and, at the same time, it is unlikely that the insurer will be able to recoup administrative costs through attracting the lower premiums he can offer.

Even where the risk has been rated correctly, the insurer must not sit back and watch things develop during the currency of the contract. Rather, risk evaluation is an on-going job that requires close monitoring of the insured. In most lines of insurance, the event insured against is not fully out of the control of the insured herself. Without doubt, liability insurance is one of the cases in which the insured exerts considerable influence on the proceeds the insurer has to pay under the policy. After all, the insured controls both the level of care and the level of activity. Where the principal is unable perfectly to observe the actions of the agent (hidden action) or where the agent has private information inaccessible to the principal (hidden information), it is impossible for the parties to write an efficient contract (*supra*, p. 386). A perfect contract would require that the insurer knew everything the insured knew and in addition could observe the actions and omissions of the insured. Only by monitoring the behaviour of the insured *ex post*, after the contract has been signed, can the insurer learn about changes in risk profile and adjust the premium accordingly. In the example of motor liability insurance, the insurer would have to sit next to the driver and record the amount she drives and the care and foresight that she employs in any given situation in order to adjust the premium continuously. Needless to say, it is impossible to do this, and even if it were possible, an insurer would be ill advised to do so because costs would be prohibitive.

To sum up, real-world insurance contracts are never perfect. It is either impossible or too costly to rate the risk accurately up front, to calculate an actuarially fair insurance premium, and then to monitor the behaviour of the insured constantly in order to make necessary adjustments in due course. The imperfection of insurance contracts gives rise to a tandem of

problems that every insurance market has to cope with: adverse selection and moral hazard.

13.4.2 Adverse selection

Adverse selection can occur in any market with asymmetric information concerning the quality of goods, services or risks (of the pathbreaking Akerlof, 1970; cf. also Rothschild and Stiglitz, 1976, pp. 629–49; Wilson, 1977, pp. 167–207; Spence, 1977, pp. 427, 447; for an overview cf. Wilson, 1987, pp. 32–4; Hellwig, 1988, pp. 1065 ff). In the special case of insurance, it denotes the fact that in a world where insurance premiums are set at average levels and thus do not accurately reflect the risk represented by each individual insured, insurers attract a disproportionately number of bad risks which in turn might cause the market to unravel (Borch, 1990, pp. 319 ff; Graf von der Schulenburg, 2005, pp. 297 ff; Zweifel and Eisen, 2003, pp. 320 ff). The cause of adverse selection is the above-described asymmetric distribution of information between the parties: the insured has more information about the amount and probability of loss than the insurer.

Imagine an insurance market whose demand side is comprised of an even distribution of two types of individuals, the good risks (G) and the bad risks (B). The good risks will incur a liability of 100,000 with a probability of 5 percent, the bad risks will incur the same liability with a probability of 10 percent. The fair premium for the G-type insured is 5,000 whereas for the B-type insured it is 10,000. These are the premiums that will be charged as long as the insurer is able to discriminate between G and B, charging each type its fair premium. If, however, discrimination does not occur, the insurer will allocate the average premium of 7,500 to every insured. Given such a high premium, the Gs will think twice before buying insurance and do so only if their risk-aversion is so intense that they are willing to cover a risk worth 5,000 with a premium of 7,500. Now assume that 10 percent of G drop out of the market because they are willing to live with the risk and save 7,500. Now the risk pool is made up of 52.63 percent (50/95) bad risks and 47.37 percent (45/95) good risks, and the average premium that will be charged is 7,631.58. With a premium this high, the Gs remaining within the pool will ask themselves whether the policy is worth this amount. Again, some proportion of G – let us assume another 10 percent of the original population – will reach the conclusion that a price of 7,631.58 is too much for a cover worth only 5,000 to them. Now the risk pool is 55.56 percent (50/90) B-type and 44.44 percent (40/90) G-type, and the average premium amounts to 7,777.78, which will cause another fraction of the remaining Gs to drop out. This process may continue until all the Gs have left the pool. Once the last G is gone, the premium will be 10,000, which is fair for the Bs. Whether they remain within the pool depends on their degree of

risk-aversion and their ability to pay a high premium, set at a level which reflects the costs of accidents which the bad risks cause.

As demonstrated by the above example, adverse selection destroys part of the demand for insurance in the sense that risk-averse individuals who would be willing to buy cover for a fair premium refrain from doing so if they are charged the average premium. The fact that this demand cannot be satisfied in the market is a deadweight loss within the social balance sheet.

Adverse selection is not only a cause of social welfare losses but may also jeopardize the performance of insurance companies. In order to demonstrate this effect, it is enough to modify the example in such a way that there are two insurers active in the market, a perfect insurer P and an imperfect insurer X. Assuming that P is able to discriminate between good risks and bad risks, he will demand a premium of 10,000 from Bs and a premium of only 5,000 from Gs. His imperfect competitor X, in turn, is not able to do this but charges the average premium of 7,500 from both Bs and Gs. The consequences are obvious: the good risks can save 2,500 by signing up with P instead of X or from switching from X to P. Eventually, all Gs will be customers of P and pay the low premium of 5,000 whereas the Bs will remain with X and pay the high premium of 10,000. However, until the two types have separated perfectly, X will constantly lose money. As X is not able to discriminate between Gs and Bs, the only thing he can do is adjust the premium upward after he has learnt that his pool has attracted more Bs than Gs. Losses incurred in the previous period of insurance remain with X.

13.4.3 Moral hazard

13.4.3.1 Effect: destruction of incentives generated by tort law Whereas adverse selection is a problem at the stage of contract formation and price calculation, the phenomenon called moral hazard occurs after the insurance contract has begun. The term was developed in marine insurance where it was used as a demarcation concept for the purpose of defining the event insured against (Borch, 1990, p. 325; a different historical account is provided by Baker, 1996, pp. 246 ff). In contrast to the 'physical hazard' represented by the high seas, the 'moral hazard' was created by the ship owner and crew themselves. In short, it may be said that moral hazard is a risk of an endogenous nature in the sense that the fact that an insurance contract exists changes the incentives of the insured to take care and thus the probability of loss as well as the magnitude of damages (Arrow, 1971, p. 142; Shavell, 1979 p. 541; Zweifel and Eisen, 2003, pp. 295 ff; Endres and Schwarze, 1991, pp. 10 ff; Baker, 1996, 239, who is, however,

deeply sceptical about the conventional economic reading of moral hazard expounded above). Where the insured and her servants have no influence on the probability and magnitude of loss, moral hazard cannot occur. In the case of liability insurance, however, the reverse is true, as both the magnitude and the probability of harm are subject to the decisions and actions of the insured.

Moral hazard is best illustrated in the stylized case where the insurance contract runs for one period only, the risk is rated up front, and the premium paid in advance. Within such a framework, the insured has no incentive to avoid harm. The costs of safety measures, be they of a pecuniary or a non-pecuniary nature, would fall upon the insured, whereas the gains accompanying such measures in terms of reduced harm would accrue to the insurer.

Imagine that the insured faces a 10 percent chance of harm in the region of 100,000. The probability of harm could be reduced to 5 percent by implementing a safety measure that costs 4,000. Because the costs of the precaution (4,000) are smaller than the value of the harm prevented (5,000), the safety measure should be implemented. However, the insured gains nothing if she spends 4,000 on something that benefits a third party to the tune of 5,000. Rather, it is in her self-interest to remain idle, do nothing and let the insurer internalize any losses that might materialize during the currency of the contract.

The resulting loss of any incentive to the insured to prevent harm through the exercise of care amounts to a disaster. In the above example, moral hazard frustrates the purpose of tort law of generating incentives for careful behaviour. If moral hazard were left to itself, the preventive function of tort law would lie in ruins. Given the pervasiveness of liability insurance and the high administrative costs consumed by the tort system, the investment seems to be in vain. Fortunately, this conclusion is premature because it overlooks the causes of moral hazard and thus does not arrive at the instruments for remedy.

13.4.3.2 Source: informational asymmetry Adverse selection and moral hazard are fruits of the same tree. They both owe their existence to asymmetries in information (Arrow, 1963, p. 941; Pauly, 1968, p. 531; Hellwig, 1988, p. 1072 ff). In a perfect world, the insurer would be able to monitor every action and omission of the insured in order to re-calculate the premium anytime the insured deviated from the course of action prescribed by efficiency (see Section 13.4). If such constant adaptations were feasible, then the self-interest of the insured would coincide with the self-interest of the insurer.

Imagine that a person faced with an expected harm of $0.1 \times 100,000$ is offered an insurance premium of 10,000, and that, by incurring costs

of 4,000, she could bring the probability of harm down to 5 percent. In deciding whether to incur these costs, the insured will be aware that failure to take the precaution will result in the insurance premium remaining at 10,000, whereas taking the safety measure will reduce the expected costs, and thus the insurance premium, to 5,000. As the sum of the costs of the safety measure (4,000) and the insurance premium (5,000) is smaller than the insurance premium the insurer would charge if the precaution were not taken (10,000), it is in the self-interest of the insured to take the precaution and be rewarded with a modest insurance premium.

In the real world, insurers are never able perfectly to monitor those they insure. On the other hand, it would be an error to think that monitoring does not take place. Where machines, engines, other technical installations or buildings present risks of liability, it is a common policy for insurers not only thoroughly to screen and evaluate these structures *ex ante* for the purpose of avoiding adverse selection, but also to monitor the state of affairs during the currency of the insurance contract. Such monitoring is impossible to implement with respect to the day-to-day behaviour of human beings, and even were it possible to do so, it would be too costly. It is only worthwhile to incur such costs where the stakes are sufficiently large, that is, where the maximum loss is considerable and the likelihood of harm is non-negligible.

13.4.3.3 Remedy: partial insurance Where observation of the insured is either impossible or prohibitively costly, one has to look for other instruments capable of restoring the incentives of tort law to take due care. As it turns out, there is a variety of such tools. They all rest on the same idea: the insurance cover is partly removed and the insured exposed to personal liability. To the extent that this happens, the insured will behave as if she was not protected, that is, exercise due care (Endres and Schwarze, 1991, pp. 13 ff).

Partial insurance in its simplest form is represented by caps and deductibles. Both clauses work to the effect that the obligation of the insurer is limited, and the flipside is that the protection of the insured is only partial. If she becomes liable for a loss that exceeds the cap, she has to cope with the costs herself. Thus, she has an incentive to take precautions where the marginal costs of such precautions are less than the marginal loss prevented.

What a cap does at the top end of a potential damage claim, the deductible does at the bottom. With a deductible, a certain sum stipulated in the insurance contract remains with the insured, with the insurer picking up the loss only to the extent that it exceeds the deductible. Such a clause is indispensable in addition to a cap, because, in the ordinary course of

business, large losses are the exception and minor ones the rule. In cases of minor losses, the ratio between the administrative costs incurred by the insurer and the benefits conferred by insurance on risk-averse insured individuals is particularly unattractive.

The question arises whether the insured will accept a deductible, given that an insurance contract lacking such clause will protect them completely from risk. The answer is that rational insured persons themselves have an interest in including a deductible because the savings in terms of reduced premiums outweigh the sum of costs of precautions and of residual losses (Shavell, 2004, p. 263).

To demonstrate, imagine an insured person that stands to become liable in the amount of 100,000 with a probability of 15 percent. Without a deductible, the fair insurance premium would be 15,000. The alternative would be a contract providing for a deductible of 20,000 such that the fair premium would be 12,000. Now assume that there is a safety measure available to the insured that would cost 1,000 and would bring down the probability of harm to 5 percent. Under full cover, the insured has no incentive to take the precaution. With the deductible, the insured will compare the cost of precaution (1,000) to the savings in terms of a reduction in personal liability (10 percent of 20,000 = 2,000) and take the precaution. In doing so, the probability of harm declines to 5 percent, with expected losses on the part of the insurer falling to 4,000 (5 percent of 80,000). The fair premium under the contract including the deductible would thus be 4,000, and the total costs to be borne by the insured would sum up to 6,000 (4,000 for the premium + 1,000 for the costs of precaution + 1,000 expected value of the deductible). The latter amount is far below the premium level of a contract providing full cover, without a deductible (15,000).

13.4.3.4 Activity levels The fact that liability insurance may impair incentives to take care is generally accepted in the literature. In contrast, the effects of liability insurance on activity levels have not been studied thoroughly. This imbalance has no substantive basis because activity levels are every bit as important for the efficient functioning of tort law as care levels.

Suppose that the insured is strictly liable for harm caused, that there is a 1 percent chance of causing harm to a third party to the value of 500,000 associated with the activity in question, and that the insured has to determine whether to engage in the activity or to refrain from it. A risk-neutral actor would eschew liability insurance and would thus be forced by tort law to consider whether the benefits associated with the activity in question are sufficient to compensate for the expected losses. As expected losses are worth 5,000, she would only engage in the activity if the profits from the

activity – benefits minus costs – were greater than 5,000. If they were not, it would be in the interest of both the insured and of society that the activity should not be carried out.

Liability insurance disrupts the alignment of social interest and self-interest in much the same way as it does incentives to take care. Here, however, roles are reversed. Liability insurance creates a setting in which the benefits of a particular course of action accrue to the insured, whereas the costs are for the insurer to take up. In the above example, imagine that the net benefit from the dangerous activity is not 6,000 but only 4,000. In this case, the insured should not engage in the activity. However, because the expected losses in terms of damage payments worth 5,000 have to be borne by the insurer, the insured looks at the prospect of foregoing an activity that would benefit her to the tune of 4,000. It is apparent that the insured has an incentive to reap the benefits instead of foregoing them to the benefit of the insurer.

In contrast to the issue of incentives to take efficient care, there is very little insurers can do to protect or reinstate incentives to engage in efficient activities only. In theory, the remedy is obvious; the insurer would ‘only’ have to monitor the insured and to charge a premium that is proportionate to risk. For example, insurers could make the premium contingent on the chosen activity level, such as, kilometres driven, the amount of exhaust fumes emitted or the amount of products marketed. In some markets, insurers have introduced such measures, if only haphazardly, and with little accuracy.

13.5 Economic virtues of liability insurance

The previous section addressed the fact that liability insurance may impair the incentives generated by the law of torts. Now the analysis turns to the way in which liability insurance can create incentives to take care and curb activity levels over and above those created by the mere threat of liability. The potential of liability insurance actually to improve matters is caused by the fact that, in practice, liability in tort is always limited.

13.5.1 Unlimited liability on paper, limited liability in reality

In theory, fault-based liability in tort or delict is unlimited, that is, the defendant is bound to compensate losses sustained by victims in full. However, many jurisdictions operate with caps limiting liability to maximum amounts stipulated by law. Within Europe, the directive on products liability provides an instance in point as its Article 16 paragraph 1 allows member states to cap the obligation of the producer at 70 million euros (Council Directive 85/374/EEC of 25 July 1985 on the approximation of the laws, regulations and administrative provisions of the member states concerning

liability for defective products, Official Journal L 210 of 07.08.1985, Article 16 paragraph 1: ‘Any Member State may provide that a producer’s total liability for damage resulting from a death or personal injury and caused by identical items with the same defect shall be limited to an amount which may not be less than 70 million ECU.’).

Regardless of whether there is a cap or whether liability is unlimited on paper, there are much tighter constraints for damage claims in practice. Very few individuals are in a financial position to pay up claims in the region of 70 million euros or above. Many firms will be overburdened by an obligation above 70 million euros too. As far as fault-based liability is concerned, legal responsibility is usually unlimited but real-world resources never are. Regardless of the size and financial strength of a corporate entity, liabilities of the order of hundreds of millions of euros would deplete corporate funds and place the enterprise into the state of insolvency.

13.5.2 The pervasiveness of limited liability

Within the economic literature, Shavell has coined the term ‘judgment proof problem’ for an analysis of the incentive effects in cases where the assets of the tortfeasor are limited (Shavell, 1986, p. 45, 2000, p. 174). Groundbreaking as Shavell’s account was, the language used may present the problem in a false light. The talk of ‘judgment proof’ injurers suggests that the problem affects a particular group within the population only. After all, most of us are not judgment proof but solvent. If this perception exists, it is wrong. In reality, 90 percent of the population is incapable of satisfying a major damage claim by a single victim, let alone the several claims of a plurality of victims. Most people do not own fungible assets subject to execution of judgments, and the fraction of personal income not set aside for household consumption and thus exempt from execution is too small to cover more than the interest due on large damage claims. As to corporate defendants, of course everything turns on the size of the company. However, experience from the US shows that large firms attract large claims, that is, they are singled out by the plaintiff bar as their favourite defendants. In this sense, the existence of a large pool of assets works to attract liability. Firms have reacted to this fact by adapting their corporate structure, that is, by forming subsidiaries with limited assets, which serve as a shield against tort liability (Lopuci, 1998). Therefore, even a large segment of corporate entities falls into the category of ‘judgment proof’ defendants.

13.5.3 Limited liability and the incentive to take care

The inability of a tortfeasor to pay valid claims is problematic for several reasons. In the case of liability in tort, the obvious consequence is that

victims are not compensated. From an economic point of view, this is a point of little concern because there are alternative routes to compensation: first-party insurance and social insurance schemes. In real cases, however, it is too late to insure or the benefits are too small to satisfy victims. The incentive effects of limited liability are discomfiting as well. Asset-based limited liability, that is, the limitation of financial responsibility due to the fact that the tortfeasor holds limited assets only, has the same effect as caps imposed by law. Damages that exceed the legal cap or the value of assets available simply drop out of the calculus of potential tortfeasors. As a consequence, incentives to take care are diminished.

To illustrate, imagine that damages are 1,000,000 and that the probability of harm is 15 percent. The defendant holds assets in the amount of 700,000. There is a safety measure available that would cost 80,000 and bring the probability of harm down to 5 percent. Because the expected value of the measure is 100,000 (10 percent of 1,000,000), society has an interest that it be taken. However, the gain to the firm from exercising care is only 70,000. It will thus decline to make the investment in safety.

13.5.4 Limited liability and the incentive to insure

In the present context, the more important question is whether the firm will buy insurance coverage in an amount exceeding its 700,000 in assets. The answer is that it may well do so because it risks losing these assets in the event of a large, uninsured loss (Shavell, 2004, p. 275; Easterbrook and Fischel, 1991, p. 50). Where the insurance policy has a limit of 1,000,000, and the damages are 1,400,000, the firm will have to hand over an additional 400,000, which is a substantial fraction of its total assets. In this example, a damage claim to the amount of 1,700,000 or greater will cause the insolvency of the firm. Therefore, firms will have an incentive to cover potential damage claims even to the extent that they exceed the value of its assets.

On the other hand, the incentive to insure the ensuing harm in full is diminished when liability is limited. An agent who holds assets worth 100,000 and runs a 10 percent risk of causing harm of the order of 1,000,000 would have to pay a premium of 100,000. If the agent did so, 90 percent of the expenditure would be applied to cover losses she would not otherwise have to bear. Furthermore, the agent would have to hand over her entire assets to obtain full coverage. Even a risk-averse person would not do so.

In certain circumstances, however, the incentive to buy liability insurance will be reduced even further than that. The crucial requirement for such an outcome is that there must be a considerable gap between the time when the limited liability entity makes a choice about its care level and the later point

in time when the damage materializes. Practical examples of such long latency periods involve defective products and the operation of facilities for waste management and disposal. Perhaps the most striking example is a waste dump operated by a limited liability company. Assume that the operator faces a choice between a standard of high safety and another of low safety. The high standard requires safety measures in the amount of 40 per unit of waste; the low standard represents the minimum measures required by regulatory law, which cost 20 per unit of waste. If the high standard is observed, the harm caused after 20 years will be 0, whereas under the low standard, the harm will be 50 per unit of waste. Here, it would clearly be desirable for the operator to commit to the high standard, and incentives would lead the operator to do just that if the investment in the safety of the site and the damage payment were due simultaneously or within the same fiscal year. However, if there is a lapse of 20 years between the investment in safety and the payoff in terms of damages saved, matters are different. The shareholders of the operator might rationally adopt a looting strategy, that is, commit to the low standard of safety and let the company generate high profits which are paid out to shareholders over 20 years in order to let it fall into bankruptcy once the harm has materialized.

In the above example, shareholders have the chance of reaping additional profits to the tune of 20 per unit of waste by charging customers a price of 40, reflecting the costs of the high standard of safety, but then adopting the low standard which involves costs of only 20 per unit of waste. The prospect of pocketing large extra profits over a long period of time may well outweigh any losses incurred by the eventual demise of the corporation after the damage has materialized.

Within such a scenario, the shareholders have no incentive to insure their company against the future liabilities looming beyond the horizon. Doing so would diminish present profits to the benefit of tort victims whose claims would be left uncompensated without insurance.

In the context of corporate torts, a way of improving the situation by exposing shareholders of a limited liability company to unlimited liability *vis-à-vis* non-contractual creditors has been suggested (Hansmann and Kraakman, 1991, p. 1879). An alternative remedy would be to make directors liable for the torts committed by the enterprise they are running (Kraakman, 1984, pp. 867 ff). It is difficult to decide which of these strategies would be more effective (cf. Leebron, 1991, pp. 1574 ff; Wagner, 2004, pp. 1054 ff). Although it may be doubted that shareholders of a public corporation can do much to monitor the behaviour of its agents (Shavell, 1987, p. 176), the only decision that counts in the present context is the one to take out insurance or not. In this respect, both shareholders and directors are in a position to exert considerable influence on corporate

decisions. On the other hand, it is obvious that exposing shareholders or directors to personal liability for torts of the corporation would destroy some significant part of the benefits limited liability was invented for. Therefore, one might think of a third solution which would focus not on liability regimes but on the law of insolvency. It is suggested that tort and other non-voluntary creditors of an insolvent corporation should be accorded a kind of 'superpriority' with regard to the distribution of assets (Painter, 1984, pp. 1080 ff).

13.5.5 Limited liability and activity levels

Of course, the same reasoning that was just applied with regard to safety measures also applies to the level of activity. Again, the efficient mark will be missed if the agent can reap the benefits from the activity at the time he pursues it and postpone its costs in terms of damages into the future. In cases of long periods of latency tortfeasors will not do what efficiency requires, that is, compare the utility derived from the activity with total costs – including the costs of future liabilities. Rather, the agent will compare utility with present-day costs in order to engage in it whenever utility exceeds just these present-day costs. Therefore, there will be too much of the latently dangerous activity, and too much damage caused.

13.5.6 Compulsory insurance

There exist several legal instruments to counteract looting strategies and to ensure that future liabilities are anticipated in present-day decisions. One such instrument is a legal obligation to take out liability insurance (Jost, 1996, pp. 263 ff; Polborn, 1998, p. 141; Skogh, 2000, pp. 529 f). If liability insurance is mandatory, limited liability companies have no choice over whether to protect against future liabilities. As they are liable to pay premiums for the coverage of future tort claims today, they are forced to internalize the anticipated amount of damage payments that are likely to become due after the harm has materialized.

Against this reasoning one may object that it does not improve matters if insurers are brought into the game since the agent still lacks incentives to take care or to curb its level of activity because she has shifted the risk of liability onto the insurer (Shavell, 2000, p. 176). This argument is correct in pointing out the danger of moral hazard in scenarios with long latency periods from the time when the agent decides whether to engage in the activity and what level of safety to observe. Important as this aspect is, insurers have shown themselves to be aware of the problem, and have resorted to effective countermeasures (see Section 13.6.3). In the special area of environmental liability insurance, insurers have gone to great lengths to see to it that each risk is comprehensively analysed *ex ante*, and

to monitor those insured closely lest they are confronted with a tail of long-term liabilities (Wagner, 2007, pp. 96 f).

Regrettably, some of the instruments employed by insurers to limit their own exposure have resulted in rolling back the risk to the limited liability company, as is the case with claims-made policies lacking an extension period. Under such a policy, the firm remains essentially uninsured against long-term liabilities and thus may still have an incentive to play the looting strategy.

13.5.7 *Alternative means*

Mandatory liability insurance is not the only means available in order to realign the incentives of an agent having the option to reap profits now and leave future damage claims to an administrator in bankruptcy. Alternative means are minimum asset requirements (cf. Shavell, 2005, pp. 63–72), the directing of tort claims at managers or shareholders of limited liability companies, exposing managers to criminal liability, and the regulation of the dangerous activity through administrative law. This is not the place to discuss the advantages and disadvantages of these instruments in comparison to compulsory insurance (for a theoretical analysis, cf. Shavell, 2005, pp. 63–72). Suffice it to say that the alternative instruments all have their limitations and all come at a certain cost. None of these instruments forces the agent to internalize the full costs of the activity in question, including the expected value of future losses. In contrast, the premiums paid to liability insurers, if calculated accurately, make the external effects of the activity visible *ex ante* such that the agent has the incentive to choose the level of activity that is desirable from a social point of view (Shavell, 2000, p. 176, 2004, p. 277).

As far as the disadvantages of alternative means are concerned, minimum asset requirements restrict entry into the market for the activity in question and lock out start-up firms with little capital from competition (Shavell, 2005, pp. 63, 64). The personal liability of managers, under both tort and criminal law, comes at the price that these managers will act in a risk-averse, rather than a risk-neutral, manner, and thus fail to maximize the value of the firm. The piercing of the corporate veil in order to make shareholders personally liable removes the shield of limited liability and threatens to destroy the benefits in terms of efficient investment for which limited liability was created in the first place (Easterbrook and Fischel, 1991, pp. 41 ff). Finally, public regulation of the activity is certainly indispensable and is, in fact, common with regard to dangerous activities. On the other hand, it would be naïve to expect too much of regulation or to think that government agencies are particularly good at foreseeing the future and at anticipating damages.

13.6 The limits of insurance: insurability

13.6.1 Uninsurability as an argument in political discourse

The concept of insurability is difficult to pin down. It plays a major role in political discourse, where it is used by the insurance industry as an argument against expansions of tort law into uncharted territory, like liability for environmental harm (Wagner, 2005a, p. 99). In the US, insurability is a concern counselling in favour of tort reform, for example, by restricting the discretion of juries to award damages in exorbitant amounts. In a broad sense, insurability denotes the fact that the insurance industry is confident of being able to manage the risk because it is foreseeable and calculable.

In the US, concerns about insurability are fuelled by the indeterminacy and unpredictability of outcomes under the American tort system. Although the bulk of cases are settled in a straightforward manner, which generates outcomes that are readily foreseeable, the system suffers from a small number of blockbuster awards, mostly rendered in one of the so-called hellhole jurisdictions located in the Gulf South. In recent years, both the US Supreme Court and legislators have addressed the problem. The US Supreme Court has developed a set of principles aimed at delineating the discretion of juries by imposing upper limits on the calculation of punitive damages (*State Farm Mutual Automobile Insurance Co. v. Campbell*, 538 US 408, 425 (2003)). Among those, the most important constraint is that the ratio between compensatory and punitive damages must not exceed a single-digit multiplier. In addition, some state legislatures have committed themselves to tort reform and introduced damage caps, in particular with regard to punitive damages and damages for non-pecuniary losses. Empirical research on the practical effects of these changes on the law of damages confirms that they benefited insurers in the sense that they reduced losses and made them more predictable (Viscusi, 2004, pp. 9–24; Born, Viscusi and Baker, 2006).

13.6.2 Elements of insurability

Insurability is also a term of art in insurance economics. As such, insurability is a multi-dimensional concept that defines the threshold requirements for a risk to be insurable (for a more detailed account, cf. Wagner, 2007, pp. 87 ff; for an even richer array of criteria, cf. Berliner, 1982, p. 13). In order to qualify for insurance, a risk must be:

- accidental
- determinable and measurable
- independent
- non-catastrophic

Within the context of liability insurance, accidentalness requires that the harm be contingent upon a move of nature and not the result of a deliberate choice by the insured. Therefore, claims for damages that were caused intentionally by the insured are excluded from the scope of coverage of liability insurance. Of course, the intentional infliction of harm on others is only the most extreme in a continuum of scenarios in which the actions of the insured determine the probability of harm. This raises the problem of moral hazard, discussed above (see Section 13.4), but does not render the risk uninsurable. If it were otherwise, liability insurance could not exist, at least not in the area of fault-based liability.

However, liability for fault is precisely the area where liability insurance developed and in which it has thrived until today.

The requirements that the risk be determinable and measurable come closest to the common use of insurability in political discourse. Insurers charge premiums in exchange for extending cover. The premium must reflect the expected value of the liabilities for which cover is granted. Therefore, the scope of potential liabilities must be anticipated by the insurer, the expected loss estimated and the premium calculated. Where the risk is indeterminate or immeasurable, rational calculation of the premium is impossible.

In order for the Law of Large Numbers to work (see Section 13.2.2.1), the risks within an insurance pool must be independent of one another. The fact that one risk has materialized must not increase the probability that a significant portion of the other risks will materialize as well. If all car owners in the world were involved in accidents simultaneously, liability insurers would be bankrupt within an instant. The system works only because such a scenario is virtually impossible. The requirement that the risk be non-catastrophic addresses the problem that the resources of an insurer might be exhausted by a single loss of exorbitant magnitude.

13.6.3 Insurability as a flexible concept

Insurability is anything but a hard concept allowing for black-and-white distinctions. It is all a matter of degree. The individual risks within a single pool may not be fully independent of one another; in most cases, the insured has some influence on the occurrence and the magnitude of losses; and measurability is usually achieved simply by extrapolating loss experience into the future on the counterfactual assumption that the future will be exactly like the past. Thus, the requirements of insurability are never met to their fullest degree. This does not cause practical problems as long as insurers can adjust the premium to reflect the added uncertainty. Where a risk is impossible to measure, the insurer might make a rough estimate and then add a sum that makes up for the remaining uncertainty. It has rightly

been said, 'a risk can be insured also when no statistics is available, and even when no theoretical analysis seems possible' (Borch, 1990, p. 316).

A famous example of a seemingly uninsurable risk that was nonetheless insured goes back to the times when jet-powered aeroplanes were introduced into commercial air service. When the first of this new type of aircraft was taking up service, insurers set the premium for hull insurance at 8 percent of the value (Borch, 1990, pp. 315 f). Administrative costs aside, with such a premium no fewer than eight out of 100 planes could have crashed every year without the insurer losing money. This was a safe bet for the insurance industry because the flying public would never have tolerated such a high loss ratio. As this example illustrates, insurability is not only a matter of degree, it is first and foremost a matter of price. Insurability places limits on the extent to which a particular risk may be covered and it influences the premium charged. As the history of Lloyd's but also the experience of other insurers illustrate, virtually anything can be insured, if only for 'suitable prices' (Arrow, 1971, p. 141).

13.7 The impact of liability insurance on tort law

It is a widespread belief that liability insurance is a major force driving the development of tort law. This is obviously true in the sense that most of the funds collected by tort victims come out of the pockets of insurance carriers. Most individuals would be unable to pay up major claims for damages brought against them (see Section 13.2.1.1). If tort law functions at all as a mechanism for compensating victims it does so to a large extent because insurance is available and in fact widespread (Lewis, 2005, pp. 47 ff; Baker, 2005b, 295 ff).

Since the seminal work of Calabresi, scholars of economic analysis of law have gone further than that and developed risk-spreading into an autonomous goal of tort law in its own right (Calabresi, 1970, pp. 39 ff). Given that most individuals and even many firms are risk-averse (see Section 13.2.1.1), the spreading and diversifying of risk confers benefits on actors who would otherwise have to live with a risk they would rather like to get rid of. Insurance is a common strategy of risk-spreading. Therefore, the question arises whether liability rules should be tailored in such a way as to attach liability to the party who is in the best position to insure the loss.

A famous decision that deviated from the common restraint of judges in embracing the insurance function of tort law is that of the California Supreme Court in the product liability case of *Escola v. Coca-Cola Bottling Co. of Fresno*. In the words of Justice Traynor ((1944) 150 P.2d 436, 441): 'The cost of an injury and the loss of time or health may be an overwhelming misfortune to the person injured, and a needless one, for the risk of

injury can be insured by the manufacturer and distributed among the public as a cost of doing business.’ This judgment is one of the milestones in the development of strict products liability and one of the rare instances when a court has openly embraced the risk-spreading function of liability. In most European jurisdictions, strict liability is the domain of the government rather than the courts (Wagner, 2003, pp. 274 ff, 2006, pp. 1030 ff). In general, lawmakers are on the one hand concerned with victim compensation and on the other they pay much attention to issues of insurability in order to protect the tortfeasor (Faure, 2005, pp. 248 ff). Loss spreading as such plays a minor role, at best.

As far as the application and development of fault-based liability is concerned, it is lawyer’s lore that courts do take the insurance question into account even though they often pay lip-service to the principle that liability comes first and must be determined without keeping an eye on the insurance cover that may or may not be available in the case at hand (Wagner, 2005b, pp. 323 ff). It is very difficult to verify what is really going on because it is impossible to look into the minds of judges applying tort law rules to particular cases. Outside special areas like liability in equity, the evidence does not support the assumption that courts follow the policy of risk spreading via insurance. This is a healthy approach (Trebilcock, 1988, pp. 246 ff; Faure, 2005, pp. 260 ff; Wagner, 2005b, pp. 342 ff). If fault-based liability were contingent on whether the potential tortfeasor was insured or not, the incentives to buy market insurance would be distorted. In addition, one would also have to consider whether the victim enjoyed the benefit of first-party insurance for the particular loss. Liability rules would thus have to be tailored to fill up whatever interstices are left after the parties have resorted to the insurance markets. Finally, if market insurance played a role, there is no reason to decide otherwise with respect to self-insurance. Precisely because the potential to self-insure increases with wealth, the objective of risk-spreading would come close to a form of deep-pocket liability (Trebilcock, 1988, pp. 258 f).

Bibliography

- Akerlof, George (1970), ‘The Market for Lemons’, *Quarterly Journal of Economics*, 84, 488–500.
- Arrow, Kenneth J. (1963), ‘Uncertainty and the Welfare Economics of Medical Care’, *American Economic Review*, 53, 941–73.
- Arrow, Kenneth J. (1971), *Essays in the Theory of Risk Bearing*, Amsterdam: North-Holland Publishing Company.
- Arrow, Kenneth J. (1985), ‘The Economics of Agency’, in John W. Pratt and Richard J. Zeckhauser (eds), *Principles and Agents*, p. 37–61.
- Baker, Tom (1996), ‘On the Genealogy of Moral Hazard’, *Texas Law Review*, 75, 237–92.
- Baker, Tom (2005a), ‘Medical Malpractice and the Insurance Underwriting Cycle’, *DePaul Law Review*, 54, 393–438.

- Baker, Tom (2005b), 'The View of an American Insurance Law Scholar: Six Ways that Liability Insurance Shapes Tort Law', in Gerhard Wagner (ed.), *Tort Law and Liability Insurance*, Vienna and New York: Springer-Verlag, pp. 295–306.
- Baker, Tom, Alon Harel and Tamar Kugler (2004), 'The Virtues of Uncertainty in Law: An Experimental Approach', *Iowa Law Review*, 89, 443–94.
- Berliner, Baruch (1982), *Die Grenzen der Versicherbarkeit von Risiken*, Zurich: Schweizerische Rückversicherungsgesellschaft.
- Borch, Karl H. (1990), *Economics of Insurance*, Amsterdam: Elsevier Science Publishers B.V.
- Born, Patricia, W. Kip Viscusi and Tom Baker (2006), 'The Effects of Tort Reform on Medical Malpractice Insurers' Ultimate Losses', *NBER Working Papers* No. 12086.
- Calabresi, Guido (1970), *The Costs of Accidents*, New Haven, CT: Yale University Press.
- Croley, Steven P. and Jon D. Hanson (1995), 'The Nonpecuniary Costs of Accidents: Pain-and-suffering Damages in Tort Law', *Harvard Law Review*, 108, 1785–917.
- Dahlby, Beverly G. (1983), 'Adverse Selection and Statistical Discrimination: An Analysis of Canadian Automobile Insurance', *Journal of Public Economics*, 20, 121–30.
- Danzon, Patricia M. (1984), 'Tort Reform and the Role of Government in Private Insurance Markets', *Journal of Legal Studies*, 13, 517–49.
- Deweese, Don, David Duff and Michael Trebilcock (1996), *Exploring the Domain of Accident Law: Taking the Facts Seriously*, New York: Oxford University Press.
- Dionne, Georges (1983), 'Adverse Selection and Repeated Insurance Contracts', *Geneva Papers on Risk and Insurance*, 8, 316–32.
- Dionne, Georges and Scott E. Harrington (1992), *Foundations of Insurance Economics: Readings in Economics and Finance*, Norwell: Kluwer Academic Publishers.
- Doherty, Neil and James Garven (1986), 'Price Regulation in Property/Liability Insurance: A Contingent Claims Approach', *Journal of Finance*, 41, 1031–50.
- Easterbrook, Frank and Dan Fischel (1991), *The Economic Structure of Corporate Law*, Cambridge, MA: Harvard University Press.
- Ehrlich, Isaac and Garry S. Becker (1972), 'Market Insurance, Self-insurance and Self-protection', *Journal of Political Economy*, 80, 623–48.
- Endres, Alfred and Raimund Schwarze (1991), 'Allokationswirkungen einer Umwelthaftpflicht-Versicherung', *Zeitschrift für Umweltpolitik*, 1–25.
- Faure, Michael G. (2005), 'The View from Law and Economics', in Gerhard Wagner (ed.), *Tort Law and Liability Insurance*, Vienna and New York: Springer-Verlag, pp. 239–73.
- Graf von der Schulenburg, J.-Matthias (2005), *Versicherungsökonomik – ein Leitfaden für Studium und Praxis*, Karlsruhe: Verlag Versicherungswirtschaft.
- Guthrie, Chris and Jeffrey J. Rachlinski (2006), 'Insurers, Illusions of Judgment & Litigation', *Vanderbilt Law Review*, 59, 2017–49.
- Hansmann, Henry and Reinier Kraakman (1991), 'Towards Unlimited Shareholder Liability for Corporate Torts', *Yale Law Journal*, 100, 1879–934.
- Harrington, Scott E. (1988), 'Prices and Profits in the Liability Insurance Market', in R. Litan and C. Winston (eds), *Liability: Perspectives and Policy*, Washington, DC: Brookings Institution, pp. 42–100.
- Heimer, Carol A. (2002), 'Insuring More, Ensuring Less: The Costs and Benefits of Private Regulation through Insurance', in Tom Baker and Jonathan Simon (eds), *Embracing Risk*, Chicago: The University of Chicago Press, pp. 116–46.
- Hellwig, Martin (1988), 'Versicherungsmärkte: Theorie', in Dieter Farny, Elmar Helten, Peter Koch and Reimer Schmidt (eds), *Handwörterbuch der Versicherung*, Karlsruhe: Verlag Versicherungswirtschaft, pp. 1055–77.
- Hellwig, Martin (1995), 'The Assessment of Large Compounds of Independent Gambles', *Journal of Economic Theory*, 67, 299–326.
- Jost, Peter-J. (1996), 'Limited Liability and the Requirement to Purchase Insurance', *International Review of Law and Economics*, 16, 250–76.
- Kahneman, Daniel and Amos Tversky (1984), 'Choices Values and Frames', *American Psychologist*, 39, 341–50.

- Kihlstrom, Richard E. and Alvin E. Roth (1982), 'Risk Aversion and the Negotiation of Insurance Contracts', *Journal of Risk and Insurance*, 49, 372–87.
- Kotowitz, Yehuda (1987) 'Moral Hazard, Allocation Information and Markets', in John Eatwell, Murray Milgate and Peter Newman (eds), *The New Palgrave: A Dictionary of Economics*, London: Macmillan, pp. 207–14.
- Kraakman, Reinier (1984), 'Corporate Liability Strategies and the Costs of Legal Controls', *Yale Law Journal*, 93, 857–98.
- Kunreuther, Howard and Mark V. Pauly (1985), 'Market Equilibrium with Private Knowledge: An Insurance Example', *Journal of Public Economics*, 26, 269–88.
- Leebron, David (1991), 'Limited Liability, Tort Victims, and Creditors', *Columbia Law Review*, 91, 1565–650.
- Lewis, Richard (2005), 'The Relationship between Tort Law and Insurance in England and Wales', in Gerhard Wagner (ed.), *Tort Law and Liability Insurance*, Vienna and New York: Springer-Verlag, pp. 47–85.
- Lopuci, Lynn M. (1998), 'The Essential Structure of Judgment Proofing', *Stanford Law Review*, 51, 147–60.
- Mayers, David and Clifford W. Smith (1982), 'On the Corporate Demand for Insurance', *Journal of Business*, 55, 281–96.
- Mayers, David and Clifford W. Smith (1983), 'The Interdependence of Individual Portfolio Decisions and the Demand for Insurance', *Journal of Political Economy*, 91, 304–11.
- Mossin, Jan (1968), 'Aspects of Rational Insurance Purchasing', *Journal of Political Economy*, 76, 553–68.
- Ott, Claus and Hans-Bernd Schäfer (1990), 'Schmerzensgeld bei Körperverletzungen', *Juristenzeitung* 1990, 563–73.
- Painter, Christopher M.E. (1984), 'Tort Creditor Priority in the Secured Credit System: Asbestos Times, the Worst of Times', *Stanford Law Review*, 36, 1045–85.
- Pauly, Mark V. (1968), 'The Economics of Moral Hazard: Comment', *American Economic Review*, 58, 531–7.
- Polborn, Mattias K. (1998), 'Mandatory Insurance and the Judgment Proof Problem', *International Review of Law and Economics*, 18, 141–6.
- Pratt, John W. (1964), 'Risk Aversion in the Small and in the Large', *Econometrica*, 32, 122–36.
- Priest, George (1987), 'The Current Insurance Crisis and Modern Tort Law', *Yale Law Journal*, 96, 1521–90.
- Raviv, Arthur (1979), 'The Design of an Optimal Insurance Policy', *American Economic Review*, 69, 84–96.
- Rea, Samuel (1982), 'Nonpecuniary Loss and Breach of Contract', *Journal of Legal Studies*, 11, 35–53.
- Rothschild, Michael and Joseph E. Stiglitz (1970), 'Increasing Risk I: A Definition', *Journal of Economic Theory*, 2, 225–43.
- Rothschild, Michael and Joseph E. Stiglitz (1976), 'Equilibrium in Competitive Insurance Markets: An Essay on the Economics of Imperfect Information', *Quarterly Journal of Economics*, 90, 629–49.
- Samuelson, P.A. (1963), 'Risk and Uncertainty. A Fallacy of Large Numbers', *Scientia*, 6th Series, 57th year, 1–6.
- Schwartz, Alan (1988), 'Proposals for Products Liability Reform: A Theoretical Synthesis', *Yale Law Journal*, 97, 353–419.
- Shavell, Steven (1979), 'On Moral Hazard and Insurance', *Quarterly Journal of Economics*, 93, 541–62.
- Shavell, Steven (1986), 'The Judgment Proof Problem', *International Review of Law and Economics*, 6, 45–58.
- Shavell, Steven (1987), *Economic Analysis of Accident Law*, Cambridge, MA: Harvard University Press.
- Shavell, Steven (2000), 'On the Social Function and the Regulation of Liability Insurance', *Geneva Papers on Risk and Insurance: Issues and Practice*, 25, 166–79.

- Shavell, Steven (2004), *Foundations of Economic Analysis of Law*, Cambridge, MA: Harvard University Press.
- Shavell, Steven (2005), 'Minimum Asset Requirements and Compulsory Liability Insurance as Solutions to the Judgement-Proof Problem', *Rand Journal of Economics*, 36, 63–72.
- Skogh, Göran (2000), 'Mandatory Insurance: Transaction Costs Analysis of Insurance', in Boudewijn Bouckaert and Gerrit De Geest (eds), *Encyclopedia of Law and Economics*, Vol. II, Cheltenham, UK and Northampton, MA: Edward Elgar Publisher, pp. 521–37.
- Smith, Michael L. and Robert C. Witt (1985), 'An Economic Analysis of Retroactive Liability Insurance', *Journal of Risk and Insurance*, 52, 379–400.
- Spence, Michael (1977), 'Product Differentiation and Performance in Insurance Markets', *Journal of Public Economics*, 10, 427–77.
- Stapleton, Jane (1995), 'Tort, Insurance and Ideology', *Modern Law Review*, 58, 820–45.
- Stone, Deborah (2002), 'Beyond Moral Hazard: Insurance as Moral Opportunity', in Tom Baker and Jonathan Simon (eds), *Embracing Risk*, Chicago: The University of Chicago Press, pp. 52–80.
- Trebilcock, Michael J. (1988), 'The Role of Insurance Considerations in the Choice of Efficient Civil Liability Rules', *JLEO*, 4, 243–65.
- Van Boom, Willem H. and Michael Faure (2007), *Shifts in Compensation between Private and Public Systems*, Vienna: Springer-Verlag.
- Viscusi, W. Kip (2004), 'Tort Reform and Insurance Markets', *Risk Management and Insurance Review*, 7, 9–24.
- Wagner, Gerhard (2003), 'Grundstrukturen des Europäischen Deliktsrechts', in Reinhard Zimmermann (ed.), *Grundstrukturen des Europäischen Deliktsrechts*, Baden-Baden: Nomos Verlagsgesellschaft, pp. 189–340.
- Wagner, Gerhard (2004), 'Deliktshaftung und Insolvenzrecht', in Eberhard Schilken, Gerhart Kreft, Gerhard Wagner and Diederich Eckardt (eds), *Festschrift für Walter Gerhardt*, Cologne: RWS Verlag, pp. 1043–76.
- Wagner, Gerhard (ed.) (2005a), 'Tort Law and Liability Insurance: German Report', in Gerhard Wagner (ed.), *Tort Law and Liability Insurance*, Vienna and New York: Springer-Verlag, pp. 87–117.
- Wagner, Gerhard (2005b), 'Comparative Report and Final Conclusions', in Gerhard Wagner (ed.), *Tort Law and Liability Insurance*, Vienna and New York: Springer-Verlag, pp. 309–52.
- Wagner, Gerhard (2006), 'Comparative Tort Law', in Reinhard Zimmermann and Mathias Reimann (ed.), *The Oxford Handbook of Comparative Law*, Oxford: Oxford University Press, pp. 1003–41.
- Wagner, Gerhard (2007), '(Un)insurability and the Choice between Market Insurance and Public Compensation Systems', in Willem Van Boom and Michael Faure (eds), *Shifts in Compensation between Private and Public Systems*, Vienna: Springer Verlag, pp. 87–112.
- Wilson, Charles (1977), 'A Model of Insurance Markets with Incomplete Information', *Journal of Economic Theory*, 16, 167–207.
- Wilson, Charles (1987), 'Adverse Selection, Allocation Information and Markets', in John Eatwell, Murray Milgate and Peter Newman (eds), *The New Palgrave: A Dictionary of Economics*, London: Macmillan, pp. 32–4.
- Zweifel, Peter and Roland Eisen (2003), *Versicherungsökonomie*, Berlin: Springer-Verlag.

14 No-fault compensation systems

*Karine Fiore**

14.1 Introduction

In 2000, McEwin (2000, p. 745) concluded by saying:

One thing seems clear. If we are concerned . . . with accident compensation, the tort law system is unsatisfactory.

This assertion relies on the law and economics literature, and more particularly on the no-fault advocates' arguments, according to which the tort system would be deficient in providing sufficient compensation to accident victims.

The tort system is one of the oldest systems used to manage economic and social activities by allocating the burden of a loss to an injurer. However, since the 1960s, the implementation of no-fault compensation systems has continuously increased (traffic accidents, product accident, medical malpractice, etc.). Before the 1960s, no-fault systems were mainly (and logically) used for risks with non-identifiable injurers (natural risks, terrorism, etc.). Since then, in many fields, these systems have substituted the traditional tort system, even for risks with identifiable injurers. For example, we could have observed, in many countries, shifts to no-fault systems for automobile or product accidents (Keeton and O'Connell, 1971; Demsetz, 1969; Posner, 1975; Tunc, 1981; Schwartz, 1985; Schwartz and Mahshigian, 1987; Priest, 1989; Hensler *et al.*, 1991; Croley and Hanson, 1991; Chapman and Trebilcock, 1992). This trend is even more conspicuous for workplace accidents (Ashford and Johnson, 1982; Chelius, 1990; Bruce and Atkins, 1993; Bilandic, 1995; van Velthoven, Chapter 16, this volume). Some countries are fervent supporters of no-fault systems and some of them even defend universal no-fault schemes, for all accidents. This is, for example, the case with New Zealand (Palmer, 1979; McEwin, 2000).

How to explain this trend towards no-fault systems? The unprecedented catastrophes of the 20th century and the liability insurance crisis of the 1980s have raised the question of the victims' compensation for large, irreversible and/or latent damages. In this context, the worry of

* Centre d'Analyse Economique, UPCAM, Aix-en-Provence, France.

guaranteeing an equitable, fast and full compensation for all victims of an accident has caused tort reforms in many countries. These reforms took the form of switches from the traditional tort system to no-fault schemes. The protection of victims has thus become the main priority for governments and no-fault systems seem to be better instruments to reach this goal.

However, although the tort system is argued to be insufficiently distributive compared to no-fault systems, the law and economic literature also shows that it is far more efficient as regards accidents reduction (Barnes and Stout, 1992). Therefore, on the one hand, the tort system is deterrent but inefficient in protecting victims. On the other hand, no-fault systems are highly compensatory but fail to provide incentives to care. The two systems are thus imperfect. One gives priority to prevention, whereas the other gives priority to compensation. The literature is quite unanimous about this result.

Hence, it seems then that the debate is in a cul-de-sac. It appears that governments' decision, as regards the implementation of one system, is simply taken according to the priority they want to favour.

Nevertheless, relying on the tools law and economic literature offers, isn't it possible to reconcile (and maximize) prevention and compensation within the same system? How to combine the advantages of the tort and no-fault systems?

This chapter examines this question relying on the no-fault compensation and tort (negligence) systems literature. It aims first to show how no-fault systems are better at providing compensation than the negligence system (Section 14.2). Referring to empirical evaluations, it also shows that no-fault systems display inefficiencies which can be reduced within the tort system. Hence, a third system is examined: the strict liability system. There is a very thin line between the no-fault and the strict liability systems, but the latter allows priority to be given to the protection of victims while being within the tort system. Strict liability reinstates the injurer's liability at the centre of the scheme. It conciliates prevention and compensation (Section 14.3). The necessary conditions for guaranteeing the efficiency of the strict liability system, and compensation systems in general, are then studied (Section 14.4). Section 14.5 gives examples of compensation systems based on strict liability for catastrophic risks. Section 14.6 concludes.

14.2 No-fault systems: the priority given to the protection of victims

14.2.1 Definition of no-fault systems

The traditional tort system, or *negligence system*, is basically articulated around the notion of fault. It implies that a tortfeasor is held liable if and

only if he has committed a fault or if he has been careless. As a result of this logic, the tortfeasor has to compensate the victims if he has been proven to be negligent by the legislator. The fault is defined according to a certain level of care enacted in the regulation. In this case, the tortfeasor liability is governed by the rule of *subjective* liability.

In contrast, no-fault systems are not based on the criterion of fault. They are systems whereby a victim receives automatic compensation from a third party without having to prove any fault or negligence. This third party can be the injurer himself but is usually a public collectivity or the State. No-fault systems are thus particular. They are outside the tort system since compensation to victims is totally disconnected from the tortfeasor's liability or behavior. No-fault systems aim only at compensation and protection for victims independently of any notion of relative risk or level of care. As a consequence, within no-fault systems, when a risk is realized and an accident happens, victims don't need to prove the injurer's fault or negligence. They only have to claim compensation from the collectivity or the State concerned. No-fault systems are often coupled with compulsory self-insurance. That means potential victims are required to buy insurance to protect themselves against accidents. In case of an accident, compensation amounts are then paid to victims either via their own insurance or through public funds (from 'accident funds'). Sometimes insurance is also public. This is the case with automobile insurance in Quebec for example, which consists of a fund collecting and pooling a unique premium for all drivers.

No-fault systems can have many different manifestations: government-provided compensation, public compensation scheme, but also first-party insurance. There are different degrees of no-fault systems between 'pure' no-fault and 'mixed' no-fault systems. Within 'pure' no-fault systems, victims obtain full compensation from their insurers (often public) or the State. This first category of no-fault has been implemented in Quebec, Northern Australia and New-Zealand.¹ Within 'mixed' no-fault systems, insurers compensate the victims up to a certain threshold above which the latter can claim supplementary compensation against the injurer himself (Derrig et al., 1994). This second category thus maintains a link with the traditional tort system and is mainly practised in the United States.

For fifty years, no-fault systems have substituted for the tort system in several countries' accidents legislation. How to explain such a trend?

¹ These systems are examined in Section 14.2.3.

14.2.2 The theoretical rationale of no-fault systems

No-fault advocates set forth three main advantages of no-fault over the negligence system: they provide higher compensation, they imply lower transaction costs and they generate lower insurance premiums.²

14.2.2.1 Higher compensation Within the tort system, compensation is given only if the tortfeasor has not respected the level of care defined by the judge. The corollary is thus that if the tortfeasor is proven to comply with this level, compensation will not be paid to victims. That is an important shortcoming highlighted by no-fault advocates. The question of the determination of the optimal level of care is an issue largely analysed in the literature and obviously influences the efficiency of the system (Shavell, 1986a, 1987).

Since no-fault schemes provide automatic compensation to victims, they are argued to be more distributive and thus more efficient. Moreover, relying on Carroll and Kakalik (1991a, 1991b, 1993), McEwin (2000, p. 739) shows that:

The tort system tends to overcompensate small losses and undercompensate large losses.

As far as compensation is concerned, no-fault systems are also considered as more moral. Indeed, with the tort system, victims are not completely protected. From a social and moral viewpoint, this will eventually become less and less acceptable. In particular, this is even less tolerated for unilateral accidents, where victims don't contribute to the risk at all. This is the case, for example, with terrorist or natural risks.

14.2.2.2 Lower transaction costs Beyond the compensatory advantage, no-fault systems also protect victims by reducing transaction costs. They reduce them in two ways.

First, Grabowski et al. (1989) and Devlin (1992) documented that since victims obtain compensation without pursuing the injurer, there are fewer lawsuits and thus, administrative costs are lower. Equally, compensation is made faster because the procedure is direct, avoiding legal intermediaries and court slowness (Kakalik and Pace, 1986; Studdert et al., 2006; Hersch and Viscusi, 2007).

Secondly, since the victims don't have to prove the injurer's fault or negligence, they are relieved of the costs of proof. This is an important advantage because the costs of proof might be very high, especially for industrial and

² Dewees et al. (1996) provide a complete and relevant survey of no-fault advantages.

technological risks which require advanced and qualified information. In those cases, victims often suffer from an informational asymmetry which prevents them from proving the fault or the negligence (Franklin, 1967; O'Connell, 1975; Chelius, 1976; Carroll and Kakalik, 1991a, 1991b). As a consequence, either the lack of information discourages victims straight away or the costs of proof are too prohibitive for them to continue their enterprise. Therefore, no-fault systems allow lower transaction costs, less waste and again, higher compensation. As O'Connell (1975, p. 461) points out:

With the savings from arguments over fault . . . , more peoples are eligible for payment from the insurance pool This is, in essence, the 'miracle' being wrought by no-fault auto insurance.

Relying on O'Connell (1975), McEwin (2000, p. 737) goes on:

Savings in legal costs and the other costs of administering a liability system mean that can be provided to those not compensated through the tort system.

14.2.2.3 Lower insurance premiums Literature on no-fault systems tends to show that tort reforms have a positive impact in terms of insurance premiums reduction. In this respect, empirical evaluations suggest that potential victims' self-insurance is cheaper than injurers' third-party insurance within the tort system (Deweese et al., 1996). Indeed, with the latter, the injurer covers himself against the risk he generates for third parties, in cases where he would be held liable. The insurer covers the potential claims the injurer is subject to as a result of his activity. These potential claims can be very large, especially for industrial and technological activities which generate catastrophic risks. Insurance premiums thus tend to increase. This rise has been accentuated for a few years by the liability insurance crisis.

With no-fault, insurance premiums may be lower because every potential victim (everyone) is constrained to self insure individually. In this way, insurers can pool and share the potential risk over a high number of policyholders. The literature generally reports that first-party schemes imply lower insurance premiums than third-party schemes (Caldwell, 1977; Zuckerman et al., 1990; McEwin, 2000). According to Priest (1989), the increase in third-party insurance premiums has increased interest in self-insurance. As regards tort reforms in the field of medical malpractice, Zuckerman et al. (1990) showed that they have led to decreased insurance premiums. This conclusion is also stated by Born and Viscusi (1998), Thorpe (2004) and Viscusi and Born (2005).³ Medical no-fault schemes,

³ These studies specify, however, that the decrease in insurance premiums has been combined with statutory limitations on plaintiffs' recovery.

however, are not common. Only New Zealand (1974), Sweden (1975) and Finland (1987) have implemented one. As a result, there are still few empirical studies on them.⁴

From the three advantages mentioned above, no-fault systems thus seem to be preferable to the traditional tort system. They protect accident victims much more and they are cheaper in terms of transaction (legal and proof) costs and in terms of insurance premiums. The no-fault advocates rely on these arguments to refute the tort system.

14.2.3 Disadvantages of no-fault systems

In spite of their qualities, no-fault schemes also display shortcomings which may restrain their development. These defaults are of two types: one concerns their distributive (*ex post*) dimension and the other concerns their preventive (*ex ante*) dimension.

As far as compensation (distribution) is concerned, no-fault systems generally only take into account economic and direct damages in determining the compensatory amount. They thus don't include in compensation amounts an important share of the damages suffered by victims, such as pain and suffering or revenue losses and medical fees. These damages are the so-called 'non-economic' or 'indirect' damages. Therefore, although no-fault systems protect victims, their compensatory dimension is limited by these restrictions. As the negligence system compensates for these types of damages, it can be considered more distributive in this respect (Rolph et al., 1985; McEwin, 2000).

As regards their preventive dimension, no-fault systems are often argued to be inefficient. These systems are basically not fault-based. The compensation is thus not risk-related and neither is its financing. Contrary to the traditional tort system, there is no legal or systematic link between the tortfeasor and the damage payment since liability is not a criterion in compensation. The criterion is the existence of damages. Further, insurance premiums are generally not risk-related neither. They are often the same for everyone regardless of their real exposition to the risk. They are thus usually not based on the likelihood of suffering from an injury. This disconnection between tortfeasor liability, risk and compensation may have a negative impact on care behaviour. As a consequence, no-fault systems are shown to decrease safety. On the contrary, the tort system is presented as more deterrent *ex ante* because the injurer can avoid paying compensation

⁴ In addition to the studies already mentioned, see Burt (1991) and more recently Studdert et al. (2004). For a more theoretical account, see Epstein (1976, 1978, 1986).

by adopting cautious behaviour.⁵ He thus has a real advantage from being careful. It is generally argued that incentives to care are therefore better provided by the tort system. This is the main criticism of law and economics scholars against no-fault systems: they are presumed to increase the accident risk (Calabresi, 1977; Calabresi and Klevorick, 1985; Shavell, 1986a, 1987; Trebilcock, 1989). This is a familiar argument. Trebilcock (1989, p. 53) belongs to this school of thought and according to him:

It is assumed, without justification, that economic incentives do not influence individual behaviour. Neither theory nor empirical evidence supports this assumption.

The question of the choice between no-fault and tort systems is thus difficult to answer. What do empirical evaluations reveal in this respect? Are they unanimous about the superiority of no-fault over tort? What about Trebilcock's (above) statement? Two examples of no-fault schemes will be used as illustrations of this argument: automobile insurance and universal no-fault schemes.

14.2.4 Examples and empirical evaluations

14.2.4.1 Automobile insurance No-fault systems for automobile accidents were first proposed by Keeton and O'Connell in 1965. In France, they are also defended by lawyers such as Tunc⁶ (1981). In the 1970s, the USA (1971), Northern Australia and Quebec (1978) switched from the traditional tort law system to a system of no-fault in this field. These systems generally require compulsory first-party insurance from all drivers. Therefore, each driver involved in an accident is insured and compensated regardless of his own contribution to the accident. For thirty years, these systems have been empirically evaluated. Their assessment is contrasted.

According to empirical studies, the introduction of traffic no-fault systems shows positive results. First, studies show, in conformity with the theoretical rationale, that administrative costs have decreased: Danzon (1985) and Devlin (1990) calculated that these costs have decreased by

⁵ Nevertheless, Fleming (1967) and Atiyah (1980, 1993) show that the deterrent effect of the tort law system might also be reduced by imperfect insurance that doesn't properly penalize careless or unsafe behaviour.

⁶ Tunc (1981) proposed the introduction in France of a no-fault compensation system for victims of traffic accidents. This proposition was called 'Project Tunc' and had some echoes on the political scene. In particular, it led to the promulgation of the Robert Badinter Act on 5 July 1985 which partially excludes the notion of fault in the compensation scheme.

\$94 million per year in Quebec. Carroll and Kakalik's (1991a, 1991b) and Danzon's (2000) results confirm this trend. Then, as expected, these systems have provided higher compensation enlarging the number of plaintiffs (O'Connell, 1975; Atkins, 1991; Dewees *et al.*, 1996).

However, the most spectacular result of the introduction of no-fault systems for automobile accidents is negative: the increase in road fatalities. Indeed, in all the different countries where the tort reforms took place, studies report a decrease in safety.

In Quebec, Devlin (1992) and Gaudry (1992; Gaudry *et al.*, 1995) show an increase in road accidents of 9.6 percent and 3.3 percent respectively. As a consequence of this increase, Devlin (1990) shows that the supplementary social cost equals \$247 million per year, which largely cancels out the benefit in terms of administrative costs, mentioned above. Other empirical studies for Canada were led by Boyer and Dionne (1987), Boyer *et al.* (1990, 1991), Brown (1979, 1988, 1989) and Brown and Feldthusen (1988).

In Northern Australia, Swan (1984), Brown (1985) and McEwin (1989) present empirical evidence of an increase in road fatalities of 16 percent to 20 percent.

In the USA, there are two generations of studies. The first generation studies give ambivalent results: Landes (1982a, 1982b) and Medoff and Magaddino (1982) present a significant relationship between no-fault and the increase of accidents, whereas Kochanowski and Young (1985), DOT (1985) and Zador and Lund (1986) show the opposite and Kabler (1999) provides mitigating results.⁷ According to van Velthoven (Chapter 16, this volume), the methodology of these first generation studies is quite opaque. As far as the second generation North American studies (with improved econometric methodology) are concerned, apart from Loughran (2001), they are unanimous: they found an increase in traffic accidents after the 1970s as a result of weakened driver incentives. Cummins *et al.* (2001), Sloan *et al.* (1994) and Devlin (1999) reported an average increase in traffic accidents of 11 percent and Cohen and Dehejia (2004) an increase of 10 percent. This result is confirmed by Caminiti (1995a, 1995b). Cummins and Weiss (1993) showed that the number of claims has also significantly risen.

14.2.4.2 A universal no-fault system: the case of New Zealand In 1974, New Zealand introduced a universal no-fault scheme for all accidents in its jurisdiction. This is an original and (so far) unique experience. This

⁷ See also the studies by Brainard (1973a, 1973b; Brainard and Fitzgerald, 1974), Bruce (1984), Carr (1989), Carroll and Abrahamse (1996).

system is governed by a public monopoly (the Accident Compensation Commission) and covers all personal injuries resulting from an accident (medical, professional, traffic, home, etc.).

The purposes of such an initiative were equity, efficiency and protection of victims. As McEwin (2000) presents it, this scheme is based on five principles (reported in the 1967 Woodhouse Royal Commission Report):

- Community responsibility
- Comprehensive entitlement
- Complete rehabilitation
- Real compensation
- Administrative efficiency

Independently of the place and the cause of the accident, the victim will be compensated. The notions of fault or liability are excluded from the scheme. Due to the scheme's no-fault basis, people who have suffered personal injury do not have the right to sue an at-fault party, except for exemplary (punitive) damages. This scheme was also motivated by transparency care. Such a State organization allows easier empirical evaluations and thus, gathering data (Palmer, 1979). As reported by the Woodhouse Royal Commission, the organization (as amended in 1982 and 1992) is financed by the State through taxation collected for six accounts:

1. *Work-related injuries* are covered through a fund financed by employers on payrolls;
2. *Non-work-related injuries* (sport, home, etc.) are covered through a fund financed by earners on their earnings;
3. *Non-earners' injuries* are covered by general taxation on revenues and social security;
4. *Traffic accidents* are compensated from funds (the Motor Vehicle Account) composed of drivers' annual licensee fees and a tax on oil sales;
5. *Subsequent work injuries* are funded from employers, earners, non-earners and the Motor Vehicle Account;
6. *Medical injuries* are compensated through taxation on earnings and revenues.

The different accounts are managed by the State through a no-fault public insurance monopoly: the Accident Compensation Corporation (ACC, 1978a, 1978b, 1979). This public insurance was the sole (and compulsory) provider of accident insurance for all work and non-work injuries in New Zealand until 1988. Indeed, under pressure from chief executives

of major business firms in the country, the New Zealand insurance system was opened up to competition.⁸

This universal no-fault scheme was first assessed at the end of the 1970s: the assessments were mainly led internally by the Accident Compensation Corporation and aimed at collecting data on financial flows, levels of taxation, evolution of claims and at estimating the overall cost of the system. As with studies in the field of automobile accidents, the results of these assessments are entirely satisfactory. On the one hand, Palmer (1979) showed that compensation amounts have been increased substantially. This result is positive as regards the scheme's purposes and principles (mentioned above). On the other hand, however, a significant rise in injury cases has also been recorded, coupled with the appearance of some inefficiencies, especially from employees in the workplace. Relying on Palmer (1979), McEwin (2000, p. 744) indeed reports the following.

Soon after the scheme began, employers started to complain that injury rates had soared. In particular, complaints from the meat-freezing industry led to the ACC setting up an independent inquiry. The inquiry found that lost working time in the meat-freezing industry increased by 92 percent in the first two years.

As far as motor vehicle accidents are specifically concerned, Swan (1984), Brown (1985) and McEwin (1989) documented an average increase in fatalities of 18 percent after the switch to no-fault.

Hence, as regards the increases in injury rates and accidents, the under-deterrent effect of no-fault systems can again be blamed.

Empirical evaluations of the New Zealand universal no-fault scheme are still not very numerous. However, the existing studies show ambivalent results. On the one hand, the scheme better protects accident victims. On the other hand, it seems to be insufficient to maintain adequate care incentives. Still, from a theoretical law and economics perspective, it is essential that in no-fault systems incentives should still be built in, both for risk takers and for victims. In this respect, let us note the successive amendments to the ACC aimed at improving incentives and efficiency of the system. The 1982 amendments (as reported in McEwin, 2000) consisted in shifting from a fully-funded to a 'pay-as-you-go' system, with restrictions on some compensation rights. The 1992 amendments reorganized earners' accounts financing and enacted the Accident Rehabilitation and Compensation Insurance Act, the goal of which was to control premium costs in the system.

⁸ The governmental decision of 14 May 1988 facilitated this opening up to the private sector.

Referring to these empirical results for automobile accident no-fault or universal no-fault systems and to the criticisms levelled against traditional tort law, it seems rather difficult to conclude definitively between fault or no-fault. The debate appears to be infinite since none of them seems to be a first-best solution. Maybe the debate could be opened up and improved by orienting considerations towards a third system: the strict liability system.

14.3 No-fault versus strict liability systems

14.3.1 *Definition of the strict liability system*

The *strict liability* scheme is a hybrid legal system. Although it belongs to the tort system, it is halfway between the no-fault and negligence systems.

Like no-fault schemes, the *strict liability* system is not fault-based. When an accident occurs, victims don't need to prove the injurer's fault or negligence to obtain compensation. There is thus a very thin line between no-fault and strict liability systems. That is the reason why scholars in the law and economics literature sometimes deal with them as equivalent systems. Still, the line between them is far from being insignificant.

On the one hand, within strict liability systems, evidence of damages is not sufficient to make a claim result in indemnification. Indeed, contrary to no-fault, this system requires a link to be made between the prejudice and the tortfeasor's activity. The mere existence of the injury is not enough. The causal effect between the injury and the risk generated by the potential injurer has to be shown. After this link has been shown in the courts, victims can claim compensation.

On the other hand, compensation is not (or not in the first resort) financed through public funds but is funded out of the injurer's own resources. The major difference between strict liability and no-fault consists then in relating compensation to injurers' financial assets, and thus relating compensation to their liability. While (pure) no-fault systems abolish tort claims altogether, strict liability rehabilitates liability at the centre of the legal system. Hence, to obtain compensation, victims have to litigate a claim and pursue the tortfeasor himself.

From these two standpoints, the strict liability system appears to be much further removed from no-fault than it was at first sight. As a matter of fact, since it is liability-based, the strict liability system belongs to the tort system. Nevertheless, since it is not fault-based, it is more advantageous to the victim.

14.3.2 *The advantages of strict liability*

What then are the advantages of such a third system? The scheme is also called an *objective* or *absolute* liability system. Belonging to the tort system,

it still manages to bridge no-fault and negligence systems in combining their respective advantages.

First, compensation is not strictly speaking 'automatic' but is still guaranteed. Indeed, contrary to the traditional (negligence) tort system, strict liability implies that the injurer is always held liable whatever his behaviour. That means that, once the causal link between his activity and the prejudice has been demonstrated, the tortfeasor is legally bound to pay compensation to victims even if he has not been careless. This particular clause aims at palliating two problems: the possible misestimating by the judge of the level of care that is to be complied with and the undercompensation of victims.

As to the first problem, the law and economics literature showed that the precise determination of the optimal level of care might be hindered by uncertainties around the risk considered (Epstein, 1973, 1980; Shavell, 1987). Information costs are thus high. This is particularly the case with catastrophic, technological or development risks (Epstein, 1996; Faure, 2007). Under a negligence rule, it is the judge who fixes care levels. Given his potential lack of information, he might underestimate them. Of course, this problem can be reduced when the care level has been determined through safety regulation. In this case, the judge can be assisted by the legislator. Safety regulation can thus lead him to know what the minimum is that should be required from an injurer. However, in cases where the statutory level of care is set too low, the judge may still be required to examine whether the optimal care level was higher than the level of care under the regulation and thus still bears the information costs of finding out what optimal care was. These costs of information are avoided under strict liability, which allows victims to obtain compensation even if the injurer has complied with safety regulations. All the information costs are thus shifted to the injurer.

As far as the undercompensation problem is concerned, it is related to the previous one. With the tort system, the injurer compensates victims only if he has been negligent. There might thus be a large number of cases where victims are not indemnified for their injuries. From an *ex post* viewpoint, the strict liability system is thus efficient.

Secondly, since compensation is now related to risk, the tortfeasor plays a central role. On the one hand, his activity is identified as the potential origin of a risk. On the other hand, he is financially engaged. As a result, strict liability is usually considered as efficient by the law and economics literature because the tortfeasor is exposed to liability under this scheme and thus has excellent incentives for accident reduction. We understand here the essence of Trebilcock's (1989) viewpoint (quoted above). Compensation is funded by the tortfeasor himself (and his insurer) and

not by a mass of anonymous payers. This again reinforces his incentives to be careful in order to protect his resources. Since he cannot theoretically escape from his liability in case of an accident, he will implement every appropriate safety measures in order to avoid the accident and thus to avoid being condemned. From an *ex ante* standpoint, the strict liability system is thus efficient as well.

14.4 The efficiency of compensation systems: the necessary conditions

Combining the advantages of no-fault (protection of victims) and negligence (care incentives), the strict liability system has been increasingly implemented worldwide. Its success is mainly due to the fact that, within the tort system, strict liability still allows for the protection of victims. However, like other compensation systems, strict liability might face some failures which might decrease its efficiency (prevention and protection of victims). Therefore, in order to strengthen it, three conditions have to be fulfilled.

14.4.1 Unlimited liability/compensation amounts

The first hindrance a compensation system has to overcome is underdeterrence. We saw that the tort system is commonly argued to be more deterrent than no-fault systems. Still, underdeterrence can be observed for any compensation systems even within tort. This failure is mainly due to the fact that compensation systems are often coupled with some legal restrictions as regards amounts of compensation and liability. One of the most important restrictions is liability capping.

Liability capping consists in limiting the injurer's liability and duty to compensate financially. Within tort, that means that the injurer is legally held fully liable for the damages in case of an accident, but he is only partially liable economically. He has thus to pay only a share of the damages, up to a limit fixed by the legislator. This legal principle is commonly justified by the fact that it allows the insurability of the risk. The risk, in particular if it is catastrophic or unforeseeable, would not be insurable on insurance markets without this limitation (Berliner, 1982; Faure and Fenn, 1999; Skogh, 1998; Courbage and Liedtke, 2003; Faure, 2004). Nevertheless, this limitation causes three major problems.

First, the tortfeasor might adopt an insufficient level of care to prevent accidents. Since his liability is financially capped, he might be rationally induced to protect his financial resources up to the cap, and nothing more. He will thus adopt a level of care which allows him just this protection. In any case, above his own resources, he is, by definition, insolvent. Whether there is a cap on his liability or not, the problem thus arises from the fact that the tortfeasor's level of care might be insufficient to prevent accidents.

In addition, accidents could cost much more than the financial cap (depending upon its level) and/or much more than the injurer's total resources. Therefore, limited liability generates a second problem: the risk that, if damages exceed the injurer's liability cap, victims won't be fully compensated. This is particularly the case for catastrophic risks where damages might be very large. Examining strict liability systems, Faure (1999, p. 8) points out:

In the literature it has been indicated that there may be good reasons to favour a strict liability rule for major industrial accidents, the main reason being that only a strict liability rule would lead to a full internalization of those highly risky activities. Only with strict liability the potential injurer would also have an incentive to adopt an optimal activity level. This full internalization is obviously only possible if the injurer is effectively exposed to the full costs of the activity he engages in and is therefore in principle held to provide full compensation to a victim. An obvious disadvantage of a system of financial caps is that this will seriously impair the victim's rights to full compensation.

Even within pure no-fault systems, the problem of undercompensation exists if limitations are set on compensation amounts. As a consequence, combining compensation systems with liability/compensation caps is inconsistent with the initial purpose of these systems: protecting victims of accidents. Further, the financial liability limit is also sometimes coupled with a limitation in time. This limitation takes the form of prescribing terms after which victims can no longer pursue the tortfeasors. These terms are unfavourable to victims, especially when damages are latent and/or hereditary. In this case, the goal of protection of victims might not be achieved.

Thirdly, when compensation systems (especially within the tort system) are coupled with liability limits, they might prevent tortfeasors from internalizing all the risk costs they generate by their activity. The importance of the internalization of the risk costs by tortfeasors has been analysed *inter alia* by Coase (1960). The internalization rule implies that tortfeasors assume the whole risk they generate by bearing the costs of prevention and costs of compensation (through, for example their insurance). If the risk concerns an industrial or commercial activity, the full internalization of the risk supposes that these costs are passed on to consumers at the sell price, so that the price reflects the real producer's costs. However, when liability/compensation is capped, the internalization is partial and the costs passed on in the price are thus artificially low. As a consequence, the price is no longer a correct signal to consumers. This might lead to overconsumption and overproduction.

How to remedy these three problems?

As regards underdeterrence and under-internalization, these can be solved through the substitution of caps by unlimited liability or full

compensation. As Faure (1999) points out, most important is that injurers are fully exposed to the risk they generate. In this way, they will internalize their whole risk costs, thus inducing an increase in their level of care. Let us note, however, that unlimited liability is economically purely theoretical given that the tortfeasor's financial assets are never infinite. Therefore, even if his liability is unlimited (within the tort system), he will protect his whole resources (and nothing more). Nevertheless, his level of care will surely be higher than with a liability cap.

As to compensation, it could be funded to a greater extent through the private sector, with States paying for excess damage if needed. This intervention is thus a means of remedying undercompensation. Even within the tort system, States often provide supplementary compensation through public funds, above the injurer's liability cap (or once all his resources have been used up in the case of unlimited liability). In this case, States can act in two distinct ways: either they intervene graciously by paying direct compensation to victims (States are thus helpers of last resort), or they make the tortfeasor pay for their intervention (States are thus reinsurers).

14.4.2 Safety regulation

To strengthen the deterrent effect of compensation systems, safety regulation is often necessary. This argument has been widely analysed in the law and economics literature, in particular by Shavell (1984a, 1984b). As Shavell (1984b, p. 271) points out:

Neither regulation nor liability . . . leads all parties to exercise the socially desirable levels of care. Regulation does not result in this outcome because the regulatory authority's information about risk is imperfect, while liability does not create sufficient incentives to take appropriate care because of the possibility that parties would not be able to pay fully for harm done or would not be sued for it. But as is stressed, it is often socially advantageous for the two means of controlling risk to be jointly employed—for parties to be required to satisfy a regulatory standard and also to face possible liability.

Safety regulation allows the raising of the level of care adopted by the potential tortfeasor by imposing care standards and rules on him. These standards and rules are enforced by the legislator and are coupled with negative sanctions in case of no application (going from pecuniary penalties to imprisonment). These may concern technological processes, materials, maintenance procedures, etc. In this way, safety regulation reduces moral hazard. Safety regulation is particularly crucial for activities which generate catastrophic risks or risks which are still marked by uncertainties, such as some technological or industrial risks.

Safety regulation is thus an exogenous additional source of incentives. Some scholars set forth another (endogenous) source of deterrence: within some industries, the ‘reputation effect’ is considered a powerful tool of prevention (Brissette, 2005; Laurent, 2005). Through this effect, it is considered that industrial tortfeasors are spontaneously induced to prevent accidents, independently of legislative sanctions or legal liability, because there is a real gain in maintaining the reputation and the image of their industry. This is, for example, the case for nuclear operators, who have much to gain from avoiding another Chernobyl.

14.4.3 Compulsory insurance

A final problem raised by compensation schemes and linked to the risk of undercompensation mentioned above, comes from the potential tortfeasor’s insolvency. This problem is named by Shavell (1986b) ‘*the judgement proof problem*’. Although no-fault-based systems aim at guaranteeing victims’ compensation, this purpose might be thwarted if the injurer is *de facto* unable to pay the whole reparations. This is particularly the case with catastrophic risks generated by small operators for whom assets are restricted. Even with a liability cap, it is thus possible that the tortfeasor can’t compensate victims (if his resources are lower than the cap). Therefore, the most common solution to this problem is for the State to impose compulsory insurance, either on the potential tortfeasor (third-party insurance), or on the potential victims (first-party or self-insurance).

Referring to the examples of automobile and products accidents, McEwin (2000, p. 735) said:

Victims are made to buy self-insurance or tortfeasors are made strictly liable and forced to buy liability insurance, or some combination. For example, automobile no-fault systems typically cover the driver-owner (self-insurance) as well as other drivers of the vehicle, passengers and any pedestrians injured by the vehicle (compulsory strict vehicle liability insurance). Product liability no-fault schemes involve imposing some form of strict liability on producers coupled with compulsory liability insurance (self-insurance may be permitted).

In the case of bilateral accidents (such as traffic accidents), first-party insurance and third-party insurance are generally required by the State. However, in the case of unilateral accidents, most of the time only third-party insurance is required. For instance, in the field of catastrophic risks, where the injurer can be identified (industrial and technological risks), compulsory insurance is generally imposed upon him. This constraint is justified because, given that victims cannot contribute to the risk and that they suffer from asymmetric information, it is considered that insurance has to be taken out by the tortfeasor himself. On the one hand, he is the

sole person to influence the risk. On the other hand, he has better quality information to measure and prevent the risk. Moreover, insurers who cover these specific risks (nuclear risk, chemical risk, etc.) are generally specialized in this type of coverage. Therefore, they can share with operators information about the risk and price it better. Insurance premiums are thus risk-related and better reflect this. In this respect, it is often argued that third-party insurance for catastrophic risks leads to fairer pricing for insurance premiums than first-party insurance.

Compulsory insurance is an efficient tool to guarantee tortfeasors' solvency and thus to strengthen the efficiency of compensation systems. It can also be combined with guarantees and/or financial securities required from the tortfeasor and his insurer. These solutions may contribute to reducing adverse selection as well. In this respect, although compulsory insurance is favourable to victims as far as compensation is concerned, it has to be coupled with risk differentiation to be an effective deterrent. Indeed, risk differentiation is essential to reduce adverse selection. Relying on Priest (1996) and Epstein (1996), Faure (2007, p. 346) argues:

An adequate differentiation of risks and premiums (is) a remedy to adverse selection Government relief programs have been insufficiently able to provide incentives for prevention as risk differentiation under insurance does.

To be sufficiently deterrent and to maximize the protection of victims, compensation systems may need to be combined with a variety of additional legal and economic instruments: unlimited liability and compensation amounts, State intervention, safety regulation and compulsory insurance. For example, as McEwin (2000, p. 745) sums it up:

Different combinations of insurance/safety regulation should be considered in terms of their ability to provide optimal compensation and safety.

In this way, compensation legal designs are made efficient.

14.5 Examples of compensation systems (based on strict liability) for catastrophic risks

Compensation systems for catastrophic risks are specific. Catastrophic risks are special risks: they are rarely foreseeable and their damages might be irreversible, large and cross-border. There are two categories of catastrophic risks:

- Catastrophic risks with non-identifiable causes: these concern natural risks (storm, flood, hurricane, earthquake, etc.) and terrorist risks. For these risks, most of the time, States implement no-fault

compensation schemes and take charge of an important share (or the whole) of damages. Self-insurance is often required from potential victims for property damages. Personal injuries are mainly financed through social security.

- Catastrophic risks with identifiable injurers: these concern industrial and technological risks (chemical, nuclear, oil pollution, etc.). Given the specific characteristics of these risks, they are generally governed by a no-fault-based tort system, and more particularly by strict liability. Strict liability is indeed increasingly used to manage compensation of catastrophic accidents. A precise person is thus named by the legislator as liable in case of an accident. We present herein two examples of these schemes: compensation for nuclear and marine oil pollution accidents. In a sense, these are hybrid systems, given that they are based on the one hand on strict liability and on the other hand, on government compensation.

14.5.1 Compensation for nuclear accidents

Civil liability, in the case of a nuclear accident, is governed by three international Conventions: the Paris Convention (1960), the Brussels Convention (1963) and the Vienna Convention (1963). The Paris and Brussels Conventions are the pioneers in the field of nuclear civil liability. They were drafted by the NEA (Nuclear Energy Agency), an OECD (Organization for Economic Cooperation and Development) agency, in order to manage nuclear operators' liability, in case of an accident at their installations. For now, the Paris and Brussels Conventions have been ratified by twelve contracting countries (all western European). The Vienna Convention has been enacted by the IAEA (International Atomic Energy Agency) for thirty-two countries from Asia, South America and Eastern Europe. These three international Conventions have been revised several times ever since. The last amendments of the Paris and Brussels Conventions were drafted in 2004 (but have not yet entered into force) and the last amendments to the Vienna Convention were adopted in 1997. Although they are OECD countries, the USA and Canada are not members of these international Conventions; they have their own national nuclear liability regimes. However, their regimes are very close to the Conventions in their principles.

The nuclear civil liability Conventions are all based on the same liability principles. They are no-fault-based. The liable person named by the legislator is the nuclear operator. His liability is strict, limited and channelled. In case of an accident, the nuclear operator will always be held liable for compensation, whatever his contribution to the risk and whatever his level of care. Of course, in the nuclear industry, safety regulation plays an

important role in accident prevention. It is controlled today by national and international agencies and it relies on the 1994 IAEA Convention on nuclear safety. This safety regulation aims at remedying the lack of incentives generated by the nuclear operators' liability limit. Since the 2004 amending Protocols, their liability is limited to €700 million per accident.

As regards this cap, two remarks can be made. On the one hand, the liability limit is defined 'per accident' and not 'per reactor'. This implies that whatever the number of reactors an operator runs, he has to cover the same amount of damages. The risk is thus not differentiated. However, an operator who runs fifty-eight nuclear reactors (such as the French operator EDF) might generate a much higher risk than an operator which has only seven reactors (such as the Belgium operator Electrabel NP) (Faure and Skogh, 1992). On the other hand, the current cap is far lower than the cost of a major accident which is estimated at between €10 billion and €100 billion. For example, the Chernobyl accident cost amounted to €40 billion. As a consequence, because of the cap, nuclear operators internalize only a share of their risk costs and the problem of underdeterrence, mentioned above, might appear (Faure and Van den Bergh, 1990; Faure, 1995). Safety regulation aims precisely at palliating this negative effect. Besides, it is much stricter than for other industries. The safety standards are draconian.

As regards channelled liability, nuclear operators are not only always held liable in case of an accident, but they are also solely liable. This principle is called *legal channelling* or *exclusive liability*. It implies that the operator will be held liable even if another partner of the production chain (radioactive wastes carrier, reactor builder. . .) has contributed to the accident. This principle is justified by the fact that it makes pursuance easier for the victims. Indeed, channelling liability on a unique person avoids the multiplication of procedures against several nuclear actors and the possible redundancy or contradiction of their respective conclusions. By identifying a uniquely liable person, channelled liability thus allows the acceleration of judicial procedures and makes payment of compensation faster. In this way, this principle is consistent with the priority of no-fault-based systems, the protection of victims. However, we can also see in channelled liability a disadvantage for victims as far as deterrence is concerned. Indeed, channelling liability on operators might induce underdeterrence for the operators' partners (Faure and Hartlief, 1998; Van den Borre, 1999). What, for example, would be the safety incentives for the radioactive wastes carrier if he is never held liable in case of an accident during transport? According to the Conventions, the nuclear operator of the installation which the convoy has left is designated as liable. To prevent underdeterrence of the nuclear operator's partners and to avoid him bearing the charge of damages caused

by others, nuclear operators must thus drastically control their behaviour. They have several means of doing that. For example, they can include specific liability clauses in their contracts which make partners jointly liable for reparations. As a result, the liability remains legally channelled on operators but is economically cumulative and solidary. In most countries, the nuclear industry is vertically integrated. In those circumstances, the control of each partner should be easier for nuclear operators than in an atomistic market.

As far as compensation is concerned, compulsory insurance is imposed on nuclear operators to guarantee their solvency. Nuclear operators cover their liability cap today mainly by resorting to national insurance pools. As regards the possible gap between the operators' liability limit and the damages of a nuclear accident, the Conventions have implemented two additional risk layers based on public funds: the first additional risk layer is financed by the State where the nuclear accident occurs (up to €500 million) and the second additional risk layer is jointly supported by the contracting countries (up to €300 million). The public financing of compensation is important in the nuclear industry. Above the total amount of compensation (€1,500 million), the Conventions do not specify who has to pay the potential excess damages. We may expect that States would finally pay for these damages in the last resort. These amounts have been enacted by the 2004 amending Protocols, but have not yet entered into force.

14.5.2 Compensation for marine oil pollution accidents

Civil liability in the case of marine oil pollution accidents is also governed by an international Convention. This Convention was drafted under the auspices of the IMO (International Marine Organization) in 1969 and was last revised in 1992. Today, 117 countries are members of this Convention. Like the nuclear liability Conventions, this regime is based on (no-fault) strict liability. The liable person designated by the law is the oil tanker owner.

Again, the tankers owners' liability is strict, limited and channelled. They are always liable independently of their fault or negligence. Their liability is financially limited to between \$7 million and \$136 million per accident. Let us note that, in contrast to nuclear liability Conventions, the liability cap is here differentiated according to the risk generated by each oil tanker owner. Indeed, it is considered that the heavier is the tonnage (the higher the quantity of oil conveyed), the higher is the risk. The differentiation includes three layers: the owner's liability cap amounts to \$7 million for gross tonnage up to 5,000 units, between \$7 million plus \$955 per additional unit for gross tonnage between 5,000 and 140,000 units and to \$136 million for gross tonnage exceeding 140,000 units. Like nuclear operators, oil tanker owners are also bound by legal channelling.

As far as the problem of deterrence is concerned, we encounter the same problems mentioned above. To avoid the underdeterrent effect of the liability cap and channelling, oil tanker owners are also subjected to compulsory insurance. To cover their cap, 95 percent of them co-insure through a pool: the International Group of Protection and Indemnity Clubs (P&I Clubs). In contrast to nuclear insurance pools, this pool is not national but international. It comprises thirteen national P&I Clubs (Faure and Heine, 1991; Wren, 2000; Mason, 2003; Faure and Hu, 2006; Huybrechts and van Damme, 2006; Wang, 2006, 2007).

Moreover, these pools are not insurers' pools but horizontal risk-sharing agreements between tanker owners. The main advantage of this kind of pool consists in the fact that each participant contributes to the pool according to the risk he generates (his tonnage). If an accident occurs over the period, the joint contributions are used to pay compensation. Then, the contributions are re-paid by each participant to reconstitute the capacity of the pool. However, if no accident occurs over the period, the contributions can be taken back by the tanker owners and used for other purposes. This is a major advantage over insurance whereby premiums are lost by policyholders, whether there is an accident or not.

As far as compensation is concerned, it is here again necessary to guarantee the tankers owners' solvency. If the cost of a marine oil pollution accident exceeds the cap, the tanker owner does not have to pay the excess damages. In order to avoid undercompensation, the IMO 1992 Convention planned two additional risk layers to supplement the individual tanker owner's caps. These are financed by two compensation funds: the IOPC 1992 (International Oil Pollution Compensation Fund) and the Supplement IOPC 2003. These funds are intergovernmental organizations run by the IMO. The IOPC 1992 is funded by taxes charged on oil conveyed by sea. This fund increases the compensation amount available up to \$307 million. As regards the IOPC 2003, it is optional and open to every IOPC 1992 member. It is funded similarly and raises the total compensation up to \$1200 million per accident. States play no role in the IOPC's financing. Unlike the two additional nuclear risk layers, these IOPCs are exclusively financed by private funds. IOPC are also coupled with a compensation device established on a voluntary basis. This device relies on two agreements: the STOPIA 2006 (Small Tanker Oil Pollution Indemnification Agreement) for small oil tankers, and the TOPIA 2006 (Tanker Oil Pollution Indemnification Agreement) for the others. These agreements imply that, after an accident, the member designated as liable has to reimburse a share of the amount paid by the IOPCs to compensate the victims. The internalization of the risk costs is thus maximized. Although States do not explicitly finance any risk layers in this no-fault-based scheme, we can

still expect that, if damages exceed the available compensation amounts, they will pay for them in the last resort.

14.6 Conclusions

In the law and economics literature, the debate between no-fault and the tort systems is well known: the negligence system is argued to be highly preventive but insufficiently compensatory, whereas no-fault is considered to be underdeterrent though much more distributive. This chapter has examined this debate. It has shown that neither compensation system was perfect and considered a third system: the strict liability system. There is a very thin line between pure no-fault (which abolishes the tort system altogether) and strict liability, but the latter belongs to the tort system. It is a hybrid scheme whereby tortfeasors' liability is engaged, though it is not based on the notion of fault. Compared to the other compensation systems, it has considerable advantages given that it allows two major priorities to be reconciled. On the one hand, it protects victims in maximizing compensation amounts; on the other hand, it provides incentives to injurers to prevent accidents. Whether it is based on fault or not, any compensation scheme needs important conditions to be efficient. This chapter has shown that combinations with safety regulation, State intervention, financial securities or compulsory insurance are often necessary to guarantee tortfeasors' solvency and incentives to care and maximize compensation. Two examples of compensation systems, based on strict liability, were used to illustrate the argument: nuclear and marine oil pollution schemes.

Finally, the choice of one system instead of another is basically a political choice. No compensation system, taken alone, is a first-best solution. It always has to be combined with other tools amongst a large range of legal and economical instruments offered by the law and economics literature and accumulated from practical experiences.

Bibliography

- Accident Compensation Corporation (1978a), Report, July, New Zealand, New Zealand Accident Compensation Corporation.
- Accident Compensation Corporation (1978b), ACC Report No. 3: Application for Review, New Zealand, New Zealand Accident Compensation Corporation.
- Accident Compensation Corporation (1979), Report, March, New Zealand, New Zealand Accident Compensation Corporation.
- Ashford, Robert H. and William G. Johnson (1982), 'Negligence vs. No-fault Liability: An Analysis of the Workers' Compensation Example', *Seton Hall Law Review*, 12, 725–66.
- Atiyah, Patrick S. (1980), *Accidents, Compensation and the Law*, London: Wiedenfeld and Nicholson, 3rd edition.
- Atiyah, Patrick S. (1993), *Accidents, Compensation and the Law*, London: Weidenfeld and Nicholson, 5th edition.
- Atkins, William P. (1991), 'Standing at the Crossroads: An Empirical Analysis of No-fault Automobile Insurance and its Potential Consequences for Maryland', *Law Forum*, 21, 10–22.

- Barnes, David W. and Lynn A. Stout (1992), *Economic Analysis of Tort Law*, St Paul, MN: West Publishing.
- Berliner B. (1982), *Limits of Insurability of Risks*, Englewood Cliffs, NY: Prentice-Hall.
- Bilandic, Michale (1995), 'Workers' Compensation, Strict Liability, and Contribution in Illinois: a Century of Legal Progress?', *Illinois Bar Journal*, 83, 292–300.
- Born, Patricia H. and W. Kip Viscusi (1998), 'The Distribution of the Insurance Market Effects of Tort Liability Reforms', *Brookings Papers on Economic Activity: Microeconomics*, 55–100.
- Boyer, Marcel and Georges Dionne (1987), 'Description and Analysis of the Quebec Automobile Insurance Plan', *Canadian Public Policy*, 13, 181–95.
- Boyer, Kenneth D., Georges Dionne and Charles Vanasse (1990), *Infractions au Code de la Sécurité Routière, Infractions au Code Criminel, et Gestion Optimale de la Sécurité Routière*, Montréal: Centre de Recherche sur les Transports.
- Boyer, Marcel, Georges Dionne and Charles Vanasse (1991), 'Infractions au Code de la Sécurité Routière, Infractions au Code Criminel et Gestion Optimal de la Sécurité Routière', *L'Actualité Économique*, 67, 279–305.
- Brainard, Calvin H. (1973a), 'The Impact of No-fault on the Underwriting Results of Massachusetts Insurers', *Mississippi Law Journal*, 44, 174–81.
- Brainard, Calvin H. (1973b), 'Massachusetts Loss Experience Under No-fault in 1971: Analysis and Implications', *Journal of Risk and Insurance*, 40 (1), 95–101.
- Brainard, Calvin H. and John F. Fitzgerald (1974), '1st Year Cost Results under No-fault Automobile Insurance: A Comparison of the Florida and Massachusetts Experience', *Journal of Risk and Insurance*, 41 (1), 25–39.
- Brisette S. (2005), 'Reputation Management', *Nuclear Plant Journal*, 23 (3), 24–30.
- Brown, Craig (1979), 'Deterrence and Accident Compensation Schemes', *University of Western Ontario Law Review*, 17, 111–54.
- Brown, Craig (1985), 'Deterrence in Tort and No-fault: The New Zealand Experience', *California Law Review*, 73, 976–1002.
- Brown, Craig (1988), *No-fault Automobile Insurance in Canada*, Toronto: Carswell.
- Brown, Craig (1989), 'A Choice of Choice: Adding Postaccident Choice to the Menu of No-fault Models', *San Diego Law Review*, 26, 1095–108.
- Brown, Craig and Bruce Feldthusen (1988), 'The Osborne Inquiry into Motor Vehicle Accident Compensation in Ontario', *Windsor Yearbook of Access to Justice*, 8, 318–29.
- Bruce, Christopher J. (1984), 'The Deterrent Effects of Automobile Insurance and Tort Law: A Survey of the Empirical Literature', *Law and Policy*, 6, 67–100.
- Bruce, Christopher J. and F.J. Atkins (1993), 'Efficiency Effects of Premium Setting Regimes under Workers' Compensation: Canada and the United States', *Journal of Labor Economics*, 11, 38–69.
- Burt, Glynnis (1991), 'Creating Incentives to Market Mifepristone: No-fault Insurance for Drug-caused Birth Defects', *University of Toronto Faculty of Law Review*, 49 (2), 1–41.
- Calabresi, Guido (1977), *The Costs of Accidents: A Legal and Economic Analysis*, New Haven, CT: Yale University Press, 5th edition.
- Calabresi, Guido and K.S. Klevorick (1985), 'Four Tests for Liability in Tort', *Journal of Legal Studies*, 14, 585–627.
- Caldwell, Daniel D. (1977), 'No-fault Automobile Insurance: An Evaluative Survey', *Rutgers Law Review*, 30, 909–90.
- Caminiti, Donald A. (1995a), 'No Fault: To Be or Not to Be?', *New Jersey Lawyer*, 166, 24–5.
- Caminiti, Donald A. (1995b), 'The Automobile Insurance Fiasco: "No-fault Is At Fault"', *New Jersey Lawyer*, 166, 25–6.
- Carr, Jack L. (1989), 'Giving Motorists a Choice between Fault and No-fault Insurance: An Economic Critique', *San Diego Law Review*, 26, 1087–94.
- Carroll, Stephen J. and Allan F. Abrahamse (1996), *The Effects of a Proposed No-fault Plan on the Costs of Auto Insurance in California*, Santa Monica, CA: Institute for Civil Justice, Rand Corporation.

- Carroll, Stephen J. and James S. Kakalik (1991a), *No-fault Automobile Insurance: A Policy Perspective*, Santa Monica, CA: Institute for Civil Justice, Rand Corporation.
- Carroll, Stephen J. and James S. Kakalik (1991b), *No-fault Approaches to Compensating People Injured in Automobile Accidents*, Santa Monica, CA: Institute for Civil Justice, Rand Corporation.
- Carroll, Stephen J. and James S. Kakalik (1993), 'No-fault Approaches to Compensating Auto Accident Victims', *Journal of Risk and Insurance*, 60 (2), 265–87.
- Chapman, Bruce and Michael J. Trebilcock (1992), 'Making Hard Choices: Lessons from the Automobile Accident Compensation Debate', *Rutgers Law Review*, 44, 797–869.
- Chelius, James R. (1976), 'Liability for Industrial Accidents: A Comparison of Negligence and Strict Liability Systems', *Journal of Legal Studies*, 5, 293–309.
- Chelius, James R. (1990), 'Disaster Awaits: Workers' Compensation Liens vs. No-fault First Party Benefits', *New York State Bar Journal*, 62 (8), 22–6.
- Coase, Ronald (1960), 'The Problem of Social Cost', *Journal of Law and Economics*, 3, 1–44.
- Cohen, Alma and Rajeev Dehejia (2004), 'The Effect of Automobile Insurance and Accident Liability Laws on Traffic Fatalities', *Journal of Law and Economics*, 47, 357–93.
- Courbage C. and P.M. Liedtke (2003), 'On Insurability, its Limits and Extensions', *Journal of Insurance Research and Practice*, 18 (2), 44–9.
- Croley, Steven P. and Jon D. Hanson (1991), 'What Liability Crisis? An Alternative Explanation for Recent Events in Product Liability', *Yale Journal on Regulation*, 8, 1–111.
- Cummins, J. David, Richard D. Phillips and Mary A. Weiss (2001), 'The Incentive Effects of No-fault Automobile Insurance', *Journal of Law and Economics*, 44, 427–64.
- Cummins, J. David and Mary A. Weiss (1993), 'The Stochastic Dominance of No-fault Automobile Insurance', *Journal of Risk and Insurance*, 60 (2), 230–64.
- Danzon, Patricia M. (1985), *Medical Malpractice: Theory, Evidence and Public Policy*, Cambridge, MA: Harvard University Press.
- Danzon, Patricia M. (2000), 'Liability for Medical Malpractice', in Anthony J. Culyer and Joseph P. Newhouse (eds), *Handbook of Health Economics*, Amsterdam: North-Holland, vol. 1B, pp. 1339–404.
- Demsetz, H. (1969), 'Issues in Automobile Accidents and Reparations from the Viewpoint of Economics', in C. Gregory and H. Kalven (eds), *Cases and Materials on Torts*, 2nd edition, Boston: Little Brown, pp. 870–75.
- Derrig, Richard A., Herbert I. Weisberg and Xiu Chen (1994), 'Behavioral Factors and Lotteries under No-fault with a Monetary Threshold: A Study of Massachusetts Automobile Claims', *Journal of Risk and Insurance*, 61 (2), 245–75.
- Devlin, Rose Anne (1990), 'Some Welfare Implications of No-fault Automobile Insurance', *International Review of Law and Economics*, 10, 193–205.
- Devlin, Rose Anne (1992), 'Liability versus No-fault Automobile Insurance Regimes: An Analysis of the Experience of Quebec', in Georges Dionne (ed.), *Contributions to Insurance Economics*, Norwell MA: Kluwer Academic Publishers, pp. 499–520.
- Devlin, Rose Anne (1999), 'No-fault Automobile Insurance and Accident Severity: Lessons Still to be Learned', in Georges Dionne and Claire Laberge-Nadeau (eds), *Automobile Insurance: Road Safety, New Drivers, Risks, Insurance Fraud and Regulation*, Norwell, MA: Kluwer Academic Publishers, pp. 267–82.
- Deweese, Donald N., David Duff and Michael J. Trebilcock (1996), *Exploring the Domain of Accident Law*, Oxford: Oxford University Press.
- DOT (US Department of Transportation) (1985), *Compensating Auto Accident Victims: A Follow-up Report on No-fault Auto Insurance Experiences*, Washington, DC: US Government Printing Office.
- Epstein, Richard A. (1973), 'A Theory of Strict Liability', *Journal of Legal Studies*, 2, 151–221.
- Epstein, Richard A. (1976), 'Medical Malpractice: The Case for Contract', *American Bar Foundation Research Journal*, 1 (1), 87–150.

- Epstein, Richard A. (1978), 'Medical Malpractice: Its Cause and Cure', in S. Rottenberg (ed.), *The Economics of Medical Malpractice*, Washington, DC: American Enterprise Institute for Public Policy Research.
- Epstein, Richard A. (1980), *A Theory of Strict Liability: Toward a Reformulation of Tort Law*, San Francisco, CA: Cato Institute.
- Epstein, Richard A. (1986), 'Medical Malpractice, Imperfect Information, and the Contractual Foundation for Medical Services', *Law and Contemporary Problems*, 49, 201–12.
- Epstein, Richard A. (1996), 'Catastrophic Responses to Catastrophic Risks', *The Journal of Risk and Uncertainty*, 12, 287–308.
- Faure, M.G. (1995), 'Economic Models of Compensation for Damage caused by Nuclear Accidents: Some Lessons Learned from the Revision of the Paris and Vienna Conventions', *European Journal of Law and Economics*, 2 (1), 21–43.
- Faure, M.G. (1999), 'Financial Caps as Remedy in Case of Major Industrial Accidents?', in P. Andersen and T. Nissen (eds), *Liability, Economics and Insurance*, Odense: Son Publication, Vol. 32, 1–31.
- Faure M.G. (2004), 'Alternative Compensation Mechanisms as Remedies for Uninsurability of Liability', *The Geneva Papers on Risk and Insurance Theory*, 29 (3), 455–89.
- Faure, M.G. (2007), 'Financial Compensation for Victims of Catastrophes: A Law & Economics Perspective', *Law and Policy*, 29 (3), 339–66.
- Faure M.G. and P. Fenn (1999), 'Retroactive Liability and the Insurability of Long-tail Risks', *International Review of Law and Economics*, 19, 487–500.
- Faure, M.G. and T. Hartlief (1998), 'Remedies for Expanding Liability', *Oxford Journal of Legal Studies*, 8, 681–706.
- Faure, M.G. and G. Heine (1991), 'The Insurance of Fines: The Case of Oil Pollution', *The Geneva Papers on Risk and Insurance*, 58, 39–58.
- Faure M.G. and J. Hu (eds) (2006), *Prevention and Compensation of Marine Pollution Damage: Recent Developments in Europe, China and the US*, the Netherlands: Kluwer Law International.
- Faure, M.G. and G. Skogh (1992), 'Compensation for Damages Caused by Nuclear Accidents: A Convention as Insurance', *The Geneva Papers on Risk and Insurance*, 17 (65), 499–513.
- Faure, M.G. and R. Van den Bergh (1990), 'Liability for Nuclear Accidents in Belgium from an Interest Group Perspective', *International Review of Law and Economics*, 10, 241–54.
- Fleming, J. (1967), 'The Role of Negligence in Modern Tort Law', *Virginia Law Review*, 52, 815–46.
- Franklin, Marc A. (1967), 'Replacing the Negligence Lottery: Compensation and Selective Reimbursement', *Virginia Law Review*, 53, 774–814.
- Gaudry, Marc (1992), 'Measuring the Effects of the No-fault 1978 Quebec Automobile Insurance Act with the DRAG model', in Georges Dionne (ed.), *Contributions to Insurance Economics*, Norwell, MA: Kluwer Academic Publishers, pp. 471–98.
- Gaudry, Marc, François Fournier and Robert Simard (1995), *DRAG-2, un Modèle Économétrique Appliqué au Kilométrage, aux Accidents et à leur Gravité au Québec – Synthèse des résultats (DRAG-2, An Econometric Model Applied to Mileage and to Accidents and their Seriousness in Quebec – Summary of Results)*, Québec: Société de l'assurance automobile du Québec.
- Grabowski, Henry, W. Kip Viscusi and William Evans (1989), 'Price and Availability Tradeoffs of Automobile Insurance Regulation', *Journal of Risk and Insurance*, 56, 275–99.
- Hensler, Deborah R., M. Susan Marquis, Allan F. Abrahamse, Sandra H. Berry, Patricia A. Ebener et al. (1991), *Compensation for Accidental Injuries in the United States*, Santa Monica, CA: Institute for Civil Justice, Rand Corporation.
- Hersch, Joni and W. Kip Viscusi (2007), 'Tort Liability Litigation Costs for Commercial Claims', *American Law and Economics Review*, 9, 330–69.
- Huybrechts, M.A. and K.N. van Damme (2006), 'Protection of the Marine Environment under Belgian Law', in M.G. Faure and J. Hu (eds), *Prevention and Compensation*

- of *Marine Pollution Damage: Recent Developments in Europe, China and the US*, the Netherlands: Kluwer Law International, pp. 119–35.
- Kabler, Brent (1999), 'The Case Against Auto Choice', *Journal of Insurance Regulation*, 18, 53–79.
- Kakalik, James S. and Nicholas M. Pace (1986), *Costs and Compensation Paid in Tort Litigation*, Santa Monica, CA: Institute for Civil Justice, Rand Corporation.
- Keeton, R. and Jeffrey O'Connell (1965), *Basic Protection for the Traffic Accident Victim: A Blueprint for Reforming Automobile Insurance*, Boston, MA: Little Brown.
- Keeton, R. and Jeffrey O'Connell (1971), 'Alternative Paths toward Nonfault Automobile Insurance', *Columbia Law Review*, 71, 241–66.
- Kochanowski, Paul S. and Madelyn V. Young (1985), 'Deterrent Aspects of No Fault Automobile Insurance: Some Empirical Findings', *Journal of Risk and Insurance*, 52, 269–88.
- Landes, Elisabeth M. (1982a), 'Insurance, Liability, and Accidents: A Theoretical and Empirical Investigation of the Effect of No-fault Accidents', *Journal of Law and Economics*, 25, 49–65.
- Landes, Elisabeth M. (1982b), 'Compensation for Automobile Accident Injuries: Is the Tort System Fair?', *Journal of Legal Studies*, 11, 253–9.
- Laurent C. (2005), 'La Réputation: un actif non spéculatif des entreprises du CAC 40', *La Revue Parlementaire*, 879, Paris: Presse Parlementaire.
- Loughran, David S. (2001), 'The Effect of No-fault Automobile Insurance on Driver Behavior and Automobile Accidents in the United States', in Edward L. Lascher Jr. and Michael R. Powers (eds), *The Economics and Politics of Choice No-fault Insurance*, Norwell, MA: Kluwer Academic Publishers, pp. 95–138.
- Mason M. (2003), 'Civil Liability for Oil Pollution Damage: Examining the Evolving Scope for Environmental Compensation in the International Regime', *Marine Policy*, 27 (1), 1–12.
- McEwin, R. Ian (1989), 'No-fault and Road Accidents: Some Australasian Evidence', *International Review of Law and Economics*, 9, 13–24.
- McEwin, Ian R. (2000), 'No-fault Compensation systems', *Encyclopedia of Law and Economics*, Cheltenham, UK and Northampton, MA, USA: Edward Elgar, pp. 735–63.
- Medoff, Marshall H. and Joseph P. Magaddino (1982), 'An Empirical Analysis of No-fault Insurance', *Evaluation Review*, 6 (3), 373–92.
- O'Connell, Jeffrey (1975), 'No-fault Insurance for all Accidents', *Osgoode Hall Law Journal*, 13, 461–9.
- Palmer, G. (1979), *Compensation for Incapacity*, Oxford: Oxford University Press.
- Posner Richard A. (1975), 'A Comment on "No-fault Insurance for all Accidents"', *Osgoode Hall Law Journal*, 13, 471–4.
- Priest, George L. (1989), *The Insurance Antitrust Suits and the Public Understandings of Insurance*, Yale Law School Program in Civil Liability: Center for Studies in Law, Economics and Public Policy.
- Priest, George L. (1996) 'The Government, the Market and the Problem of Catastrophic Loss', *Journal of Risk and Uncertainty*, 12, 219–37.
- Rolph, John E., James K. Hammitt and Robert L. Houchens (1985), *Automobile Accident Compensation, Volume I: Who Pays How Much How Soon?*, Santa Monica, CA: Institute for Civil Justice, Rand Corporation.
- Schwartz, Gary T. (1985), 'Foreword: Tort Scholarship', *California Law Review*, 73, 548–54.
- Schwartz, Victor E. and L. Mahshigian (1987), 'National Childhood Vaccine Injury Act of 1986: An Ad Hoc Remedy or a Window for the Future?', *Ohio State Law Journal*, 48, 387.
- Shavell, S. (1984a), 'Liability for Harm versus Regulation of Safety', *Journal of Legal Studies*, 13 (2), 357–74.
- Shavell S. (1984b), 'A Model of the Optimal Use of Liability and Safety Regulation', *RAND Journal of Economics, The RAND Corporation*, 15 (2), 271–80.

- Shavell S. (1986a), 'Uncertainty over Causation and the Determination of Civil Liability', *Journal of Law and Economics*, University of Chicago Press, 28 (3), 587–609.
- Shavell, S. (1986b), 'The Judgement Proof Problem', *International Review of Law and Economics*, 43–58.
- Shavell, S. (1987), *Economic Analysis of Accident Law*, Cambridge, MA: Harvard University Press.
- Skogh G. (1998), 'Development Risks, Strict Liability and the Insurability of Industrial Hazards', *The Geneva Papers on Risk and Insurance, Issues and Practice*, 23 (87), 247–65.
- Sloan, Frank A., Bridget A. Reilly and Christoph M. Schenzler (1994), 'Tort Liability versus other Approaches to Deterring Careless Driving', *International Review of Law and Economics*, 14, 53–71.
- Studdert, David M., Michelle M. Mello, Atul A. Gawande, Tejal K. Gandhi, Allen Kachalia, Catherine Yoon, Ann Louise Puopolo and Troyen A. Brennan (2006), 'Claims, Errors, and Compensation Payments in Medical Malpractice Litigation', *New England Journal of Medicine*, 354, 2024–33.
- Studdert, David M., Michelle M. Mello and Troyen A. Brennan (2004), 'Medical Malpractice', *New England Journal of Medicine*, 350, 283–92.
- Swan, Peter L. (1984), 'The Economics of Law: Economic Imperialism in Negligence Law, No-fault Insurance, Occupational Licensing and Criminology?', *Australian Economic Review*, 0 (67), 92–108.
- Thorpe, Kenneth E. (2004), 'The Medical Malpractice "Crisis": Recent Trends and the Impact of State Tort Reforms', *W4 Health Affairs – Web Exclusive*, 20–30.
- Trebilcock, Michael J. (1989), 'Incentive Issues in the Design of "No-fault" Compensation Systems', *University of Toronto Law Journal*, 39, 19–54.
- Tunc A. (1981), *Pour une loi sur les Accidents de la Circulation*, Paris: Economica.
- Van den Borre, T. (1999), 'Channelling of Liability: A Few Juridical and Economic Views on an Inadequate Legal Construction', in N.L.J.T. Horbach (ed.), *Contemporary Developments in Nuclear Energy Law. Harmonising Legislation in CEEC/NIS*, Boston: Kluwer Law International, 13–39.
- Viscusi, W. Kip and Patricia H. Born (2005), 'Damages Caps, Insurability, and the Performance of Medical Malpractice Insurance', *Journal of Risk and Insurance*, 72, 23–43.
- Wang, H. (2006), 'Recent Developments in the EU Marine Oil Pollution Regime', in M.G. Faure and J. Hu (eds), *Prevention and Compensation of Marine Pollution Damage: Recent Developments in Europe, China and the US*, the Netherlands: Kluwer Law International, pp. 1–24.
- Wang, H. (2007), 'Shifts in Governance in the International Regime of Marine Oil Pollution Compensation', in M. Faure and A. Verheij, *Shifts in Compensation for Environmental Damage*, 21, Vienna: Springer, pp. 197–241.
- Wren J. (2000), 'Overview of the Compensation and Liability Regimes under the International Oil Pollution Compensation Fund (IOPC)', *Spill Science & Technology Bulletin*, 6 (1), 45–58.
- Zador, Paul L. and Adrian Lund (1986), 'Re Analyses of the Effects of No-fault Auto Insurance on Fatal Crashes', *Journal of Risk and Insurance*, 53 (2), 226–41.
- Zuckerman, S., R. Bovbjerg and F.A. Sloan (1990), 'Effects of Tort Reforms and Other Factors on Medical Malpractice Insurance Premiums', *Inquiry*, 27, 167–82.

PART VI

OTHER PERSPECTIVES ON TORT LAW

15 Harmonizing tort law: a comparative tort law and economics analysis

*Willem H. van Boom**

15.1 Introduction

Differences between tort law systems can be analysed from different perspectives. Take, for instance, liability for pure economic loss, which is prototypical of an ongoing debate among comparative tort law scholars. Tort law systems in Europe diverge considerably in their dogmatic approach to such cases, regarding both the extent to which such claims are acknowledged at all and the legal reasoning used in doing so. In common law systems, the so-called ‘exclusionary rule’ is predominant. Germanic legal systems are hostile to claims for pure economic loss, but do acknowledge certain categories in which protection is offered. Contrastingly, the franco-legal systems tend to be more receptive to claims for pure economic loss as such. There are historical, dogmatic and technical legal explanations for the differences in treatment of pure economic loss and indeed differences between tort law systems as a whole. These explanations have been reported extensively in legal literature and they go a long way to explaining differences between the main families of tort law in Europe.

By contrast, comparative law and economics offers both a positive and normative economic analysis of these differences between tort law systems. (Faure, 2003, pp. 33–4). For example, in the area of pure economic loss see the comparative economic analysis of pure economic loss by Francesco Parisi (2003; Parisi, Palmer and Bussani, 2007). Concerning pure economic loss, scholars have put forward several economic justifications for upholding the ‘exclusionary rule’. Others have argued that under specific circumstances there are good reasons for allowing claims for pure economic loss. This illustrates that both comparative law and law and economics have much to gain from mutual exchange of insights and ideas. (On this topic see, for example, Bishop, 1982a, 1982b; Rizzo, 1982; Bishop, 1986; Gilead, 1997; Gómez and Ruiz, 2004; Dari-Mattiacci and Schäfer, 2007).

* Professor of Private Law, Rotterdam Institute of Private Law, Erasmus University Rotterdam. See www.professorvanboom.eu for a full profile.

The positive comparative law and economics analysis usually focuses on the central idea that differences between tort law systems are the result of differing values and preferences in domestic politics, legislation and courts (Faure, 2008, p. 40). Systems may thus spontaneously develop in converging or diverging directions. On the economics of convergence see, for example, the game-theoretical analysis of convergence by Arnald J. Kanning (2003, pp. 12 ff). The topic of convergence is closely related to the economic analysis of 'legal transplants'. (See, for example, Mattei et al., 2000, pp. 509 ff; Fedtke, 2006; Mattei, 1997, pp. 101 ff, 434 ff; Ogus, 1999, p. 409; Kerkmeester and Visscher, 2003, pp. 5 ff. On methods of convergence see, for example, Smits, 2006, pp. 66–7).

A comparative analysis also allows us to test legal regimes for effectiveness and to perform cost-benefit analysis on the various alternative tort systems. Such comparative analysis may show that the reduction in tertiary accident costs of hospital injuries in legal systems adhering to a no-fault compensation scheme is superior to legal systems that use fault-based tortious liability in such cases. See, for example, the comparative legal and economic analysis by Rui Cascão and Ruud Hendrickx (2007).

Moreover, comparative law and economics may show that although the legal reasoning and historical roots of specific items within tort law systems vary, the ultimate rationales may be identical. Compare the distinction between 'working rules' and 'legal formants' by Mattei et al., (2000, p. 507; Mattei, 1997, pp. 69 ff), or between real and superficial differences by A. Ogus (1999, p. 405). In this respect, for instance, both strict liability and fault-based liability with a rebuttable presumption of fault may serve exactly the same goals although the legal foundations are not identical (Faure, 2003, p. 60). As far as the normative comparative analysis is concerned, such efforts are usually set against the background of the Calabresi framework. The seminal contribution is that of Guido Calabresi (1970). (Cooter and Ulen, 2008, pp. 336 ff. For Europe, see, for example, Schäfer and Ott, 2004, pp. 113 ff).

15.2 Tort law as domestic preference

Comparative economic analysis would start with the assumption that differences in law stem from differences in domestic preferences. From an economic perspective, such differences in law are not to be deplored if they originate from differences in preferences. They may even contribute to competition between legal systems in providing the best legal order to their citizens (Faure, 2003, p. 78).

Normative economic analysis, however, may be sceptical of certain domestic preferences, for instance because these preferences promote the use of tort law as an instrument of wealth distribution or because these

preferences set inefficiently high levels of care standards. See generally Gerhard Wagner (2005a, p. 1300). See also Richard Craswell (1991); Duncan Kennedy (1982).

Regarding the development of legal systems, it has been pointed out that spontaneous convergence of legal systems is more likely to occur in those areas of the law that are designed primarily to facilitate trade. In more interventionist areas of the law – including tort law – such spontaneous convergence is said to be less likely to occur because strong divergence in domestic preferences regarding the level of protection is likely to occur (Ogus, 1999, p. 418).

Indeed, if tort law is first and foremost a system for setting the preferred level of reduction of accident costs, then the operation of tort law very much depends on domestic risk appetite and perception. For instance, it has been argued that the fact that the UK does not have strict liability for motor vehicle accidents and France does, should be explained by reference to differing domestic preferences regarding reduction of accident (occurrence and) costs (Ogus, 1999, p. 414; Hartlief, 2002, p. 226). Regarding accident cost, it is therefore sometimes said that some tort law systems focus more on prevention of accidents and others are primarily concerned with reducing secondary and tertiary accident costs (Magnus, 2002, pp. 214–15). Note that domestic preferences regarding tort law are not only to be found in the choice of the level of reduction but also in the position on moral and socio-economic issues such as, for example, whether to allow claims for wrongful life and whether fundamental democratic rights such as freedom of speech are to be protected with tort law.

As mentioned, differences between tort law systems may stem from different risk appetites, for instance as a result of different valuations of human life and of the societal value of activities causing accident risks. Risk perception may vary as well. Differences in risk perception may result in inefficient standards of conduct under negligence rules. There is some evidence of imprecise risk assessment by courts under the influence of cognitive distortions in judicial probability judgement (see, for example, Vertinsky and Wehrung, 1991; Slovic, 2001; Viscusi, 1992, 1998; Baron, 2000; Sunstein, 2000a; Wilson and Crouch, 2001; Sunstein, 2000b; Rachlinski, 1998).

Although this may naturally be considered to be the error cost of a negligence rule, it cannot be ruled out that similar distortions emerge when domestic legislatures decide to introduce certain liability regimes. Introduction of strict liability for a specific ultra-hazardous activity in a given country in response to a salient disaster may thus be the result of a legislative availability bias rather than a balanced risk assessment.

A case in point concerns liability for inherently dangerous activities. It

poignantly shows how legal systems can arrive at different tort law solutions to the same problem. Such differences in the treatment of inherently dangerous activities may signal differences in domestic risk appetite, but may also be caused by variation in risk perception. Moreover, such differences may also be explained by the bounded ability to assess risks in the first place. Note that this also demonstrates the limits of true harmonization of liability for inherently dangerous activities. Comparative analysis of liability for inherently dangerous activities demonstrates that certain risks are not ever present in all countries, which may justify differences in tort law regimes and may explain different risk appetites. Moreover, it also illustrates that one court may find a certain activity to be dangerous and another court may not. Consider, for example, the 'general clause' of liability for dangerous activities in Portuguese and Italian legal systems. The list of activities that were and were not considered dangerous under these legal systems seems rather unbalanced (see further van Boom, 2008).

15.3 Domestic preferences and the market for tort law systems

Concerning the market for tort law systems, it seems that theoretically speaking there are two markets. First, there is the market where potential tortfeasor and victim operate. As a rule, given prohibitive transaction costs it is impossible for potential victims and tortfeasors agreeing on the applicable tort law system. The prohibitive transaction costs are usually put forward as the justification for state intervention and the promulgation of tort law as a set of default or compulsory rules (see, for example, Calabresi and Melamed, 1972; Kaplow and Shavell, 1996; Shavell, 2004, pp. 83 ff).

Given that states design their own tort law systems, there can be a market of tort law systems in the sense that potential tortfeasors may choose to move their activities to another jurisdiction where the tort system is more favourable. One of the preconditions for such rational calculation is that it is predictable which tort law system applies to accident-causing behaviour. In Europe, this is indeed highly predictable because the Rome II Regulation (EC Regulation 864/2007) as a rule refers to the law of the country in which the damage occurs. So, if, for instance obstetricians in state A are subject to strict liability for brain damage in neonatal and as a result the liability insurance premiums in state A are excessive, they may choose to migrate to state B where a less burdensome liability system is in operation and insurance premiums are lower. In American literature, there is some empirical evidence to this effect. See, with further nuances, W.H. van Boom and Andrea Pinna (2007).

Note that central to the theoretical analysis of the market for tort law is the assumption that (1) citizens have perfect information on alternative legal systems, (2) entrance and exit costs are low (zero transaction costs),

(3) there are no conflicting or competing aspects in choosing location, and (4) competition between legal systems does not cause negative externalities. Assumptions 1, 2 and 3 may be closer to reality when the analysis is applied to businesses and when entrance and exit are not physical but virtual, as is the case with choice of law in contracts. Such choices are more difficult to make in a tort law setting. Also note that opponents of harmonization of tort law also argue that in reality businesses in Europe are rather indifferent to the details of tort law systems (see, for example, Hartlief, 2002, p. 228). This is a plausible argument but it is unclear how it fits into the comparative economic analysis. If tort law is not a relevant aspect in business decisions, how can there be a proper market for tort law?

The 'second market' for tort law systems concerns society as a whole, where a constituency has to choose (by means of election; Ogus, 1999, p. 407) between alternatives for a preferred tort law system. If country A acknowledges claims for wrongful birth and country B does not, this may be explained in terms of diverging domestic preferences. The reasoning here is that if the laws of country A have been selected through a democratic voting process, majority rule will express the majority preference. In comparative law and economics, reference is made here to Tiebout's 1956 paper on optimal provision of public goods (see Tiebout, 1956, pp. 416 ff). By allowing constituencies to vote or to vote with their feet, various legal solutions may compete and communities may thus express their preferences. Legal diversity in this theoretical analysis is thus the outcome of the diverging preferences of communities and the competition between such communities (see, for example, Faure, 2003, pp. 36 ff; Van den Bergh, 2000, pp. 437 ff; Van den Bergh, 1994, pp. 339 ff).

In our example, harmonizing the laws of countries A and B would run counter to the preferences of at least one of the countries involved and would thus not maximize overall welfare. Unsurprisingly, comparative economic analysis is said to favour decentralized rather than centralized (federalized) rulemaking and to discourage harmonization of tort law as a rule (Wagner, 2005a, p. 1271). The implicit assumption in such reasoning is that if, for example, the European Union were to harmonize tort law, this would run counter to the preferences of some of the countries involved whereas the assumption of Brussels diplomats is naturally quite the opposite.

15.4 Differences in European tort law systems and the harmonization of tort law

15.4.1 General

On comparative economic analysis in view of harmonization of European private law systems, see, for example, Michael G. Faure (2000, pp. 467

ff, 2003, pp. 31 ff.); Gerhard Wagner (2005b, pp. 3 ff.); Gerhard Wagner (2005a, pp. 1269 ff.); Roger Van den Bergh and Louis Visscher (2006, pp. 514 ff); Jan Smits (2006, pp. 67 ff). See Roger Van den Bergh (2000, p. 463), for an economic step-by-step checklist for harmonization in general.

15.4.2 *Economic analysis in the harmonization debate*

Economic analysis has definitely entered the arena of the harmonization debate. The Draft Common Frame of Reference (DCFR 2008) seems to take a principled approach: ‘All areas of the law covered by the DCFR have the double aim of promoting general welfare by strengthening market forces and at the same time allowing individuals to increase their economic wealth. In many cases the DCFR is simply setting out rules that reflect an efficient solution. . . . Many rules of the law on non-contractual liability for damage and even of unjustified enrichment law and the law on benevolent intervention in another’s affairs can be explained on the same basis; in any event, they should be efficient. The rules in the DCFR are in general intended to be such as will promote economic welfare; and this is a criterion against which any legislative intervention should be checked’ (p. 16). At the same time, however, it is argued that ‘Private law must also demand a minimum of solidarity among the members of society and allow for altruistic and social activities’.

In fact, the approach taken by the DCFR 2008 is not easily reconciled with mainstream comparative law and economics. Contrary to what the DCFR seems to suggest, law and economics would consider the efficiency paradigm to be a starting point for rejection of harmonization of European private law. Moreover, normative economic analysis may be sceptical of the idea of tort law as an instrument of wealth redistribution rather than as an instrument for optimal reduction of accident costs (see Wagner, 2005a, p. 1300. Cf. Craswell, 1991; Kennedy, 1982).

Economic analysis can give some guidance to the decision-making process concerning harmonization of tort law in Europe. It cannot give straightforward answers, as Faure (2003, p. 35) rightly observes, but it does allow balanced criteria to be advanced for identifying those areas and topics that are good candidates for harmonization. Following a similar path, W.H. van Boom (2008, pp. 131 ff) identifies some of those areas. Undeniably, in practice, at the end of the day the only practically and politically relevant question is whether there is both a perceived *need* and a *political will* for harmonizing tort law in Europe. Political will is even more relevant in light of the obstacle of the possibly absent competence of the EU to harmonize tort law anyway. On the issue of competence see, for example, Magnus (2002, pp. 208 ff).

Generally speaking, in legal doctrine the aims of tort law are considered to be the protection of interests – life, property, economic interests to some extent – against wrongs, whereas contract law aims at facilitating the exchange of goods and services. Differences between jurisdictions in contract law may merely amount to superfluous transaction costs rather than well-contemplated diverging national preferences.

The rationale for harmonization of contract law therefore does not appear to be equally forceful in the case of tort law. Moreover, tort law as it stands in Europe today seems to play such a relatively minor role in the decision-making of both businesses and consumers that it seems unlikely that differences in tort law would distort any economic level playing field. Admittedly, this might well be because on a more abstract level, tort law systems in Europe are rather similar. By and large, all these systems offer compensation in certain cases of death and personal injury; they all protect property rights and they all tend to be reluctant to allow unbridled claims for pure economic loss. In a similar vein, see Magnus (2002, pp. 206 ff). Admittedly, pure economic loss as such is treated very dissimilarly in Europe (see *supra*), but even the legal systems most favourable to claims for pure economic loss (for example, France) limit the extent of such claims with other instruments (for example, proof of damage, calculation of damage, causation). So, differences between legal systems may sometimes be more superficial than real (Ogus, 1999, p. 409). Standardization of legal terminology could help distinguish real from superficial differences, as Roger Van den Bergh (2000, p. 443) rightly observes.

By and large, tort law systems in Europe have much in common: they invariably tend to be less than fully predictable in outcome, expensive in operation, damned by business and cherished by the legal profession. So, even in this respect, European tort law systems may have more in common than comparative analysis at first blush suggests. Obviously, there are major differences between the legal systems at a concrete level. Causation, heads of damage, standard of care, the position of children in tort law, strict liabilities, they all tend to differ from country to country. See, for example, Gerhard Wagner (2005a, p. 1281) and also Jaap Spier and Olav A. Haazen (1999, p. 474; ‘The legal systems of Europe have much in common, but the differences should not be underestimated’). On a more abstract level and from a societal point of view, however, tort law systems in Europe seem to be rather similar in operation and relatively unimportant to business. As a result, pressure groups advancing the harmonization of tort law as a body of law seem to be absent. This might have been different if there were stark contrasts between the various tort law systems in Europe and if this affected private interests considerably. Imagine, for instance, that member state A in Europe adhered to a system of US-style class action complete

with contingency fees and severe punitive damage in case of corporate wrongdoing. Then there might be a stronger political call for convergence, either for that particular member state to conform to others, or vice versa. Businesses (at least those exposed to the liability regime in member state A) would surely favour ironing out the extravagancies of this exotic system, and lawyers would undoubtedly take an opposing view since such an exotic system serves the bar's private interests best. In such an economic force field, tort law harmonization would be a more political issue. In reality, there is hardly any such force field in European tort law.

Indeed, harmonization of the general part of tort law in the EU is considered by some to be politically superfluous. The common market will not stop functioning properly if torts are not harmonized (nor does it currently dysfunction without a uniform contract law; cf. Jan Smits, 2006, pp. 68–9). For criticism of the feasibility of pan-European harmonized tort law, see, for example, Stathis Banakas (2002, pp. 365 ff) and M. Faure (2003). Faure (*ibid.*, pp. 63 ff) clearly demonstrates that the costs of harmonizing tort law (for example, the cost of legal change at the cost of ignoring local preferences) have to be weighed against the benefits (market integration, quality setting).

Having said that, there can be parts of tort law that might 'need' harmonization from an EU *policy* perspective. Analysing EU policy and following a step-by-step approach, I have argued elsewhere that some areas of tort law are more likely than others to be subject to political efforts of EU harmonization. Among likely candidates for harmonization I have identified (on a decreasing scale of likelihood): economic torts, manufacturer's duty of care, cross-border tourist safety and motor vehicle accidents (see van Boom, 2008).

15.4.3 Tort law an obstacle for the mobility of persons and goods?

In the academic discussion on European harmonization of private law, the proponents of harmonization of tort law argue that a pan-European system of tort law would serve the goals of equal treatment of wrongs and rights and equal protection of, for example, business interests in Europe (level playing field, ironing out alleged 'economic distortions'). Magnus (2002, pp. 206 ff) advances the argument that the diversity of European tort law systems inhibits free mobility of persons and goods as the risk of tortious liability and the amounts of compensation vary. Roger Van den Bergh and Louis Visscher (2006, p. 514) argue that there is no empirical evidence that tort law poses such obstacles.

Likewise, Hartlief (2002, p. 228) counters the arguments put forward by Magnus with roughly the following reasoning. First, there is no empirical evidence that ingenious tort law design can constitute a comparative

advantage for domestic legislatures with which they can seduce businesses into settling in their jurisdiction. Secondly, businesses' exposure to liability will depend on the law of the market where they sell their products. Finally, it is not the differences in tort law but the differences in product safety regulation that may constitute substantial trade barriers.

On the argument of distortion, see also Geraint G. Howells (2006, pp 69 ff), who notes that differences in tort law can also work the other way round and pose an obstacle for cross-border marketing for manufacturers in state A that want to market their products in state B where the level of consumer protection under tort law is much higher than in state A.

Furthermore, Hartlief (2002, p. 229) contends that there is no need for harmonization of tort law in view of cross-border accidents. Hartlief argues that if a German tourist feels the need to buy additional accident insurance when travelling to Spain, this need actually bears witness to the fact that the Spanish people prefer lower levels of liability than the Germans do. European harmonization of the level of protection and compensation offered by liability law would amount to paternalism. Moreover, as the level of compensation reflects domestic standards of living, harmonizing compensation as such would consequently amount to wealth redistribution. Finally, if cross-border accidents are to be settled according to a European harmonized level, there is still no reason why this should also entail harmonizing purely domestic accidents. Faure (2003, pp. 52 ff) analyses the arguments in favour of harmonization of products liability. In the case of products, it is sometimes said that differences in products liability and safety regulation pose barriers to trade and distortions of competition and that legal uniformity may help integrate domestic markets into a common European market. Faure is critical of these arguments, as the current Products Liability Directive does in fact not produce total harmonization, the conditions of competition are never equal, a level playing field ideal is realistically unattainable and indeed detrimental to international trade. Moreover, harmonized tort law is unnecessary for the creation of a common market (Howells, 2006, pp. 71 ff).

15.4.4 Regulatory competition versus culture

Top-down harmonization of tort law on a European Union level stifles competition of legal rules, some argue. Non-intervention at the EU level can thus be justified on the 'regulatory competition' rationale (see, for example, Van den Bergh and Visscher, 2006, p. 517). This approach may favour the current competition between the PETL and the DCFR/PEL, which nicely illustrates that more choice for domestic legislatures between various tort law rules may be superior to no choice (Caterina, 2006, p. 162).

On the other hand, applying the theory of regulatory competition in the field of tort law seems to overestimate the rationality of tort law systems and how they evolve in practice. Rather than a flexible tax on corporate or individual behaviour, which can be raised or lowered periodically in order to adjust to market circumstances, tort law is perceived by many to be a (court-operated) system reflecting socio-legal and cultural preferences which does not easily adjust to changing demand in view of a 'legal competition' paradigm. I would not go as far as Jan Smits (2006, p. 85), who argues that (private) law is not primarily the result of conscious choice but of spontaneous development, but as far as tort law is concerned, there is an element of truth in this analysis.

In fact, the debate among legal scholars pro and contra European harmonization of private law usually turns to whether socio-legal and cultural diversity in law can be overcome. A recurring theme in the publications of Legrand is that it cannot (see, for example, Legrand, 1996, pp. 52 ff, 1997, p. 111, 2002, pp. 61 ff). In tort law, there is also reference to domestic legal culture as an expression of national preferences (see, for example, Van den Bergh and Visscher, 2006, p. 516). It should be noted, however, that reference to local legal culture can also be a disguise for local lawyers' efforts to restrain competition and to maintain their position (Ogus, 1999, p. 412).

15.4.5 Cross-border externalities argument

At first sight, it seems plausible that with the issue of cross-border torts there may be good cause for approximation of the tort laws of the countries involved. Note, however, that torts committed in country A causing externalities in country B may be judged according to the tort law system of country B. In Europe, this is exactly the case as a result of the Rome II Regulation (EC Regulation 864/2007) which as a rule leads to application of the law of the country in which the damage occurs. Therefore, domestic law itself may deal adequately with cross-border externalities. For instance, negative externalities caused by a fly-by-night manufacturer of faulty products, who operates from country A and markets his flawed products in country B, can be effectively remedied if (1) tort law in country B is applicable, (2) this tort law system gives an optimal level of deterrent incentives, (3) disadvantaged consumers in country B have optimal access to justice and (4) the verdicts in country B are readily executable on the assets of the manufacturer in country A.

As we can see, the assumptions needed to leave this case of cross-border externalities to domestic legal systems to solve, are manifold. As a result, cross-border externalities in products liability cases can therefore be targeted by various instruments. Harmonization of products liability is the

road that was actually chosen by the EC, but perhaps harmonization of choice of law rules, free exchange of court verdicts, simple procedures for cross-border attachment and execution of assets could have sufficed from a comparative economic analysis point of view (Ogus, 1999, p. 417).

Generally speaking we can say that cross-border externalities are countered by (harmonized) rules of private international law that may be equally effective and less intrusive than harmonized substantive law: by applying the law of the country in which the damage occurs, the tortfeasor in country A is not able to externalize according to the lower standard of care in country A if the tort law of the country where the damage occurs sets a higher level (Van den Bergh, 2000, p. 446).

Moreover, Roger Van den Bergh and Louis Visscher (2006, p. 518) have rightly argued that European harmonization efforts in private law do much more than simply address cross-border externalities. Most Directives in this field apply to both internal cases and cross-border cases alike. Regulating purely internal tort cases cannot be justified under the comparative economic analysis. In legal reasoning, it is not unusual to argue that if cross-border cases are treated in a certain way, the principle that like cases should be treated alike demands that internal tort cases are to be subject to the same regime.

15.4.6 Race to the bottom argument

If the tort regime in country A poses fewer burdens on potential tortfeasors than country B does, potential tortfeasors in country B may either choose to migrate their activities to country A or exert pressure on B's government to lower standards as well. This in turn may lead to convergence of law between jurisdictions. If such convergence is the result of competition between jurisdictions, this in itself may be applauded. However, if convergence leads to a 'race to the bottom', being a state of affairs of suboptimal accident cost reduction, then such convergence may be a questionable outcome. Whether a 'race to the bottom' is a truly realistic scenario depends, however, on a number of factors including whether cost increase can be transferred onto consumers or employees and whether countries have a preference for lowering standards (see Ogus, 1999, pp. 413 ff). Evidence of either a race to the bottom or to the top in (European) tort law is unavailable. See Roger Van den Bergh and Louis Visscher (2006, p. 520; and generally Van den Bergh, 2000, pp. 445 ff; Smits, 2006, p. 77; Faure, 2008, pp. 18 ff).

To counter a real-life 'race to the bottom', European legislative intervention by means of minimum harmonization may then be an appropriate measure countering substandard domestic laws. Such intervention can be assumed to be promoted by those countries that suffer from the race to

the bottom, that is, the jurisdictions with a relatively high level of liability. Businesses in country A that are subject to stricter levels of care and that have to pay more in damages because of the fact that the tort law regime in their country puts a heavier burden on corporate tortfeasors than in country B will be assumed to promote an upward harmonization in order to level the playing field for their exports to country B.

15.4.7 Reduction of (transaction) cost

Differences in private law systems may cause persons and business to incur compliance costs when engaging in cross-border activities. This cost issue is most likely to arise in respect of differences in contract law systems. Drawing up a contract under the laws of country A may require different legal skills than under the laws of country B. This difference constitutes transaction cost in operating any contract law system and there may be good reasons within a common market to reduce such transaction cost. Likewise, differences between tort law systems may impose transaction cost that can be reduced. If the European common market were to have different regimes of tortious liability for unfair commercial advertising, businesses operating in all the countries within this common market would have to adjust their advertising to the tort systems in all the separate countries. Naturally, this imposes costs on business. Reducing these costs by harmonizing tortious liability for unfair advertising may thus be considered – to some extent at least – an efficient reduction of the cost of doing business in Europe. Perhaps this cost reduction is what Recital 2 of the 1984 EC Directive concerning misleading advertising (84/450/EEC) is in fact referring to where it contends that ‘misleading advertising can lead to distortion of competition within the common market’.

So, in the end perhaps reduction of transaction cost is the most convincing justification for initiatives towards harmonization of tort law, as Faure (2008, p. 28) concludes. One should take care, however, not to confuse transaction cost with the cost of domestic preferences. If national legislatures feel strongly about their liability regimes for unfair and misleading advertising, harmonizing this liability imposes costs on these member states. If national legislatures do not feel strongly and in fact the national regimes are very much alike, then harmonization may come at a low cost. It may even (in theory at least) increase the supply of legal services in Europe if knowledge of the law of advertising is no longer a domestic prerogative but a pan-European service.

Moreover, it has been rightly observed that harmonizing (tort) law by using centralized standards that are to be applied by decentralized courts may in fact not harmonize at all (Van den Bergh and Visscher, 2006, p. 521). Furthermore, it must be admitted that minimum harmonization as

such will not completely put an end to legal differences and ensuing transaction costs (Smits, 2006, p. 70; Smits, 2005, pp. 166 ff).

Bibliography

- Banakas, Stathis (2002), 'European Tort Law: Is it Possible?', *European Review of Private Law*, 3, 363–75.
- Baron, Jonathan (2000), *Thinking and deciding*, Cambridge: Cambridge University Press.
- Bishop, W. (1982a), 'Economic Loss in Tort', *Oxford Journal of Legal Studies*, 2, 1–29.
- Bishop, W. (1982b), 'Economic Loss: A Reply to Professor Rizzo', *Oxford Journal of Legal Studies*, 2, 207–10.
- Bishop, W. (1986), 'Economic Loss: Economic Theory and Emerging Doctrine', in M. Furmston (ed.), *The Law of Tort*, London: Duckworth, pp. 73–82.
- Calabresi, Guido (1970), *The Costs of Accidents – A Legal and Economic Analysis*, New Haven and London: Yale University Press.
- Calabresi, Guido and A. Douglas Melamed (1972), 'Property Rules, Liability Rules, and Inalienability: One View of the Cathedral', *Harvard Law Review*, 85, 1089–128.
- Cascão, Rui and Ruud Hendrickx (2007), 'Shifts in the Compensation of Medical Adverse Events', in W.H. van Boom and M.G. Faure (eds), *Shifts in Compensation between Private and Public Systems*, Vienna: Springer, pp. 113–42.
- Caterina, Raffaele (2006), 'Comparative Law and Economics', in J. Smits (ed.), *Elgar Encyclopedia of Comparative Law*, Cheltenham: Edward Elgar, pp. 161–71.
- Cooter, R. and T. Ulen (2008), *Law & Economics*, 5th edition, Boston: Pearson.
- Craswell, Richard (1991), 'Passing on the Costs of Legal Rules: Efficiency and Distribution in Buyer-Seller Relationships', *Stanford Law Review*, 43, 361–98.
- Dari-Mattiacci, Giuseppe and Hans-Bernd Schäfer (2007), 'The Core Of Pure Economic Loss', *International Review of Law and Economics*, 27, 8–28.
- Faure, Michael G. (2000), 'Product Liability and Product Safety in Europe: Harmonization or Differentiation?', *Kyklos*, 53, 467–508.
- Faure, M. (2003), 'How Law and Economics may Contribute to the Harmonisation of Tort Law in Europa', in R. Zimmerman (ed.), *Grundstrukturen des Europäischen Deliktsrechts*, Baden-Baden: Nomos, pp. 31–82.
- Faure, M. (2008), 'Legal Harmonisation from the Perspective of the Economic Analysis of Law', in M.G. Faure, H. Koziol and S. Puntscher-Riekmann (eds), *Vereintes Europa – Vereinheitliches Recht? Die Rechtsvereinheitlichung aus rechtsökonomischer, privatrechtlicher und politikwissenschaftlicher Sicht*, Vienna: Verlag der Österreichischen Akademie der Wissenschaften, pp. 11–46.
- Fedtko, Jörg (2006), 'Legal Transplants', in J. Smits (ed.), *Elgar Encyclopedia of Comparative Law*, Cheltenham, UK and Northampton, MA, USA: Edward Elgar, pp. 434–7.
- Gilead, Israel (1997), 'Tort Law and Internalization: The Gap between Private Loss and Social Cost', *International Review of Law and Economics*, 17, 589–608.
- Gómez, Fernando and Juan Antonio Ruiz (2004), 'The Plural – and Misleading – Notion of Economic Loss in Tort: A Law and Economics Perspective', *ZEUP*, 908–31.
- Hartlief, T. (2002), 'Harmonization of European Tort Law. Some Critical Remarks', in M. Faure, J. Smits and H. Schneider (eds), *Towards a European Ius Commune in Legal Education and Research*, Antwerpen: Intersentia, pp. 225–36.
- Howells, Geraint G. (2006), 'The Rise of European Consumer Law – Whither National Consumer Law?', *Sydney Law Review*, 28, 63–88.
- Kanning, Arnald J. (2003), *Unifying Commercial Laws of Nation-States – Coordination of Legal Systems and Economic Growth*, Maastricht: Ph.D. thesis Maastricht.
- Kaplow, Louis and Steven Shavell (1996), 'Property Rules versus Liability Rules: An Economic Analysis', *Harvard Law Review*, 109, 713–90.
- Kennedy, Duncan (1982), 'Distributive and Paternalist Motives in Contract and Tort Law, with Special Reference to Compulsory Terms and Unequal Bargaining Power', *Maryland Law Review*, 41, 563–658.

- Kerkmeester, Heico and Louis Visscher (2003), 'Learned Hand in Europe: A Study in the Comparative Law and Economics of Negligence', *German Working Papers in Law and Economics No. 2003/6*.
- Legrand, P. (1996), 'European Legal Systems are Not Converging', *International and Comparative Law Quarterly*, 45, 52–81.
- Legrand, P. (1997), 'The Impossibility of "Legal Transplants"', *Maastricht Journal of European and Comparative Law*, 4, 111–24.
- Legrand, P. (2002), 'On the Unbearable Localness of the Law: Academic Fallacies and Unseasonable Observations', *European Review of Private Law*, 61–76.
- Magnus, Ulrich (2002), 'Towards European Civil Liability', in M. Faure, J. Smits and H. Schneider (eds), *Towards a European Ius Commune in Legal Education and Research*, Antwerpen: Maklu, pp. 205–24.
- Mattei, Ugo A. (1997), *Comparative Law and Economics*, Ann Arbor: University of Michigan Press.
- Mattei, Ugo A., Luisa Antonioli and Andrea Rossato (2000), 'Comparative Law and Economics', in B. Bouckaert and G.D. Geest (eds), *Encyclopedia of Law and Economics*, Cheltenham, UK and Northampton, MA, USA: Edward Elgar, pp. 505–38.
- Ogus, A. (1999), 'Competition between National Legal Systems: A Contribution of Economic Analysis to Comparative Law', *International and Comparative Law Quarterly*, 48, 405–18.
- Parisi, Francesco (2003), 'Liability for Pure Financial Loss: Revisiting the Economic Foundations of a Legal Doctrine', in M. Bussani and V.V. Palmer (eds), *Pure Economic Loss in Europe*, Cambridge: Cambridge University Press, pp. 75–93.
- Parisi, Francesco, Vernon Valentine Palmer and Mauro Bussani (2007), 'The Comparative Law and Economics of Pure Economic Loss', *International Review of Law and Economics*, 27, 29–48.
- Rachlinski, Jeffrey J. (1998), 'A Positive Psychological Theory of Judging in Hindsight', *University of Chicago Law Review*, 65, 571–625.
- Rizzo, M.J. (1982), 'The Economic Loss Problem: A Comment on Bishop', *Oxford Journal of Legal Studies*, 2, 197–206.
- Schäfer, Hans-Bernd and Claus Ott (2004), *The Economic Analysis of Civil Law*, Cheltenham, UK and Northampton, MA, USA: Edward Elgar.
- Shavell, S. (2004), *Foundations of Economic Analysis of Law*, Harvard, MA: Belknap.
- Slovic, Paul (2001), *Smoking – Risk, Perception, and Policy*, Thousand Oaks, CA: Sage Publications.
- Smits, Jan (2005), *The Need for a European Contract Law*, Groningen: Europa Law Publishing.
- Smits, Jan (2006), 'European Private Law: A Plea for a Spontaneous Legal Order', in D.M. Curtin, J. Smits and J.A. McCahery (eds), *European Integration and Law*, Antwerpen: Intersentia, pp. 55–107.
- Spier, Jaap and Olav A. Haazen (1999), 'The European Group on Tort Law ("Tilburg Group") and the European Principles of Tort Law', *ZEuP*, 469–93.
- Sunstein, Cass R. (2000a), *Behavioral Law and Economics*, Cambridge: Cambridge University Press.
- Sunstein, Cass R. (2000b), 'Cognition and Cost-Benefit Analysis', *Journal of Legal Studies*, 29, 1059–103.
- Tiebout, Charles M. (1956), 'A Pure Theory of Local Expenditures', *Journal of Political Economy*, 56, 416–24.
- van Boom, W.H. (2008), 'European Tort Law: An Integrated or Compartmentalized Approach?', in A. Vaquer (ed.), *European Private Law Beyond the Common Frame of Reference – Essays in Honour of Reinhard Zimmermann*, Groningen: Europa Law Publishing, pp. 131–49.
- van Boom, W.H. and Andrea Pinna (2007), 'Shifts from Liability to Solidarity: The Example of Compensation of Birth Defects', in W.H. van Boom and M.G. Faure (eds), *Shifts in Compensation between Private and Public Systems*, Vienna: Springer, pp. 143–80.

- Van den Bergh, Roger (1994), 'The Subsidiarity Principle in European Community Law: Some Insights from Law and Economics', *Maastricht Journal of European and Comparative Law*, 1, 337–66.
- Van den Bergh, Roger (1998), 'Subsidiarity as an Economic Demarcation Principle and the Emergence of European Private Law', *Maastricht Journal of European and Comparative Law*, 5, 129–52.
- Van den Bergh, Roger (2000), 'Towards an Institutional Legal Framework for Regulatory Competition in Europe', *Kyklos*, 53, 435–66.
- Van den Bergh, Roger and Louis Visscher (2006), 'The Principles of European Tort Law: The Right Path to Harmonization?', *European Review of Private Law*, 511–43.
- Vertinsky, Ilan B. and Donald A. Wehrung (1991), 'Risk Perception and Drug Safety Evaluation', *Risk*, 2, 281–312.
- Viscusi, W. Kip (1992), *Fatal Tradeoffs – Public and Private Responsibilities for Risk*, New York: Oxford University Press.
- Viscusi, W. Kip (1998), *Rational Risk Policy*, Oxford: Oxford University Press.
- Wagner, Gerhard (2005a), 'The Project of Harmonizing European Tort Law', *Common Market Law Review*, 42, 1269–312.
- Wagner, Gerhard (2005b), 'The Virtues of Diversity in European Private Law', in J. Smits (ed.), *The Need for a European Contract Law*, Groningen: Europa Law Publishing, pp. 3–24.
- Wilson, Richard and Edmund A.C. Crouch (2001), *Risk-benefit Analysis*, Cambridge, MA: Harvard Center for Risk Analysis.

PART VII

EMPIRICS

16 Empirics of tort

Ben C.J. van Velthoven

16.1 Introduction

People can incur damage in many ways. A person's feelings and property may get hurt by slander, deceit, assault or battery; a consumer may be injured by a defective product; a motorist may see his car being driven into from behind; an employee may get sick from the working conditions in his job; a patient may be harmed by a medical error. In each of these instances, the victim can turn to the tort liability system and try to obtain a court order to make the injurer pay for his losses. In this way, the tort liability system serves three purposes. It provides a forum for the victims to be heard and to oblige the injurers to make up for morally culpable and egregious behavior (corrective justice). It provides compensation to those who are harmed (distributive justice). And it provides incentives for individuals and firms to take appropriate care and to reduce the number of injuries (prevention or deterrence).

The economic approach, drawing on concepts of efficiency, tends to emphasize the deterrent objective of the tort system. The efficiency question is about minimizing the total costs associated with injuries, which include:

- the costs of prevention, when efforts are put in place to take a certain level of care to avoid injuries;
- the costs of the injuries that nonetheless occur (both economic losses such as material damage, medical care and decreased worker output, and non-economic losses such as pain and suffering);
- the costs of administrative resources (such as attorneys' fees) to obtain compensation through a court order or a settlement in the shadow of the law;
- and the costs of uncertainty, when potential victims and injurers are risk-averse and may try to reduce that burden through insurance or other risk-spreading mechanisms (with associated transaction costs).

From this perspective, law and economics scholarship over the past 30 or so years has greatly enhanced our understanding of tort rules (Calabresi, 1970; Landes and Posner, 1987; Shavell, 1987 and 2004). It has analyzed

the pros and cons of negligence versus strict liability, of contributory versus comparative negligence, of punitive damages, and so on. And it has done so from various angles and for various cases: level of care and level of activity, unilateral and bilateral accidents, injurer and victim being strangers and involved in a contractual relationship, and so on. But much of the analysis is done in a more or less partial framework. That is, the elements of the tort system are studied one by one and in isolation from other social institutions that affect the frequency and severity of injuries occurring and the handling of claims when losses have been sustained. When it comes to abstract theorizing, such a partial approach is the only fruitful way to proceed, taking full advantage of the *ceteris paribus* setting.

But in the end, theoretical analysis cannot give us a definitive and clear-cut answer as to how the tort system can best be organized in the real world. For, as Schwartz (1994, pp. 382 ff) points out, tort law need not be a *necessary* factor in achieving deterrence. It may be rendered superfluous by other incentives operating on the parties to avoid unduly risky behavior and accidents. These other incentives include: moral principles discouraging people from needlessly inflicting risk and harm on others, the risk of hazardous behavior for the acting party's own safety, market forces driving unsafe products out or internalizing job hazards in wage differentials, and the regulatory programs put in place by the government for the purpose of achieving specific safety goals in society. At the same time, tort law also might not be a *sufficient* factor to achieve deterrence. It may turn out to be futile in its efforts, for various reasons. Because individuals operate under cognitive and psychological limitations that stand in the way of fully rational behavior towards accident risks, they may be ignorant of the legal rules and the due standard of care, or they may discount a small chance of a major future liability. Negligent conduct can be inadvertent and result from lapses by parties that are genuinely accidental. Liability insurance can intervene and reduce or eliminate the incentive effects of the threat of liability. The same holds for tort litigation, where the prospect of substantial legal costs and an imperfectly predictable verdict may withhold victims from filing a claim or induce them to accept a settlement that does not cover all losses.

For all these reasons, exactly how much deterrence tort law provides is ultimately an empirical question. However, it is not so easy to find the answer. For one thing, we need reliable data, on the level of care, the number of accidents, the frequency and severity of injuries, and the costs of prevention, which in general are not readily available. We also need variation in the tort rules, across time or space, for it is the differential impact that can truly inform us of the effects of the rules. But as soon as we start to compare outcomes across time or space, we have to control for other

social, economic and technological developments that might be responsible for the differences. Furthermore, we have to ascertain that the substantive effects of tort law can be distinguished from the effects which may be due to the process of litigation, the organization and regulation of the insurance industry, and governmental safety policies. For these other social institutions condition the working of tort rules, and thus may dampen and mask the actual effects of (variations in) these rules. And they exhibit variations of their own across time and space, which perhaps may give a better explanation of observed differences in the frequency and severity of accidents than (the variation in) tort law. A final remark relates to the fact that decisions on tort reform, as well as on governmental safety policies, are not made within a political void (Epstein, 1988; Rubin, 2005). They are influenced by lobbying efforts from special interest groups (business, the insurance industry, the medical profession, the consumer movement, trial lawyers). As a consequence, the relationship between tort law and the frequency and severity of accidents in society may well be bi-directional, and difficult to disentangle.

Of course, the above problems are not unique for tort law. Therefore it did not come as a real surprise when Landes (2003) showed that empirical analysis plays a much smaller role in the economic analysis of law than in economics in general. He argues that law and economics scholars are more likely to choose theoretical projects because they hold out the prospect of lower costs and greater rewards than empirical projects. But that is not to say that there is no empirical work at all, as this survey will show. Posner (1972) used a sample of over 1,500 US appellate court decisions in accident cases over the period 1875–1905 to illustrate the ‘classical’ application of the negligence concept. In his interpretation of the historical facts, the standards of due conduct were broadly designed to bring about the efficient (cost-justified) level of accidents and safety. Nevertheless, he also notes that the courts did not lead the way to major innovations in safety methods. In his sample, no enterprise was ever held negligent for having failed to introduce a safety method or appliance that was not already broadly used in the industry.

Since Posner, two main lines of inquiry can be distinguished within the empirical literature on tort law, by far the greater part of which concentrates on the situation and developments in the US. Many empirical studies relate to the operation of the *tort litigation system* (cf. survey articles by Saks, 1992; Galanter, 1996; Schwartz, 2002; CBO, 2004). A series of questions is addressed in this line of inquiry. Is the number of tort claims more or less stable, or is it getting out of control? Are all claims more or less valid, or is a substantial fraction inflated or even totally fake? Are awards in general and punitive damages in particular moderate and predictable?

Are the results about the same if the trial is by judge rather than by jury? Which percentage of tort victims is able to recover for injury losses, and to what extent? And how large are the overhead costs of the tort system?

The second line of research is concerned with the *safety effects* of the tort system (cf. general surveys by Dewees and Trebilcock, 1992; Schwartz, 1994; Dewees, Duff and Trebilcock, 1996). What are the effects of tort law on the parties' level of care, on the number of accidents, and on the frequency and severity of injuries? How do these effects compare to the safety effects from regulatory interventions? And what would be the verdict if we – cautiously – try to implement a cost-benefit analysis of the tort system?

Both lines of inquiry will be addressed here, as the results from the second line of research cannot be viewed in the proper perspective without the findings from the first line. I will start, however, with a short detour among some more technical issues.

16.2 Prerequisites for empirical analysis

16.2.1 Variation

Most empirical studies on tort law focus on the US. The reason for this is easily understood, even apart from the presumably national bias of the leading law and economics scholars and journals. Although Congress has broad constitutional authority to change tort rules under its power to regulate interstate commerce, tort cases in the US until now have been primarily governed by state law (CBO, 2003). Hence, tort rules may vary across states, and indeed do so to a considerable extent. Tort rules have, moreover, been changing over time.

In the 19th century, US common law generally established negligence as the basis for tort liability. Plaintiffs had to provide sufficient evidence that defendants had been negligent, chiefly defined in terms of the extent to which injury-causing behavior deviated from the normal. In practice, the requirements turned out to be rather restrictive and hence severely limited the scope of the tort system (Priest, 1991). In the course of the 20th century, public debate increasingly emphasized victim compensation and accident reduction. This led to several 'waves' of changes in legislation and in court-imposed standards and rules.

The first wave had to do with workers' injuries (Chelius, 1976; Schwartz, 1994). Around 1900, a number of states passed legislation, expanding employers' liability by modifying various defenses. Congress followed in 1908 with the Federal Employers' Liability Act, which broadened the liability of railroads for workers' injuries by abrogating the fellow-servant rule and replacing contributory negligence as a full defense with comparative

negligence as a partial defense. Then, beginning in 1911, the states started to switch from a negligence system to the by now general program known as workers' compensation. Under this program, an employer is required to pay employees compensation for work-related accidents, regardless of the cause. On the other hand, the employee who is covered by workers' compensation is barred from any negligence proceeding against his employer. The amount of compensation, which is established individually according to statutes that vary by state, is substantially less than the employee's full accident costs. So, the program operates as a system of shared strict liability.

A second major wave of changes affected product liability (Higgins 1978; Priest, 1991). Until the 1950s, manufacturers' liability for defective products had generally been subject to a regime of negligence under privity of contract. The plaintiff could not sue the manufacturer unless the commodity was purchased directly from the producer. And he had to show that the manufacturer had not exercised reasonable care in the design or construction of the defective product. In the course of the 1960s, most states switched to a standard of strict liability. Strict liability is not absolute, however, as the carelessness of the plaintiff may be brought in defense. Furthermore, it became accepted that defects not only could relate to design or manufacturing, but also to warnings for a proper use.

Liability for automobile accidents underwent a significant change between 1971 and 1975, when a number of states switched from negligence to a system of no-fault for bodily injuries (Schwartz, 2000; Cohen and Dehejia, 2004). No-fault systems generally require drivers to purchase insurance that provides first-party coverage for economic losses, regardless of who was at fault. And they limit the extent to which drivers can initiate tort suits. In a pure no-fault system, victims do not have any recourse to negligence-based suits. However, all US states provide for a threshold, beyond which parties to an accident may sue for negligence. The no-fault systems in the US thus have a hybrid character.

In the context of automobile accidents, there have also been two other relevant changes in liability law. The first one is that over time most states, many of them in the 1970s, replaced the rule of contributory negligence by comparative negligence (White, 1989). Secondly, since the 1980s, many states imposed tort liability on commercial servers of alcoholic beverages, either by statute or by case law (Sloan, Reilly and Schenzler, 1994). Through these so-called dram shop laws, servers can be found liable for accident costs from injuries caused by their intoxicated customers.

The changes in tort law have not happened without fierce discussion. Legal scholars and interest groups argued that the expansion of the tort system went too far. Lawsuits were started frivolously; damages were awarded arbitrarily; the administrative costs of the system, particularly

attorneys' fees, had gone too high; the costs of liability insurance were rising, to the point that availability became an issue; business was saddled with excessive costs, driving up consumer prices; doctors were restricting their practices or submitting to defensive medicine. In response to these criticisms, a large majority of states has since the mid-1980s enacted statutes to restrict the number of tort lawsuits filed and/or the damages awarded (CBO, 2004; Rubin and Shepherd, 2007). The list of tort reform measures includes: caps on non-economic damage awards; caps on punitive damage awards; higher evidence requirements for punitive damages; allowing the admissibility of evidence of collateral source payments; allowing courts to offset awards by the amount of collateral source payments; restrictions on prejudgment interest; reductions in the statute of limitations; restrictions on contingent fee arrangements; restrictions on joint-and-several liability rules; and certain limitations in manufacturers' product liability. Interestingly enough, while tort reform has been a national trend, the extent and specifics of that reform vary from state to state.

And that brings us back to the main point of this section. The fact that liability rules have varied so much across time and states makes the US the obvious choice for a comparative analysis of the empirical effects of tort law. That is not to say that there are no alternative objects of study at all. In the field of automobile accidents, for instance, no-fault systems have also been introduced in (parts of) Canada, Australia and New Zealand.

16.2.2 Data

For an empirical analysis of the operation and efficiency of the tort system, we need data. Alas, getting a more or less complete picture turns out to be an almost impossible job.

To start with, no data have been available until recently that cover all of the tort cases brought in the various jurisdictions across the US (Saks, 1992; CBO, 2003). Data about cases disposed of in the federal court are available from the Administrative Office (AO) of the US Courts. The National Center for State Courts (NCSC) has been working over the years to bring about more uniform data collection and reporting on trends in civil filings in general jurisdiction state courts. It also conducts periodic surveys of civil trials in the nation's 75 largest counties for the Bureau of Justice Statistics (BJS).

Even with full court data now, our information would only be partial, for the majority of tort disputes never reach a trial verdict. Generally, settlement details are not reported to the courts. However, since a large percentage of tort awards is actually paid by defendants' insurers, insurance company records may be of help here. But note that these companies do not regularly make their records available.

To put the number of tort claims in proper perspective, we should have data on accidents and injuries. The National Safety Council reports on unintentional injury deaths and on medical visits and hospitalization as a result of accidents. There is no institute that keeps track of developments in the frequency and severity of accidents, let alone of the degree to which accidents were due to negligence or pure coincidence. Information can only be obtained through time- and cost-consuming surveys, be it nationally (Hensler et al., 1991) or by sector (see for medical injuries: Mills, 1978; Harvard Medical Practice Study, 1990; Studdert, Brennan and Thomas, 2000).

When it comes to efficiency, we have to balance the costs and benefits of the tort system, both in its current state and with alternative standards and/or rules. Estimates of the administrative costs of the system are published regularly now by Tillinghast, a management consulting firm that relies on data from the insurance industry (see, for example, Tillinghast-Towers Perrin, 2003). Data on damages avoided because of (additional) precaution are, as a matter of fact, not readily available, but can perhaps be inferred from econometric analyses of the relationships between tort rules and the frequency and severity of injuries (see further on). What we certainly don't have is information on most of the indirect costs of the tort system, such as the costs of precautions taken by potential injurers.

16.2.3 Methods

Suppose we wish to compare liability rules across time and/or across states, for example, tort versus no-fault in case of automobile accidents. Our working hypothesis reads that the liability rule affects the average level of care by drivers. For that reason, we may want a statistical estimate and test of the relationship between the liability rule and the number of fatalities in road traffic.

If so, we should take account of other factors that may influence the relationship. For the number of fatalities may also depend on the number of cars and the amount of miles driven, on the presence of speed limits and the intensity of their enforcement, on the degree of experience rating in drivers' insurance contracts, and so on. One reason for introducing all possibly relevant variables in the relationship to be estimated is to find out which are the real explanatory factors. But there is an even more important reason: failure to control for some explanations by leaving out critical variables may bias the estimates of the effects of the remaining variables. In general, omitting a variable that is not correlated with the variables that are included in the equation does not affect the results. If the correlation is positive (negative), however, the coefficients of the included variables will to some degree take on (be dampened by) the explanatory power of the

omitted variable. The included variables will appear more (less) important than they really are. Moreover, standard errors will also be biased, so confidence intervals and hypothesis tests are inaccurate. In the case of automobile accidents, for example, the researcher should be aware that the transition to no-fault may have coincided with certain changes in the insurance regime and in traffic safety measures.

While the obvious solution to the omitted variable problem is to include all potentially explanatory factors, there may be good reasons for not doing so. Available data put more or less stringent limits on our ability to add new variables. If the number of degrees of freedom becomes too small, the standard errors and confidence intervals associated with our estimates will be too large to tell us much. And when the explanatory variables are indeed highly correlated among each another, it may prove difficult to pull the individual effects apart, the so-called multicollinearity problem.

A frequently used method in the empirics of tort is the panel data approach, which yields more observations than pure cross-sectional or pure time-series data. Mostly, the analysis then controls for fixed effects of each state and each year, through the inclusion of dummy variables. The state dummy variables will capture the effects of those variables that differ more or less permanently among the states, but have not been included in the equation (weather conditions, maybe). The year dummy variables will capture the effects of those omitted variables that affect all states over time.

Another issue that deserves attention is the problem of simultaneity or endogeneity. For instance, when a state has decided to make the transition from tort to no-fault, that shift may affect the average level of care by drivers and hence the number of fatal accidents. But note that the decision in itself may have been taken as a result of a large number of automobile accidents within the state that produced (too) high pressure on the tort system. What then, if we find that no-fault states have more fatal accidents than tort states? Is it because drivers tend to be less careful under no-fault? Or is it because only those states have switched over that for some reason or other (for example, bad weather conditions) are accident-prone, while drivers' care is not affected at all, or maybe even in the opposite direction but to a relatively lesser degree? Unless the two effects can be separated, any attempt to estimate either relationship alone is bound to bring in the effects of the other.

The appropriate method to deal with this problem is to find exogenous variables that may affect one relationship (for example, the decision to switch from tort to no-fault), but not the other (for example, the number of fatal accidents). The usefulness of these so-called instrumental variables,

or, in short, instruments, depends on two factors. Firstly, they must be good predictors for the relationship in which they are included. Secondly, it must be correct to exclude them from the other relationship. In practice, it often turns out to be quite difficult to find instrumental variables that satisfy these two conditions.

A final remark pertains to the functional form of the relationship to be estimated. As it turns out, all kinds of specifications can be found in the empirical literature. For example, the dependent variable sometimes reads in terms of fatalities per (1, 10 or 100) million miles traveled, sometimes in fatalities per 100,000 inhabitants. Sometimes, the dependent variable is in level form, sometimes it is converted by taking logarithms. Alas, theory generally does not give us much to hold on to with respect to the functional form. It can be noted though that a logarithmic transformation may yield certain technical benefits. If the dependent variable varies considerably across states and/or time, as the accident rate certainly does, its logarithm presumably has a distribution that is less skewed. This will tend to make the coefficients and their confidence intervals more reliable. Moreover, coefficients in a log-log equation can be read as elasticities.

This is not the place to delve any further into technical details on the appropriate statistical methods to estimate coefficients and test hypotheses in relationships. For that, the reader is referred to the econometric literature; see, for example, Greene (2008). Spelman (2000) provides a highly readable guide to the various methodological problems and the ways to solve them, for the admittedly different, but as to the essentials very much comparable, context of crime and punishment.

16.3 The tort litigation system

This section surveys the empirical evidence concerning the operational behavior of the tort litigation system. The evidence will be organized within a general model of the flow of disputes into and through the system (Saks, 1992). This model may be visualized in the standard approach of legal scholars as a 'dispute pyramid' made up of successive layers (Felstiner, Abel and Sarat, 1981; Galanter, 1996). The model tries to unravel the path from adverse events to final dispositions. After an adverse event occurs, a victim must decide whether or not to complain; lawyers must decide whether or not to accept and file the cases offered to them; a process of negotiation resolves most cases short of a trial; an important minority of cases will be resolved by trial; and various post-verdict remedies are available. A parallel course is followed by plaintiffs who have suffered non-compensable injuries which are nonetheless brought to the system; these claims are either correctly put aside or mistakenly granted compensation at one stage or another.

Examining the system in this way brings to light how decisions at one stage affect what may come to the surface at later stages. It can tell us to what degree victims are compensated for the tortious conduct of their injurers. And it informs us to what extent the system makes (potential) injurers internalize the damages they bring about by their conduct, and under what margin of error. Thus, it provides a frame of reference for studying the effects of changes in the system and in the external environment.

16.3.1 Base rate

To have a full view of the dispute pyramid we should start at the base, consisting of all the events in which, for example, a particular product is used. In a – small – fraction of these events someone gets hurt. This yields the first layer of adverse events.

Hensler et al. (1991) report on a large-scale national survey by the RAND Institute for Civil Justice in 1988/89. They find that a person has a 15.8 percent probability of suffering some economic loss from a non-fatal injury in a year. Some 38 percent of the person-incidents are caused by slips and falls; 30 percent involve a product, such as a tool, a household appliance or sports equipment; 18 percent involve motor vehicles; and 1 percent results from medical treatment. Motor vehicle accidents are much more likely than product-associated incidents or slips and falls to result in very serious injuries and to require hospitalization or surgery.

More recent statistics from the National Safety Council are on rather similar lines.¹ It is estimated that in 2004 11.5 percent of the population sought medical attention for an injury. From the unintentional-injury deaths estimated to total 112,000, that is 38.1 per 100,000 population, some 45,300 were killed in motor vehicle crashes and 5,000 at work.

Ideally, we should be able to separate the accidental injuries into those which are tortious and those whose costs must remain with the victim. When the RAND study asked respondents about what they considered to be the main cause of their injury, 10 percent attributed the accident to chance only, 50 percent mostly to one's own behavior, 29 percent mostly to someone else, and 11 percent equally to oneself and another person. But these subjective judgments do not constitute solid ground for research into negligence questions.

The most useful studies in that regard relate to medical malpractice. Three large-scale surveys of the medical records of hospitalized patients have investigated the incidence of injury due to medical care and the subset

¹ I quote from http://www.nsc.org/library/report_table_2.htm, visited on November 20, 2007.

caused by negligence. The first study was done in California in 1974 (CMA and CHA, 1977; Mills, 1978), the second in New York in 1984 (Harvard Medical Practice Study, 1990; Brennan et al., 1991; Leape et al., 1991; Weiler et al., 1993) and the third in Utah and Colorado in 1992 (Studdert, Brennan and Thomas, 2000; Studdert et al., 2000; Thomas et al., 2000). The California study concluded that 4.65 percent of hospitalized patients suffered an injury due to medical care. Of these, 17 percent involved a negligent act or omission. In the New York study, 3.7 percent of patients suffered an injury due to medical care, 28 percent of which were attributed to negligence. And in the Utah and Colorado study, adverse events occurred in 2.9 percent of hospitalizations, 29 percent of which were due to negligence. Thus, the results are remarkably similar as they point out that between 0.8 and 1.0 percent of all hospitalized patients suffer a negligent injury. The results differ, however, with respect to mortality rates. Extrapolating the Utah and Colorado results to all hospital admissions in the US in 1992 reveals that 980,000 adverse events might have led to 65,000 deaths, of which 25,000 can be attributed to negligence. That burden of mortality is considerably less than the estimate from the New York study: nearly 200,000 deaths a year due to adverse events, of which 120,000 are negligent. But the mortality rate remains a startling figure, as such, and in comparison to the fatality rate in motor vehicle and workplace accidents.

The figures on iatrogenic injury rates, instructive as they are, should nevertheless be viewed with some caution (Danzon, 2000). A substantial – but undetermined – proportion of the patients were seriously ill and many would have died from their underlying illness anyway, whereas most victims of automobile and workplace injuries were healthy. Secondly, the findings reflect the broad definitions used in the studies. A negligent adverse event was defined as the consequence of treatment that failed to meet the standard of the average medical practitioner. None of the studies attempted to define negligence by weighing marginal costs and benefits of additional precautions. So, the resulting count of negligent injuries does not necessarily correspond to economically inappropriate injuries.

16.3.2 Claiming rate

The second layer of the dispute pyramid discloses how many of the injury victims take measures to obtain compensation from those who injured them.

The RAND study cited above found that 90 out of 100 accidentally injured people did not take any action at all. The remaining ten that took some action pursued multiple paths; two tried to negotiate directly with the injurer and four with his insurer, while seven consulted an attorney at

one time or other. Eventually, four out of 100 hired a lawyer and only two filed a lawsuit.

It is tempting to compare the 10 percent of injured people that took some action and the 2 percent filing a lawsuit with the 29 percent that attributed the cause of the accident mostly to someone else's behavior. This suggests that a large number of potential plaintiffs with a valid claim never initiate one and thereby become instant 'false negatives'.

The RAND study further points out that claiming patterns may differ sharply between subclasses of accidental injuries. While 39 percent of the persons who were injured in a motor vehicle accident took some action to obtain compensation, this only holds for 11 percent in the case of work accidents and 4 percent with other injuries. Note that this pattern correlates well enough with the percentage of accidents being attributed mostly to others, which ranges from 71 percent in case of motor vehicle accidents, 38 percent for work-related accidents, and 13 percent for other injuries.

More specific information is available for medical injuries. The California study did not take a direct look at claims filed by patients within the sample, but the other two studies did. In the New York study (Localio et al., 1991) only 1.5 percent of the patients who were identified as having sustained an injury due to negligence filed a malpractice claim, and in the Utah/Colorado study the figure was 2.5 percent. These results affirm that claims lag well behind the incidence of negligent injury. Moreover, factors other than individual merit appear to play a role in determining who uses the malpractice system. Compared with patients who did sue for negligence, non-claimants were found more likely to have suffered minor injury and to be Medicare/Medicaid recipients, elderly and low income earners (Danzon, 1985; Studdert et al., 2000).²

There is also a significant number of 'false positives' among medical malpractice claims. Starting from the California study, Danzon (1985) made a comparison between the extrapolated total number of negligent injuries and aggregate claim data from insurers' records. It appeared that, overall, 1 in 10 negligent injuries resulted in a claim. Later studies found this ratio to be 1 in 7.6 (New York), 1 in 5.1 (Utah) and 1 in 6.7 (Colorado). Once again, this claim ratio of between 10 and 20 percent shows how negligent behavior frequently escapes redress. But note that this overall claim ratio is definitely higher than the 1.5 to 2.5 percent figure that followed from a

² Posner (1997) shows that interstate differences in factors like these (income, education, age distribution) may help to explain the variance in overall per capita tort filing rates across the US, and between the US and England. He suggests that, having corrected for these factors, England might be more litigious than the US.

direct look at claims filed by patients who were known to be treated negligently. Indeed, it was estimated from the New York results that only 1 in 6 malpractice claims responded to an identifiable injury due to negligent medical behavior (Localio et al., 1991).

Upon closer scrutiny, the picture is somewhat less alarming. Several studies have investigated sets of closed malpractice claims, focusing on a single specialty (Cheney et al., 1989; Sloan et al., 1997), insurer (Taragin et al., 1992), hospital (Farber and White, 1994) and state (Harris et al., 2006), or covering the whole terrain (Studdert et al., 2006). Examination of medical records made it clear that 40 to 60 percent of claims did not involve any negligence and hence had no merit. That fraction is still considerable, but it is, notably, an *ex post* and expert judgment. Plaintiffs may have filed the claims in good faith, from a state of imperfect information. It is up to the tort litigation system, then, to separate the rightful claims from the non-deserving ones.

16.3.3 Disposition of claims

The third layer of the dispute pyramid discloses how filed claims fare in the system.

Although there are no all-encompassing statistics of tort filings in the US, combining data from various sources provides a useful overview. BJS data for the fiscal year 2002–03 (Cohen, 2005) show that tort filings in federal courts amount to some 34 per 100,000 population. Tort filings in state courts are far more numerous, at an average rate of some 280 claims per 100,000 persons, according to NCSC data for 2004 (Schauffler et al., 2006). Around this average there is substantial variation in the rate at which tort cases are filed in state courts, from 90 per 100,000 in North Dakota to 786 in New Jersey. Densely populated states in the north east generate many of the highest figures.

Available data also give some insight into the composition of the incoming tort cases. Schauffler et al. (2006) report how automobile accidents clearly dominate in state courts with a share in torts of 51 to 67 percent. Medical malpractice and product liability cases amount to no more than 3 and 4 percent, respectively. These proportions are corroborated by somewhat more detailed findings from a sampling of tort cases in the nation's 75 largest counties (Smith et al., 1995) and in Georgia (Eaton and Talarico, 1996; Eaton, Talarico and Dunn, 2000).

When it comes to the disposition of the claims, we must first of all face up to the fact that a large majority is settled in the 'shadow of the law'. Cohen (2005) notes that only 2 percent of tort cases in federal courts in 2002–03 were decided by trial. Smith et al. (1995) give more details for tort case disposition in state courts. The most common method is an agreed

settlement (73 percent), followed by dismissal (10 percent), transfer (5 percent), arbitration award (4 percent) and default judgment (3 percent). Alas, no general and systematic data are available regarding the substantive outcome of the underlying dispute under these various headings. But this much is clear: that a trial verdict resolves relatively few cases (3 percent).³

The composition of trial cases differs between courts (Cohen, 2004 and 2005). Automobile accident, product liability and medical malpractice cases make up 20, 15 and 10 percent, respectively, of federal court trials, and 53, 2 and 15 percent, respectively, of state court trials. When the latter distribution is compared to the incoming case load, it becomes apparent that medical malpractice cases are relatively more often brought to trial than other tort cases.

The average plaintiff win rates in federal and state court trials, 48 and 52 percent, are almost perfectly in conformity with the 50 percent rule derived by Priest and Klein (1984). If there is no real asymmetry in the stakes of the parties, and if significant legal costs can be avoided by settling, they predict that only close call cases will proceed to trial. But going into more detail, plaintiff win rates differ markedly between automobile accidents on the one hand (around 60 percent) and product liability and medical malpractice cases on the other hand (some 40 and 30 percent, respectively). Differential stakes and information clearly play an important role, as automobile accident cases are mostly between individuals, while defendants in product liability and medical malpractice cases are mostly 'repeat players' (business, hospitals, insurers). The hospital or producer whose reputation may be harmed has more at stake than the damages sought by the plaintiff. Therefore, defendants may be more willing to settle strong plaintiff suits.⁴

³ See also Eaton, Mustard and Talarico (2005) with rather more recent, but somewhat comparable results for Georgia.

⁴ Viscusi (1986, 1988, 1989) provides detailed analyses of the disposition of product liability claims, using insurance data from all US states on claims closed between 1976 and 1977. See Viscusi and Scharff (1996) for a summary. Of all claims, 19 percent are dropped. Of the claims not dropped, 95 percent are settled. The plaintiff win rate at verdict is 37 percent. To assess the measure of compensation, Viscusi considers the replacement ratio, that is the ratio of the payment (through settlement or court verdict) to financial losses due to bodily injury (thus, excluding compensation for pain and suffering). For the full sample, on average, this replacement ratio is 1.05, so there is slight overcompensation of economic losses. The replacement ratio declines quite steadily with the size of losses, and drops below unity for losses in excess of \$100,000. For losses over a million dollars, the replacement ratio is only 0.25.

The final amount awarded in federal and state court trials has a median of \$210,000 and \$27,000 respectively. Here too, major differences can be observed between case types. The trial awards are on average substantially lower in automobile accident cases, especially in state courts (median \$164,000 and \$16,000), than they are in product liability and medical malpractice cases (where the median ranges from \$350,000 to \$600,000).

An additional source of variation stems from the fact that trial can be by jury or by judge. The plaintiff win rate appears to be somewhat higher in a bench trial, while the awarded amount tends to be higher in a jury trial.⁵

Finally, it should be noted that a trial award needs not be the final result of the litigation process. A party that is unhappy with the size of a jury award can request a review from the trial judge. And parties can, of course, enter an appeal, the threat of which in itself can lead to further negotiations. In a study by Shanley and Peterson (1987), 20 percent of jury awards were found to be adjusted in the post-trial stage. On average, defendants paid 71 percent of what juries had awarded.

Instructive as they are, the preceding figures on plaintiff win rates and awarded amounts do not tell us whether the tort litigation system reached the correct decisions. Were false positive claims at one moment or other put aside? And were rightful claims remunerated in such a way as to adequately compensate for false negatives in creating incentives for the (potential) injurers?

Once again, analysis of medical malpractice cases has raised a corner of the veil. Several studies have modeled the handling of claims (drop, settle, proceed to trial verdict) as a process in which the parties form expectations about the probability and size of award at verdict and about the litigation costs. Empirical tests lend support to the non-random selection of

Overall, the performance of the tort litigation system closely reflects the predictions of economic models. Decisions to drop and settle claims are dictated by economic stakes, not by unconstrained commitments to justice. Similarly, the magnitude of out-of-court settlements reflects the character of the legal bargaining game.

⁵ It has to be acknowledged that most of these differences in mean awards and win rates may be due to selection effects. Clermont and Eisenberg (1992) suggest that parties, through their lawyers, send quite different mixes of cases to the two modes of trial as a result of persistent misperceptions of judge/jury differences for various tort categories. But judges and juries also exhibit some 'real' differences as adjudicators. Helland and Tabarrok (2000) note that juries, in particular if they are drawn from pools with high poverty rates, appear to be more receptive to 'redistribute wealth' arguments than judges. Tabarrok and Helland (1999) pursue a similar line, when they argue that elected judges may grant higher awards in cases with out-of-state defendants, *ceteris paribus*, than appointed judges.

cases to trial verdict. The data are more or less consistent with a model in which plaintiffs are poorly informed *ex ante* about whether there has been negligence, file suit to gather information, and either drop the case if they find that negligence is unlikely or settle if negligence is likely (Farber and White, 1991 and 1994). Thus, legal standards (that is, prevailing practice) influence court verdicts directly and settlements indirectly. And plaintiff win rates at settlement (around 50 percent) are higher than at verdict (30 percent) (Danzon and Lillard, 1983). Overall, compensation in most cases falls short of plaintiff's losses, especially for more serious injuries (Sloan and Hoerger, 1991). Harris et al. (2006) also find that cases are generally settled when negligence is rated as probable by the defendant's insurer. But when negligence is rated as uncertain or unlikely, 'strategic variables', such as the witness potential of the plaintiff versus the defendant physician and the reputation of the plaintiff's attorney, play a supplementary role. It appears that cases in which the defendant (plaintiff) has a strategic advantage are much less (more) likely to settle.

Other studies provide illustrative descriptive data. White (1994) summarizes existing evidence and concludes that the probability of a claim is 0.026 per negligent injury, 0.01 per non-negligent injury and 0.001 per non-injury. Quality of care also has a strong impact on the probability and size of a compensatory award. Valid claims are much more likely to receive payment than invalid claims, and at a higher average amount. The percentage of patient claims that result in actual compensation varies between 73 and 91 percent in case of negligent injury, and between 16 and 47 percent in case of non-negligent care (Cheney et al., 1989; Taragin et al., 1992; Farber and White, 1994; Studdert et al., 2006).

The tort litigation system is not perfect, then. It sometimes makes doctors – or their insurers – pay damages for non-negligent care. But the system is clearly not a random lottery. As a result of a selection process, negligent injuries are at least ten times as likely to end up in compensatory payments as non-negligent injuries. More disturbing for the proper working of the system seems to be the high rate of false negatives, mainly because a large fraction of valid claims is not filed, but to a lesser degree also because not all valid claims that are filed get honored. If that result is combined with the finding that compensation generally falls short of victims' losses, the deterrent function of the system might be insufficient after all.

16.3.4 *Punitive damages*

Punitive damages have attracted special attention over the past decades, both in public policy debates and in empirical research. From a deterrence perspective, the rationale of punitive damages lies in the fact that an injurer sometimes may escape liability. The level of damages imposed on him when

he is found liable then needs to exceed a compensatory award, so that, on average, he can expect to pay for the full harm he inflicts upon his victims. To play this incentive role properly, punitive damages should be set equal to compensatory damages multiplied by $(1 - p)/p$, where p denotes the probability that the injurer is detected and found liable. However, the incentive role loses weight, if the frequency with which punitive damages are awarded is basically unpredictable and the size arbitrary.

Eisenberg et al. (1997) studied the predictability of punitive damage awards in jury trials. They note that punitive damages are awarded in only 6 percent of jury trials where plaintiffs prevail. Most of the punitive damage awards occur in business/contract and intentional tort cases, and only a small minority of 4 percent in product liability and medical malpractice cases. The median punitive damage award is \$50,000, which is not strikingly high. However, the mean value of \$534,000 shows that the distribution is rather skewed, with some high-end awards. Most importantly, regression analysis shows that the size of the punitive damage award is strongly and significantly correlated with the compensatory award.⁶

The implications which seem to follow from these findings, that punitive damages are (1) rare and insignificant and (2) predictable, have not gone unchallenged (Polinsky, 1997). Firstly, even if punitive damages are on average rather insignificant at trial, it does not follow that the effect on settlements is minimal as well. However, empirical findings with respect to the settlement process suggest that there is no need for alarm. Eaton, Mustard and Talarico (2005) study whether and how the major decisions in the tort litigation process are affected by a request for punitive damages. In most phases of the litigation process, they can find no significant impact. Koenig (1998) analyses liability insurance data from Texas, where claims adjusters must report on the components of all closed claims settled without a verdict. In only 5.5 percent of the cases which settled for \$10,000 to \$25,000 did the threat of punitive damages play any role. If so, the payout was inflated by an average of only 12.5 percent. In larger settlements, 43 percent

⁶ Several studies compare judge and jury performance in awarding punitive damages, with mixed results. Eisenberg et al. (2002) find no substantial evidence that judges and juries differ in the rate at which they award punitive damages or in the relationship between the size of the punitive and compensatory awards. Hersch and Viscusi (2004), on the contrary, report that juries are significantly more likely to award punitive damages and award higher levels of punitive damages than judges. The results in Eisenberg et al. (2006) affirm that juries and judges award punitive damages in approximately the same ratio to compensatory awards, conditional on the existence of a punitive award. But they also reveal some differences in juries' and judges' tendencies to award punitive damages between bodily and non-bodily injury cases.

of claimants received more than economic losses. If so, punitive damages made up 11 percent of the settlement amount, against 56 percent for non-economic damages.

The second target of criticism is the predictability of punitive damages. It may be true that a substantial part – some 50 percent – of the variation in the size of punitive damages can be explained, conditional on knowledge of the compensatory award and of the assignment of a punitive award. But that still leaves the issue whether punitive damages will be awarded at all. Karpoff and Lott (1999) show that without prior information on the allotment of a punitive award, less than 2 percent of the variation in punitive damages can be explained. An additional problem is that the compensatory award is not known until after the verdict, and that it is unlikely that parties might forecast it without error. Viscusi (1998b) concludes that there is no real basis for decision makers to predict the punitive awards arising from different safety choices.⁷

16.3.5 Administrative costs

A major source of concern is the considerable cost of administering the tort system.

Kakalik and Pace (1986) estimated total expenditure for tort litigation in state and federal courts in 1985 to be between \$29 and \$36 billion. From this total 46 percent was paid to plaintiffs as net compensation, while the rest was taken up in legal fees, insurance company costs of claim processing, the value of litigants' time, and the costs of operating the court system. Defendants' costs made up 28 percent of total expenditure, plaintiffs' costs 24 percent and court expenditure 2 percent. Apparently, it costs society on average more than \$2.10 to deliver \$1 of net compensation to a tort victim.

Automobile tort cases, which account for 53 percent of all tort filings, only cover 41 percent of total expenditure. The average net compensation per claim is lower, but more importantly, so are litigation costs, as these cases are usually relatively straightforward to handle. For that reason, delivering \$1 of net compensation in an automobile tort case costs society \$1.90, and over \$2.30 in other tort cases.

More recent estimates corroborate the above findings. Studdert et al. (2006) provide some detail on medical malpractice claims, suggesting that the average administrative cost of handling such a claim at present amounts to more than \$140,000. Tillinghast-Towers Perrin (2003) estimate

⁷ Indeed, Viscusi (1998a) cannot find any systematic differences in the safety and environmental performance between states with and without punitive damages.

total expenditure on tort claims nationwide at \$290.0 billion in 2005, that is 2.33 percent of GDP. Plaintiffs receive 46 percent in net compensation, to wit: 22 percent for economic losses and 24 percent for non-economic loss. Defendants' costs (insurance companies' administration and defense costs) amount to 35 percent, and plaintiffs' attorney fees to 19 percent. Once again, it appears to cost society overall more than \$2.10 to deliver \$1 of net compensation.⁸

16.4 Effects of tort reform on litigation and insurance

The previous section gave an overview of the main characteristics of the operational behavior of the tort litigation system. Historical developments were left aside. However, some of the trends over time are highly relevant, as they provided the trigger to tort reform initiatives.

A brief look at the scarce figures that sketch long-term trends reveals that the total number of tort filings rose steadily between 1970 and the mid-1980s, both in state and federal courts (Ostrom et al., 2004; Schaufler et al., 2006; Cohen, 2005). Observing this trend in litigation, Hensler (1987) noted that there was no single tort system. At least three different types of tort litigation should be distinguished: (1) ordinary accident litigation, best illustrated by cases that arise out of automobile accidents; (2) 'high stakes' litigation, illustrated by product liability and medical malpractice lawsuits; and (3) mass latent injury cases, such as asbestos. The observed steep growth in (per capita) numbers of lawsuits and (inflation-corrected) median verdicts could mainly be attributed to product liability and medical malpractice cases, which showed much more volatility over time than the rather stable development of automobile accident cases. The ensuing escalation in liability insurance costs caused problems with insurance premiums, and with insurance availability (Priest, 1987 and 1991; Viscusi, 1991a, 1991b). A first 'crisis' in the mid-1970s was more or less concentrated in the medical malpractice sphere and remained confined to a number of states, the next in the mid-1980s was much more general. Following these 'crises', most US states have adopted tort reform measures. The extent and specifics of that reform, however, vary from state to state.⁹ Some reforms make it more costly or difficult to file tort cases, such as by imposing limits to the

⁸ Hersch and Viscusi (2007) analyze tort litigation costs in Texas over the years 1988–2004 and report total transaction costs for each dollar received by claimants at \$0.75.

⁹ A listing of tort reforms by state up till now can be obtained from the American Tort Reform Association (ATRA) at www.atra.org. ATRA was co-founded in 1986 by the American Medical Association and the American Council of Engineering Companies.

application of the joint-and-several liability rule, reductions in the statutes of limitation, and caps on legal contingent fees. Other reforms aim at a reduction of damage awards, such as by limits on non-economic damages, limits on punitive damages, and reforms of the collateral source rule which prohibits the introduction at trial of evidence about the plaintiff receiving payments from other sources.

The figures for long-term trends suggest that tort reform has had some success. The steadily upward trend in tort filings was curbed at the end of the 1980s, with some serious up- and downswings until the end of the 1990s, and an apparently downward movement since then. Notwithstanding, tort reform is a continuing issue in the US (see, for example, Black et al., 2005). That makes it interesting to know which of the tort reform measures have been the more effective.

Several empirical studies have analyzed the effects of tort reform on the frequency and severity of tort claims and on liability insurance losses and premiums. In general, they did not address the social desirability of the reforms.¹⁰ For that, one should know whether the use of the tort system was indeed too intense, leading to overinvestment in care and defensive medicine. And one should have more precise information on whether the problems in the insurance industry were indeed due to overclaiming, or resulted from more or less 'natural' cycles in building up loss reserves and in investment returns on those reserves.

Most attention has been given to medical malpractice (cf. partial surveys in Studdert, Mello and Brennan, 2004 and Rapp, 2006). First, Danzon (1984) showed that pro-plaintiff common law doctrines adopted prior to 1970 contributed significantly to claim frequency. Subsequently, Danzon (1986) analyzed the tort reforms that followed in the mid-1970s. States that enacted shorter statutes of limitations and set outer limits on discovery rules had less growth in claim frequency than states that were more lenient to patients. Statutes permitting or mandating the offset of collateral benefits reduced both claim frequency and awards. And damage caps were effective in reducing plaintiffs' recovery. The latter result is also found by Yoon (2001), who reports on the implementation and nullification of damage-cap laws in Alabama between 1987 and 1995.¹¹ Other studies examined liability insurance company losses and premiums. The only reforms found by

¹⁰ The one or two studies that analyzed the effects of tort reform on the number of accidental injuries and on defensive medicine will be addressed in Section 16.5.

¹¹ In another article, Yoon (2004) examines the introduction of pretrial mandatory arbitration by screening panels in Nevada in 1986. The reform led to a decrease in the percentage of claims being resolved by the courts, but did not affect plaintiffs' recovery.

Zuckerman, Bovbjerg and Sloan (1990) to significantly lower premiums were those that impose a cap on the provider's liability or reduce the statute of limitations. That damage caps may indeed be an effective instrument (and perhaps the only one) to reduce losses, lower premiums and enhance insurer profitability is corroborated by the empirical results in Born and Viscusi (1998), Thorpe (2004) and Viscusi and Born (2005).

Some studies discuss the consequences of reform in other fields of tort. Viscusi et al. (1993) report that limits on non-economic damages and modifications of the joint-and-several liability rule have been able to restrain the costs of general liability insurance (which includes product liability). On the other hand, Lee, Browne and Schmitt (1994) find no real evidence that joint-and-several liability reform reduced the total number of tort filings, apart from a surge in the period before the reform took effect. And Browne and Puelz (1999) examine how tort reform has affected automobile accident claims. Caps on non-economic damages and collateral source reforms result in lower awards, while joint-and-several reforms are associated with an increase in non-economic damages. Caps on non-economic damages also reduce the number of filings, while reforms of the joint-and-several and collateral source rules have no significant effect.

On the whole, the most consistent finding is that caps on damage awards reduced the number of lawsuits filed, the value of awards, and insurance costs. There is little systematic evidence that any other type of reform had a significant impact on any of the various outcome measures studied. But that result may, after all, be more reflective of the lack of data than of a failure of the reforms (CBO, 2004).

16.5 Safety effects

Let us now address the incentive and safety effects. What is the impact of liability rules on the parties' level of care, on the number of accidents, on the frequency and severity of injuries? To survey that literature in a meaningful way, it is an absolute necessity to disaggregate and categorize. Between categories of accidents, there are large differences in the factors that bear on incentives. Some categories of accident are generally of a bilateral nature, where the level of care by the victim plays its role; medical malpractice on the other hand mostly has a unilateral character. Some categories of accidents occur in a contractual setting, where parties can bargain on safety elements and where prices can adjust; automobile accidents, on the other hand, generally occur between strangers. There are also important differences between accident categories in the price structure of insurance, and in the extent of public safety regulation. The evidence is therefore presented on a sector-by-sector basis.

16.5.1 Automobile accidents

The natural category to start with is that of automobile accidents. For one thing, it is the source of by far the largest number of claims. The most important characteristic of traffic accidents is that they are generally between strangers. Hence, transaction costs stand in the way of *ex ante* bargaining about the level of care and activities. Another important characteristic is the interchangeability of injurers and victims. The injurer who causes an accident by being careless may well get personally injured himself. This stimulates drivers to take a reasonable level of care, even in the absence of liability rules and public safety regulation. Most drivers carry some kind of insurance, which has generally been subject to a considerable degree of experience rating, at least under negligence.

Note that it is taken for granted (1) that the causes of most accidents can be identified with some degree of certainty, (2) that drivers can alter their accident-causing behavior (3) and that financial incentives can play a role (Bruce, 1984; Grayston, 1973).

No-fault Starting with Massachusetts in 1971, some 19 US states, New Zealand, one province in Canada and three provinces in Australia, have replaced tort law with no-fault systems for the compensation of personal injury losses in traffic accidents.¹² Under a pure no-fault system, injurers are not liable for victims' damages. Instead, victims bear their own damage or collect compensation from their own insurance company. Proponents of no-fault argue that it has lower administrative costs because there are fewer lawsuits,¹³ and that it is more equitable because victims can collect for their damage regardless of whether injurers are negligent. In practice, there are several variants of no-fault. Under 'pure' no-fault, victims must always collect damages from their own insurance company. No compensation is paid for non-economic damages (pain and suffering) and there are limits on recovery for economic damages (such as lost wages and medical costs). Under 'mixed' versions of no-fault, victims are allowed to opt out and to sue injurers under the tort system if their losses exceed a monetary or verbal threshold. Under the tort system, they may receive higher compensation, including non-economic damages. Mixed versions of no-fault are the rule in US states; pure no-fault has only been adopted in New Zealand, Quebec and the Northern Territory of Australia.

¹² Some US states that adopted no-fault later repealed it. By now, the number of states with a no-fault system has fallen to 14, with six states switching status in between.

¹³ This effect is documented in, for example, Devlin (1992) and Grabowski, Viscusi and Evans (1989).

Swan (1984) and McEwin (1989) present empirical evidence on the switch to no-fault in New Zealand and the Northern Territory, compared to other provinces of Australia; see also Brown (1985). The switch, with its abolition of negligence, was found to be associated with a substantial increase of 16 to 20 percent in the number of road fatalities.¹⁴ However, as McEwin points out, the results should be interpreted with care as the switch to no-fault was really a combination of changes in liability and insurance. Pure no-fault combined with compulsory non-merit-rated first-party insurance replaced tort with compulsory non-merit-rated liability insurance. The switch should be decomposed into its liability effects (the loss of the incentive to meet the negligence standard, but also an increase in uncompensated non-economic losses which might induce more care) and insurance effects (an increased coverage without merit rating to counter moral hazard). From his finding that the switch to mixed no-fault in Victoria and Tasmania did not affect road accident fatalities, McEwin concludes that compulsory first-party insurance, by itself, had no impact on road safety.

The switch to pure no-fault in Quebec was also a combination of changes in liability and insurance, but with somewhat different characteristics. Here, the existing private insurance system with experience-rated individual premiums was replaced by a public insurance system with a flat-rate pooled premium across all drivers. The vehicles that were previously uninsured, some 15 percent of the total, were forced to carry insurance. Devlin (1992) reports that the switch increased fatal road accidents by 9.6 percent. In the same vein, Gaudry (1992) concludes from his results that the switch certainly decreased road safety, although his finding of a 3.3 percent increase in fatal accidents is not very significant.

Let us now turn to the US states that adopted a mixed system of no-fault. A victim can bring a tort claim for his losses, but only if his injury is serious enough to exceed a 'threshold'. Such a threshold can either take a dollar form for the victim's costs of medical treatment or it may give a verbal description of the injury ('serious impairment of body function', 'permanent serious disfigurement'). The real value of these thresholds varies widely, not only between states, but also over time (much of which is due to inflation). For example, in 1987, the proportion of personal insurance claims that was ineligible for tort recovery under a no-fault threshold

¹⁴ Empirical studies in this field generally focus on fatalities, as it is the indicator which is most consistently measured over time and between jurisdictions. Derrig, Weisberg and Cheng (1994) and Cummins and Tennyson (1996), for example, provide evidence of significant *ex post* moral hazard effects in bodily injury claims.

varied between 37 percent for New Jersey and 88 percent for Michigan.¹⁵ There is also considerable variation between states and over time in the organization of insurance. Since 1970, when the purchase of automobile liability insurance was compulsory in only three states, many states have introduced that obligation. All states that introduced no-fault limitations on liability also adopted compulsory insurance requirements at the same time. Alas, the literature remains rather vague on the degree to which premiums depend on drivers' behavior.

Landes (1982) delivered the first empirical study of the relationship between no-fault restrictions on tort and road fatalities in the US. She found that the adoption of no-fault resulted in 4 percent additional fatal accidents when the threshold barring claims from tort recovery was low (\$500), and over 10 percent when the threshold was high (\$1,500). This decrease in road safety was subsequently confirmed by Medoff and Magaddino (1982), but contradicted by Kochanowski and Young (1985), DOT (1985) and Zador and Lund (1986), while Kabler's (1999) results are mixed. However, there are doubts about the econometric methodology of these studies. They do not adequately control for differences in other state characteristics that may affect accident rates. Moreover, they do not take account of the potential endogeneity of no-fault (cf. Harrington, 1994).

More recent studies try to avoid these problems. Cummins, Phillips and Weiss (2001) estimate that the switch to no-fault increased fatal accident rates by 7–13 percent, dependent on whether they use a 0–1 indicator or the tort claim ineligibility ratio. Sloan, Reilly and Schenzler (1994) and Derrig et al. (2002) also report an increase in road fatalities. Maybe the most careful analysis until now is by Cohen and Dehejia (2004), who try to unravel liability and insurance effects. Apart from the unequivocal moral hazard costs as a result of compulsory automobile insurance, the reductions in accident liability produced by no-fault laws appear to have led to an increase in traffic fatalities of about 10 percent.

A somewhat different perspective is followed by Cummins and Weiss (1992). They note that most US no-fault laws make no change in the legal (tort) rules involving property damage claims. As no-fault nevertheless appears to be positively associated with the frequency of total property damage claims, this yields indirect evidence that no-fault weakens driver incentives. Still another approach is taken by Devlin (1999), who uses micro-data on the severity of bodily injuries. She finds that the probability of sustaining a more serious accident is higher in no-fault states, which is taken

¹⁵ Data from the Insurance Research Council, as reported in Cummins, Phillips and Weiss (2001).

as yet another sign that drivers take less care under no-fault. But it seems perfectly possible that her finding is after all due to a reporting effect.

To be fair, it must be observed that the more recent literature is not entirely unanimous. Loughran (2001) argues that no-fault in the US could hardly have a substantive impact on driver behavior, as it does not affect the expected cost of an auto accident to the at-fault driver by any significant amount. Moreover, he provides empirical tests that suggest that no-fault had no statistically significant effect on the number of fatalities, the overall accident rate as measured by property damage claims and the rate of driver negligence in fatal accidents.

Other changes in liability rules Apart from the switch to no-fault in a selection of states, there have been two other, more widespread changes in liability rules that received some attention in the empirical literature.

The first of these is the shift from negligence with the defense of contributory negligence to some form of comparative negligence. Following White's (1989) calculations, such a shift may lower incentives to avoid accidents. Sloan, Reilly and Schenzler (1995) report from survey data that the switch may have increased binge drinking among drivers, but Sloan, Reilly and Schenzler (1994) do not find a significant impact when it comes to traffic fatality rates.

On the other hand, dram shop liability rules appear to have a rather robust, significant, positive effect on traffic safety (Chaloupka, Saffer and Grossman, 1993; Sloan, Reilly and Schenzler, 1994; Ruhm, 1996; Mast, Benson and Rasmussen, 1999; Young and Likens, 2000; Sloan et al., 2000; Whetten-Goldstein et al., 2000; Liang, Sloan and Stout, 2004).

Other safety measures Ever since motor vehicle accidents became a major cause of death, governments have been engaged in various kinds of safety-enhancing measures. Starting in the mid-1960s US federal regulation has made seat belts, energy-absorbing steering columns, penetration-resistant windshields and so on, standard elements of vehicle design. The construction and maintenance of roads and intersections have been dealt with. And public policies have been directed toward changing drivers' behavior, by regulating and enforcing speed limits and seat belt usage and by discouraging drunk driving.

There is a vast literature on these safety measures, which cannot be surveyed within the scope of this chapter.¹⁶ However, it may be useful to give a short introduction to the relevant empirical law and economics studies.

¹⁶ See, for example, Crandall and Graham (1984) who consider the Peltzman

Firstly, the no-fault studies discussed above generally control for other factors that might affect traffic safety. Among the control variables one comes across are seat belt laws, speed limits and so on. Alas, the set of variables varies from study to study and does not yield very robust results. Seat belt laws, for example, are sometimes reported to have a significant negative effect on traffic fatalities (cf. Swan, 1984), but this result is not confirmed in other places (see McEwin, 1989 or Cohen and Dehejia, 2004).

A second strand of the literature is centered on alcohol control policies. Cook and Tauchen (1984) found that reductions in the minimum legal drinking age (MLDA) during the early 1970s from 21 to 18 caused a substantial increase in auto fatality rates among youngsters. Males (1986), on the other hand, concluded that raising the MLDA does not produce any net savings of lives, as the lives that are saved among drivers below the MLDA is counterbalanced by the additional lives that are lost among drivers in the hazardous first year of legal drinking after the MLDA has been reached. Saffer and Grossman (1987a, 1987b) reported that a uniform drinking age of 21 does help to reduce youth motor vehicle accident deaths, but an increase in beer taxes may be even more effective. That beer taxes and MLDA policies, along with other measures, may deter careless driving has subsequently been confirmed in a number of studies (Wilkinson, 1987; Chaloupka, Saffer and Grossman, 1993; Sloan, Reilly and Schenzler, 1994 and 1995). The literature since then is much less concerted. For one thing, the field has changed. By the late 1980s, the MLDA in every state had been set at 21. So, one started to look for other similarly straightforward and relatively costless policies. Furthermore, the 1980s, have witnessed the rise of substantial grass-roots activity (such as Mothers Against Drunk Driving), which may affect both potential drinkers and policy making. But this activity and its effects are not easily accounted for in empirical analyses. In a similar vein, researchers have become aware of methodological shortcomings in earlier work. However, introducing additional controls for all kinds of relevant factors such as interstate disparities, fluctuating economic conditions, a full(er) set of alcohol policies and policy endogeneity as yet has produced no robust results, beyond the effectiveness of MLDA and dram shop liability rules. For instance, the result by Ruhm (1996) that higher beer taxes are associated with reductions in crash deaths is not confirmed by Dee (1999),

(1975) hypothesis that the installation of safety devices in cars will be offset by a behavioral response in driving intensity. They find that the net effect is clearly positive. Feber, Feldmeier and Crocker (2003) demonstrate the feasibility of exploiting insurance claims data to estimate the benefits of highway infrastructure improvements.

Mast, Benson and Rasmussen (1999), Young and Likens (2000) or Whetten-Goldstein et al. (2000). Similarly, the suggestion by Benson, Rasmussen and Mast (1999) to intensify criminal law enforcement efforts for driving under the influence does not have much support from other studies.

16.5.2 Industrial accidents

Society has several institutions available for the control of industrial injuries (Chelius, 1974). If safety control is left only to private markets, with no remedy for employer negligence, competition among informed workers would yield higher wages for more hazardous jobs. The compensating wage differentials would give the employer an incentive to deal with the risks faced by his employees, as expending resources on accident prevention might lower his wage bill. The government can also centralize control, by installing a regulatory body (such as OSHA in the US)¹⁷ that would promulgate and enforce safety standards for the organization of the workplace. Under a strict liability regime, it is the obligation to pay for all the accidents costs suffered by his employees which would give the employer an incentive to engage in accident prevention. And under negligence, it is the standard of care that would govern the employer, as taking due care would shield him from liability for the accident costs of his employees. Of course, if safety control is organized in such a manner (regulation, tort) that employees cannot expect their full accident costs to be covered by the employer, they will still require a corresponding wage premium to equalize the net remuneration with other, less hazardous jobs.

For a proper understanding of the field, at least two additional elements have to be taken into account. Firstly, the frequency and severity of industrial accidents in general not only depend on the preventive measures undertaken by the employer, but also on the level of care exercised by employees. If information and bargaining costs are sufficiently small, employer and employees may come to an understanding, trading obligations that follow from the existing safety control institution, such that in the end the least cost preventer will take the efficient amount of action. In full accordance with the Coase theorem, the choice of safety control institution would be irrelevant to the allocation of resources. However, wage bargaining is not without transaction costs, nor is monitoring the daily

¹⁷ The Occupational Safety and Health Administration, established in 1971. See for more details www.osha.gov. Empirical analysis by Viscusi (1979) failed to indicate any significant OSHA impact on industry health and safety investments and on injury rates. He points out that OSHA enforcement efforts are too weak to create an effective financial incentive for firms. They are, moreover, dwarfed by – the safety effect from – workers' compensation premiums (Moore and Viscusi, 1992).

behavior of employees at the workplace. But then, workplace safety will after all depend on the control mechanism.

Secondly, insurance may play a role. An employer who carries insurance for his (share in) employees' accident costs has an incentive to be less careful, to the extent that his level of care is not reflected in the premium. Similarly, insured employees may be subject to moral hazard. Either they might take less care, *ex ante*, which would result in more accidents and injuries. Or they might be tempted, *ex post*, to report more injuries and/or increase the size and duration of their claims.

From negligence to workers' compensation Between 1911 and 1949, the US states successively switched from negligence to a system of shared strict liability known as workers' compensation (WC). Under WC, an employer must compensate his employees for work-related accidents, regardless of the cause. The compensation, however, is substantially less than the employee's full accident costs. At the same time, the employee who is covered by WC can no longer sue his employer for negligence.

The shift from negligence to WC led to a substantial increase in the likelihood of compensation, but also (as a result of basic rates set by legislatures) in the median amount. If transaction costs prevented wages from adjusting fully, employers' incentives to prevent accidents can be expected to have increased, while employees' incentives to exercise care decreased. Two empirical studies have tried to find out which, if either, of these effects dominated. Chelius (1976) analyzed non-motor vehicle machinery fatalities between 1900 and 1940, and found that the switch to WC was associated with a relative decline in industrial accidents. Fishback (1987) looked at coal-mining fatal accident rates and reached the opposite conclusion. The difference between the results may, of course, be due to measurement errors in data. But it might also reflect a real difference, as the costs of accident prevention and monitoring workers may well have been relatively high in mining.

Anyway, transaction costs apparently matter.

Trends in workers' compensation Numerous studies examine the impact of workers' compensation benefits in recent times. The setting for the analysis is provided by a substantial variation in workers' compensation laws across states, but also over time as states started in the 1970s to improve benefit levels.

As a general result (Chelius, 1982; Butler and Worrall, 1983; Ruser, 1985; Chelius and Kavanaugh, 1988; Krueger, 1990; Butler, 1994), injury and claims frequency are found to increase as WC benefits increase, but severity rates may be lower. Claims frequency also increases as the length

of time an injured worker has to wait before receiving benefits is shorter. Butler and Worrall (1983) observe that wages do adjust, but only to some extent. Ruser (1985) notes that the effect of higher benefits on injury rates is smaller, the greater the degree of experience rating in employers' insurance. Relatively small firms are not perfectly experience rated, while large firms are sometimes allowed to self-insure.¹⁸

The findings nicely fit the theoretical argument above, given the presence of transaction costs. Moral hazard on the employees' side as a result of more generous benefits, *ex ante* plus *ex post*, apparently outstrips employers' reaction to intensify accident prevention. However, the findings do not allow us to disentangle these effects. How much did employers actually invest in safety measures, improving on workplace risks? Which part of employees' moral hazard is attributable to *ex ante* willingness to take more risk? And which part is the result of *ex post* filing of unwarranted claims or dragging claim duration?

That challenge is taken up in the literature. Moore and Viscusi (1989, 1992) study death rate data, where *ex post* reporting effects are not very plausible. *Ex ante* moral hazard effects cannot be ruled out *a priori*, but it is rather unlikely that workers will endanger their lives if only for a more generous compensation to their surviving heirs. The authors conclude that, in the absence of WC, fatality rates would be substantially higher. Thus, WC provides powerful incentives for safety to firms that outweigh moral hazard effects, at least for the more serious accidents.^{19,20}

To place moral hazard in its proper perspective, it is useful to end this section with a reference to Biddle and Roberts (2003). They analyzed a sample of workers who were reported by physicians as having repeated trauma injuries known or suspected to be work-related. A significant proportion of these workers did not make use of the WC system. Even among those who missed more than seven consecutive days of work, almost 40 percent made no attempt to receive wage-loss benefits, and 27 percent did not file for any sort of WC benefits. Many of the non-filers reported they had access to alternative programs offered by their employers, such as sick

¹⁸ Danzon and Harrington (2001) discuss WC insurance premiums and the role of regulatory price controls.

¹⁹ Moore and Viscusi (1989, 1992) also analyze the process of wage adjustment in some detail.

²⁰ In this context, one may also refer to Kötz and Schäfer (1993), who study the introduction of a system of rebates and surcharges in accident insurance in the German sugar industry. Their analysis provides another example of how economic incentives to take preventive measures may result in a reduction in the number of accidents.

leave. Apparently in this field too, we should be aware of many ‘false negatives’ alongside ‘false positives’ (cf. Section 16.3.2).

16.5.3 *Product liability*

The control of defective products has much in common with the control of industrial accidents. Again, several social institutions are available (Spence, 1977; Higgins, 1978). Safety control might be left to the market, with no remedy for producer negligence. If consumers are well informed about the safety characteristics of each product, prices would adjust to reflect the relative hazardousness. Products that are designed and/or manufactured with inefficiently low (or high) care would be driven out of the market. Under tort, the producer has a stimulus to follow the negligence standard of due care, as it would shield him from liability costs. Under strict liability, the obligation to pay for all his customers’ accident costs would give the producer an incentive for adequate investments in product safety. But the government can also centralize control, by directly imposing product standards (think of FDA and CPSC in the US).²¹

Once again, under perfect information with no bargaining costs producers and consumers will contract their way to an efficient solution, regardless of which social institution has been put in place. If safety control is organized in such a manner that consumers can claim their accident costs from the producer, this will be reflected in the price. Anyhow, consumers will be well aware of the ‘full’ price of the product. However, when consumers are ignorant of varying levels of product safety or underestimate the risks, they will not want to pay a higher price for a safer product version. And they will buy too much of a seemingly cheap, but unsafe product. In that case, strict liability may be preferable to negligence, as it informs consumers of the actual risks by adding an (implicit) insurance premium to the product price.

There is one important ‘but’ in the matter (Calfée and Rubin, 1992). Consumers might not generally be willing to insure for non-economic

²¹ The Food and Drug Administration, dating back to 1906, and the Consumer Product Safety Commission, established in 1972. See for more details www.fda.gov and www.cpsc.gov. Empirical studies of the impact of product safety regulation yield mixed results. Viscusi (1985) found no beneficial effect from CPSC actions. Magat and Moore (1996), however, report that safety standards significantly reduced bicycle accident rates. With respect to FDA activities in the period before World War II, Law (2006) observes that the threat of (*ex post*) enforcement was an ineffective deterrent. The FDA, nevertheless, made several important contributions to product safety where it had the capacity to offer (*ex ante*) benefits to compliant firms by way of quality certification or direct technical research assistance.

losses. If non-economic losses are actually covered under strict liability, prices would be unwarrantedly high, distorting consumer choices. This distortion may be particularly disturbing in the case of a product that, overall, serves to reduce risk (for example, a vaccine). The price premium for undesired insurance for non-economic damages might lead well-informed consumers to avoid the product, yielding more risk instead of less.

Empirical findings Let us now turn to empirics, where both the shift from negligence to strict liability during the 1960s and tort reform since the 1980s constitute interesting research topics. Apart from anecdotal evidence, however, firmly grounded results are scarce, mostly because of a paucity of relevant data. Data on accidental injuries in and around the home, for instance, have shortcomings because these accidents occur for all kinds of reasons, many of which are unrelated to defective or ill-designed products. In general, the specific product at stake and the intensity of its use are also unknown.

Manning (1994, 1997) analyzes the interplay between liability rules and product prices, especially for childhood vaccines.²² The shift from negligence to strict liability appears to have resulted in a dramatic price increase in the DPT vaccine, which has a small risk of very serious side effects, of well over 2,000 percent. A tentative calculation points out that \$5–7 are expended in the process of transferring \$1 of compensation to an injured consumer.

The (threatening) liability burden has also been the cause of products being withdrawn from the market. Garber (1993) presents a list that includes the Dalkon shield, Bendectin, the Bjork-Shiley heart valve, and the Markham silicone-gel breast implant. He also points to a series of already developed products whose market introduction has been delayed or forestalled by product liability concerns. Although hard evidence is lacking, it would seem that not all these decisions were equally appropriate. Bendectin is reported to have had much support in the medical community.

Viscusi and Moore (1993) analyze the empirical relationship between product liability costs and R&D expenditures. Product liability costs increase product R&D intensity initially, but there is a point beyond which the effect becomes negative. The authors infer from their findings that the

²² Takaoka (2006) examines how the shift from negligence to strict liability in Japan affected stock market prices. His results imply that firms can not fully recover the additional costs by increasing product prices. The shift to strict liability imposes liability and litigation costs on producers that exceed the value that consumers attach to the additional protection.

development of new, safer products is the primary outcome of product liability pressure.

That leaves the question of whether product liability affects accident frequency. Higgins (1978) examined the non-transport accidental death rate at home in 1960 and 1970. The shift from negligence to strict liability reduced the accident frequency in states with low levels of educational attainment and raised it in states with high levels. Rubin and Shepherd (2007) study the impact of tort reform since 1980. Their evidence suggests that reform of the collateral source rule was associated with an increase in non-motor vehicle accidental death rates, but several other tort reform measures, such as caps on non-economic damages, had the opposite effect.

In conclusion, strict liability would seem to stimulate R&D toward safer products, to drive defective products out of the market and to raise prices. The safety effect of the latter can be positive, when it curtails the purchase of qualitatively inferior products by imperfectly informed consumers. But the findings by Rubin and Shepherd suggest that liability can go too far in its cover of non-economic damages. Lowering the liability burden may then result in lower prices, which enables consumers to buy more risk-reducing products, such as safety equipment or medicines.

Asbestos This chapter cannot do without at least a few words about asbestos. Legal claims for injuries from asbestos involved more plaintiffs, more defendants and higher costs than any other type of product liability case in US litigation (White, 2004). Although in itself a highly useful product for its excellent fire-retardant capabilities, asbestos may cause a variety of diseases among production and insulation workers who breath in its fibers, but only after a long latency period of 20 to 40 years. Physicians recognized as early as the 1920s that exposure to asbestos caused diseases. But it was not until the early 1970s that an insulation worker won the first trial from a large asbestos producer, and that OSHA regulation started to impose limits on workplace asbestos exposure.

A central question for the current survey is how liability has fared in this instance. Not so well, initially. In the early 1930s, asbestos disease was not yet recognized as an industrial accident to be covered by workers' compensation. Under tort, some workers brought negligence claims against asbestos firms, but these were settled quietly. Asbestos producers reacted by accepting workers' compensation. As the workers' compensation system is explicitly designed to cover less than the employee's full losses, it provided inefficiently low incentives for the control of asbestos hazards (Deweese, 1986; Boden and Jones, 1987). Estimates, moreover, suggest that wage differentials were too small to be in any way compensating.

However, the gradual shift in product liability after World War II from negligence under privity of contract to strict liability opened the door for workers in the insulation industry to sue the asbestos producers. By the late 1970s, the pressure of litigation caused US producers to eliminate asbestos from most products, causing overall US consumption to decline sharply. Eventually, then, tort did its job of safety regulation, and did it better than government regulation, which had been captured by the large asbestos producers. The US system also performed better than Europe, where neither liability nor regulation was effective until the 1990s (White, 2004). But that is not to say that the job could not have been done better. Tort litigation has involved massive costs. By the end of 2002, total litigation costs for plaintiffs and defendants have been estimated to amount to \$40 billion, to obtain total net compensation of about \$30 billion (Carroll et al., 2005).

16.5.4 Medical malpractice

Medical injuries are a costly by-product of medical care, an otherwise beneficial activity. They have some specific characteristics, due to asymmetric information between health care providers and patients. Firstly, medical injuries are generally assumed to be unilateral. Secondly, patients, although in a contractual relationship with providers, cannot really be expected to monitor the level of care and to bargain on the price they would like to pay for safer treatment. In theory, then, tort could create incentives for optimal care per procedure.

Under US common law, health care providers are liable for injuries that are attributable to negligence. Courts generally define due care as the customary practice of practitioners of good standing or a significant minority of such professionals (Danzon, 2000). These custom-based standards may be systematically biased, relative to first-best efficient care. One possibility is that the standard for a specific treatment is set too low, for instance because it lags behind new medico-technical developments. But it is at least as likely that the standard is too high, as a result of the financial incentives created by provider fee-for-service reimbursement on the one hand and patient insurance for medical care, typically with modest co-payment and premiums unrelated to own use, on the other hand. However, these incentives for overuse may be corrected by capitation forms of payment that more recently have been adopted under managed care in the US.

As to incentives, it should be added that physicians are nearly universally insured against medical malpractice claims, with only a minimum of experience rating (Sloan, 1990). This does not necessarily imply that deterrence incentives are non-existent, but they mostly seem to hinge on reputation loss and (uninsured) time spent in litigation. For hospitals, the situation is somewhat different. After the tort crisis of the mid-1970s, many

hospitals found it difficult to obtain insurance and turned to self-insurance or to mutual companies with at least some experience rating (Mello and Brennan, 2002).

Finally, liability is not the only mechanism to counter medical malpractice. Professional ethics, referral networks, state licensing, disciplinary boards and hospital credentialing committees may also motivate physicians to act with proper care.

Defensive medicine The central concept in the empirical literature on the incentive effects of medical liability is 'defensive medicine'. Positive defensive medicine is defined as the use of extra-medical resources (tests, procedures, office visits) due to rising malpractice liability pressure. Negative defensive medicine, on the other hand, refers to decisions by doctors to cut back on the services they offer, to retire or to move to other states.

As to the latter, some studies examine how the medical malpractice crises of the past decades with rapidly rising liability insurance premiums and the ensuing tort reform measures have affected the supply of health care services. Dranove and Gron (2005) report that neurosurgeons in Florida significantly cut back their volume of operations as medical malpractice premiums rose; but there was no similar effect for obstetricians. Mello et al. (2005) present the results of a survey among medical specialists in Pennsylvania, which suggest that the supply of services in some areas is substantially reduced as a result of the cost of liability insurance. Kessler, Sage and Becker (2005) compare the trends in the supply of physicians in states that adopted and did not adopt tort reform laws. They found greater growth in states that adopted reforms directly limiting liability, such as caps on damage awards. A similar result is obtained by Klick and Stratmann (2004, 2007). But note that, even if all these studies point in the same direction, the net effect on public health is not clear. A large(r) supply of physicians in itself can be presumed to contribute positively to social welfare, but there may also be offsetting effects in terms of the level of care provided. Indeed, when Klick and Stratmann (2004, 2007) examine infant mortality, they can only find mixed results. And Dubay, Kaestner and Waidmann (2001), who report that malpractice liability pressure was associated with less prenatal care, cannot find evidence that it affected infant health adversely.

The literature on positive defensive medicine is somewhat more extensive. Most attention has gone to obstetrics, the field which has one of the highest levels of premiums, claim frequency and damage payments. Several studies examined the impact of malpractice claim risk on cesarean section rates. Cesarean sections are a treatment thought to be more frequently adopted in equivocal situations under the influence of malpractice liability

fears. But the empirical evidence is mixed. According to the results from Localio et al. (1993), higher malpractice claim risk increased the probability of delivery by cesarean section, but only at the hospital level, not for individual doctors. See also Rock (1988). The opposite effect is reported by Tussing and Wojtowycz (1992), while Baldwin et al. (1995) and Sloan et al. (1997) did not observe any effect. Dubay, Kaestner and Waidmann (1999) provide evidence that higher malpractice risk does result in increased use of cesarean sections, most notably for women with the lowest socioeconomic status. But when they look at the impact on infant health at birth, there isn't any. Thus, it is concluded that the observed defensive response to malpractice claim risk is socially wasteful. That result also seems to be in line with a separate study by Sloan et al. (1995), which showed no systematic improvement in various indicators of infant health at birth when obstetricians faced a higher malpractice litigation threat.

Kessler and McClellan (1996) focus on a rather different field of medicine, cardiac illness in the elderly. Their findings indicate that tort reform measures that directly limit liability, such as caps on damage awards, may reduce hospital expenditures by 5–9 percent. The effects are somewhat smaller for actual heart attacks (AMI) than for a relatively less severe form of heart disease (IHD), for which more patients may have marginal indications for treatment. Reforms, on the other hand, did not lead to any consequential differences in mortality or the occurrence of serious complications. Kessler and McClellan (2002) update the analysis, by extending it into the era of managed care. The reduction in defensive practices that can be achieved with direct tort reform is found to be smaller in areas with high managed care enrollment. Managed care apparently reduces physicians' incentives and ability to engage in defensive treatment for IHD. In that sense, managed care and direct tort reform are substitutes.

The results by Kessler and McClellan, however, have not gone uncontested. Beider and Hagen (2004) apply their methods to a broader set of ailments, but can find no evidence that direct tort reforms reduce medical spending. Dhankhar, Khan and Bagga (2007) study the effect of medical malpractice risk on the application of three different procedures for treating AMI patients. Their results suggest that higher medical malpractice risk leads to a choice of procedure that is less invasive for the patient, and cost saving. Interestingly enough, health outcomes of patients improve too.²³

²³ In this context, one may also refer to results by Fenn, Gray and Rickmann (2007) for the UK. They examine the impact of risk-sharing arrangements in medical liability insurance on the use of certain diagnostic procedures. Hospitals facing higher expected costs per claim as a result of higher deductibles use these tests more frequently.

Taking stock of the available evidence, it can be concluded that medical malpractice risk does affect the behavior of health care providers. Increasing malpractice pressure appears to have a negative impact on the supply of medical services, and it would seem to affect the choice of tests and procedures in the direction of defensive medicine. Tort reform measures like caps on damage awards might restore the balance. It can also be concluded that the incentives from medical liability interact with the financial incentives from the provision of medical services (fee-for-service versus managed care).

However, when it comes to efficiency, the findings should be interpreted with caution. If malpractice risk drives some physicians out of the market and makes other health care providers defensively adapt the treatment of their patients, this might be detrimental to social welfare if initially they all exercised due care. But there are two problems here. Firstly, it is not altogether impossible, as we know from Section 16.3.2. that the doctors concerned performed below standard. Secondly, there is no guarantee that the standard of due care as it is applied in tort litigation equals the efficient level. The results for health outcomes should provide us with the material for a more decisive answer. But these results are still rather scarce and mixed.

16.6 Cost-benefit analysis

There is a lot of disagreement in society over how well the tort system is performing the functions it is supposed to play. The record clearly has some black spots: the costs of administering the system are substantial; large numbers of negligently injured people don't claim and don't receive compensation; safety and welfare-enhancing products and services are sometimes barred from the market; defensive medicine unwarrantedly drives up health care costs. But the system is, on the other hand, an intrinsic part of the whole fabric of social institutions set up to promote safety. The literature surveyed here has made clear that financial incentives from liability rules definitely play their role as part of that fabric. Overall, for the tort system to be worth retaining, one would hope at a minimum that the benefits, in terms of injuries deterred, exceed the costs of litigation and other associated costs.

Some authors try and have a shot. Donohue (1989) started from the \$16–19 billion estimate by Kakalik and Pace (1986) of the tort system's administrative costs. He then wondered whether the tort system yields at least this much in deterrence benefits. For that purpose, he combined a \$91 billion NSC estimate of all accident costs in the US during the year 1987 (exclusive of work accidents governed primarily by workers' compensation) with Landes's (1982) finding that the switch from tort to no-fault

increased road fatalities by 15 percent, at most. Supposing that the tort system produces as much as a 15 percent reduction in all accident costs, the savings from deterrence would equal \$16 billion. If so, the tort system would not be cost-effective.

Schwartz (1994) counters this conclusion, by arguing that Donohue may have structured an appropriate inquiry, but used unsatisfactory data. The 'true' costs of accidents are definitely much higher than the NSC estimate on which Donohue relied, and should be adjusted upward so as to reach a total of over \$690 billion. The overhead costs of the tort system also need revision, as the Kakalik-Pace study did not consider the administrative costs of resolving claims that did not reach the point of an actual lawsuit. On balance, the annual costs of resolving all claims might well be \$25 billion. The minimum reduction in accident costs that the tort system would need to achieve in order to justify its overhead would then be less than 4 percent, which seems rather modest.

The minimum reduction would become even more modest, if one were to realize that without the tort system society would have to organize another way of victim compensation (for example, no-fault), with overhead costs of its own. That line is followed by Danzon (1985) and Devlin (1990), when they narrow the topic and move from the universe of all accidents to a particular field of tort. Devlin points out that the switch from tort to no-fault for automobile accidents in Quebec was an inefficient move. The estimated reduction of administrative costs by \$94 million per year is far behind the additional social cost of \$247 million as a result of the increase in traffic accidents. Danzon makes a back-of-the-envelope calculation for medical malpractice, comparing victim compensation through tort and first-party insurance. The tort system should deter at least one injury of comparable severity for every injury currently compensated, in order that the benefits from deterrence outweigh the additional litigation costs. Referring to results from the 1974 California study (CMA and CHA, 1977), which showed that only 1 in 25 incidents of negligent injury receives compensation, she concludes that only a 4 percent reduction in the rate of negligent injury is required to justify the costs of the tort system. Which should be no problem.

Yet, instructive as these calculations may be, they mainly have a heuristic value. Firstly, a full cost-benefit evaluation is impossible in the current state of affairs. Notably lacking are data on 'indirect' costs: the costs of precautions by potential injurers; the opportunity costs of goods and services that are withdrawn from the market or whose introduction is forestalled; the opportunity costs of goods and services that are not bought because of liability-induced price increases; and the disruption costs of layoffs and bankruptcies caused by liability problems (CBO, 2003). Secondly, even

if the benefits of the current system do outweigh its costs, the search for marginal improvements or more cost-effective alternatives remains an open question.

Bibliography

- Baldwin, L.M., L.G. Hart, M. Lloyd, M. Fordyce and R.A. Rosenblat (1995), 'Defensive Medicine and Obstetrics', *Journal of the American Medical Association*, 274, 1606–10.
- Beider, Perry and Stuart Hagen (2004), *Limiting Tort Liability for Medical Malpractice*, Washington, DC: Congressional Budget Office.
- Benson, Bruce L., David W. Rasmussen and Brent D. Mast (1999), 'Deterring Drunk Driving Fatalities: An Economics of Crime Perspective', *International Review of Law and Economics*, 19, 205–25.
- Biddle, Jeff and Karen Roberts (2003), 'Claiming Behavior in Workers' Compensation', *Journal of Risk and Insurance*, 70, 759–80.
- Black, Bernard, Charles Silver, David A. Hyman and William M. Sage (2005), 'Stability, Not Crisis: Medical Malpractice Claim Outcomes in Texas, 1988–2002', *Journal of Empirical Legal Studies*, 2, 207–59.
- Boden, Leslie I. and Carol A. Jones (1987), 'Occupational Disease Remedies: The Asbestos Experience', in Elizabeth E. Bailey (ed.), *Public Regulation: New Perspectives on Institutions and Policies*, Cambridge MA: MIT Press, pp. 321–46.
- Born, Patricia H. and W. Kip Viscusi (1998), 'The Distribution of the Insurance Market Effects of Tort Liability Reforms', *Brookings Papers on Economic Activity: Microeconomics*, 55–100.
- Bovbjerg, Randall R. (1995), *Medical Malpractice: Problems and Reforms*, Washington, DC: The Urban Institute.
- Brennan, T. A., L.L. Leape, N.M. Laird, A.R. Localio, A.G. Lawthers, J.P. Newhouse, P.C. Weiler and H.H. Hiatt (1991), 'Incidence of Adverse Events and Negligence in Hospitalized Patients: Results of the Harvard Medical Practice Study I', *New England Journal of Medicine*, 324, 370–76.
- Brown, Craig (1985), 'Deterrence in Tort and No-fault: The New Zealand Experience', *California Law Review*, 73, 976–1002.
- Browne, Mark J. and Robert Puelz (1999), 'The Effect of Legal Rules on the Value of Economic and Non-economic Damages and the Decision to File', *Journal of Risk and Uncertainty*, 18, 189–213.
- Bruce, Christopher (1984), 'The Deterrent Effects of Automobile Insurance and Tort Law: A Survey of the Empirical Literature', *Law and Policy*, 6, 67–100.
- Butler, Richard J. (1994), 'Economic Determinants of Workers' Compensation Trends', *Journal of Risk and Insurance*, 61, 383–401.
- Butler, Richard J. and John D. Worrall (1983), 'Workers' Compensation: Benefit and Injury Claims Rates in the Seventies', *Review of Economics and Statistics*, 65, 580–89.
- Calabresi, Guido (1970), *The Costs of Accidents: A Legal and Economic Analysis*, New Haven, CT and London: Yale University Press.
- Calfee, John E. and Paul H. Rubin (1992), 'Some Implications of Damage Payments for Nonpecuniary Losses', *Journal of Legal Studies*, 21, 371–411.
- Carroll, Stephen J., Deborah Hensler, Jennifer Gross, Elizabeth M. Sloss, Matthias Schonlau, Allan Abrahamse and J. Scott Ashwood (2005), *Asbestos Litigation*, Santa Monica, CA: RAND Institute for Civil Justice.
- CBO (Congressional Budget Office) (2003), *The Economics of U.S. Tort Liability: A Primer*, Washington, DC: CBO.
- CBO (Congressional Budget Office) (2004), *The Effects of Tort Reform: Evidence from the States*, Washington, DC: CBO.
- Chaloupka, Frank J., Henry Saffer and Michael Grossman (1993), 'Alcohol-control Policies and Motor-vehicle Fatalities', *Journal of Legal Studies*, 22, 161–86.

- Chelius, James R. (1974), 'The Control of Industrial Accidents: Economic Theory and Empirical Evidence', *Law and Contemporary Problems*, 38, 700–29.
- Chelius, James R. (1976), 'Liability for Industrial Accidents: A Comparison of Negligence and Strict Liability Systems', *Journal of Legal Studies*, 5, 293–309.
- Chelius, James R. (1982), 'The Influence of Workers' Compensation on Safety Incentives', *Industrial and Labor Relations Review*, 35, 235–42.
- Chelius, James R. and Karen Kavanaugh (1988), 'Workers' Compensation and the Level of Occupational Injuries', *Journal of Risk and Insurance*, 55, 315–23.
- Cheney, F.W., K. Posner, R.A. Caplan and R.J. Ward (1989), 'Standard of Care and Anesthesia Liability', *Journal of the American Medical Association*, 261, 1599–603.
- Clermont, Kevin M. and Theodore Eisenberg (1992), 'Trial by Jury or Judge: Transcending Empiricism', *Cornell Law Review*, 77, 1124–77.
- CMA (California Medical Association) and CHA (California Hospital Association) (1977), *Report on the Medical Insurance Feasibility Study*, San Francisco, CA: Sutter Publications.
- Cohen, Alma and Rajeev Dehejia (2004), 'The Effect of Automobile Insurance and Accident Liability Laws on Traffic Fatalities', *Journal of Law and Economics*, 47, 357–93.
- Cohen, Thomas H. (2004), *Tort Trials and Verdicts in Large Counties, 2001*, Bulletin NCJ 206240, Washington, DC: Bureau of Justice Statistics.
- Cohen, Thomas H. (2005), *Federal Tort Trials and Verdicts, 2002–03*, Bulletin NCJ 208713, Washington, DC: Bureau of Justice Statistics.
- Cook, Philip J. and George Tauchen (1984), 'The Effect of Minimum Drinking Age Legislation on Youthful Auto Fatalities, 1970–1977', *Journal of Legal Studies*, 13, 169–90.
- Crandall, Robert W. and John D. Graham (1984), 'Automobile Safety Regulation and Offsetting Behavior: Some New Empirical Estimates', *American Economic Review*, 74 (2), 328–31.
- Cummins, J. David, Richard D. Phillips and Mary A. Weiss (2001), 'The Incentive Effects of No-fault Automobile Insurance', *Journal of Law and Economics*, 44, 427–64.
- Cummins, J. David and Sharon Tennyson (1996), 'Moral Hazard in Insurance Claiming: Evidence from Automobile Insurance', *Journal of Risk and Uncertainty*, 12, 29–50.
- Cummins, J. David and Mary A. Weiss (1992), 'Incentive Effects of No-fault Automobile Insurance: Evidence from Insurance Claim Data', in Georges Dionne (ed.), *Contributions to Insurance Economics*, Norwell, MA: Kluwer Academic Publishers, pp. 445–70.
- Danzon, Patricia M. (1984), 'The Frequency and Severity of Medical Malpractice Claims', *Journal of Law and Economics*, 27, 115–48.
- Danzon, Patricia M. (1985), *Medical Malpractice: Theory, Evidence and Public Policy*, Cambridge, MA: Harvard University Press.
- Danzon, Patricia M. (1986), 'The Frequency and Severity of Medical Malpractice Claims: New Evidence', *Law and Contemporary Problems*, 49 (5), 57–84.
- Danzon, Patricia M. (2000), 'Liability for Medical Malpractice', in Anthony J. Culyer and Joseph P. Newhouse (eds), *Handbook of Health Economics*, Amsterdam: North-Holland, vol. 1B, pp. 1339–404.
- Danzon, Patricia M. and Scott E. Harrington (2001), 'Workers' Compensation Rate Regulation: How Price Controls Increase Costs', *Journal of Law and Economics*, 44, 1–36.
- Danzon, Patricia M. and Lee A. Lillard (1983), 'Settlement out of Court: The Disposition of Medical Malpractice Claims', *Journal of Legal Studies*, 12, 345–77.
- Dee, Thomas S. (1999), 'State Alcohol Policies, Teen Drinking and Traffic Fatalities,' *Journal of Public Economics*, 72, 289–315.
- Derrig, Richard A., Maria Segui-Gomez, Ali Abtahi and Ling-Ling Liu (2002), 'The Effect of Population Safety Belt Usage Rates on Motor Vehicle-Related Fatalities', *Accident Analysis and Prevention*, 34, 101–10.
- Derrig, Richard A., Herbert I. Weisberg and Xiu Cheng (1994), 'Behavioral Factors and Lotteries under No-fault with a Monetary Threshold: A Study of Massachusetts Automobile Claims', *Journal of Risk and Insurance*, 61, 245–75.

- Devlin, Rose Anne (1990), 'Some Welfare Implications of No-fault Automobile Insurance', *International Review of Law and Economics*, 10, 193–205.
- Devlin, Rose Anne (1992), 'Liability versus No-fault Automobile Insurance Regimes: An Analysis of the Experience of Quebec', in Georges Dionne (ed.), *Contributions to Insurance Economics*, Norwell, MA: Kluwer Academic Publishers, pp. 499–520.
- Devlin, Rose Anne (1999), 'No-fault Automobile Insurance and Accident Severity: Lessons Still to be Learned', in Georges Dionne and Claire Laberge-Nadeau (eds), *Automobile Insurance: Road Safety, New Drivers, Risks, Insurance Fraud and Regulation*, Norwell, MA: Kluwer Academic Publishers, pp. 267–82.
- Deweese, Donald N. (1986), 'Economic Incentives for Controlling Industrial Disease: The Asbestos Case', *Journal of Legal Studies*, 15, 289–319.
- Deweese, Donald N., David Duff and Michael J. Trebilcock (1996), *Exploring the Domain of Accident Law: Taking the Facts Seriously*, New York and Oxford: Oxford University Press.
- Deweese, Donald N. and Michael J. Trebilcock (1992), 'The Efficacy of the Tort System and its Alternatives: A Review of Empirical Evidence', *Osgoode Hall Law Journal*, 30, 57–138.
- Dhankhar, Praveen, M. Mahmud Khan and Shalini Bagga (2007), 'Effect of Medical Malpractice on Resource Use and Mortality of AMI Patients', *Journal of Empirical Legal Studies*, 4, 163–83.
- Donohue, John J. III (1989), 'The Law and Economics of Tort Law: The Profound Revolution', *Harvard Law Review*, 102, 1047–73.
- DOT (US Department of Transportation) (1985), *Compensating Auto Accident Victims: A Follow-up Report on No-fault Auto Insurance Experiences*, Washington, DC: US Government Printing Office.
- Dranove, David and Anne Gron (2005), 'Effects of the Malpractice Crisis on Access to and Incidence of High-risk Procedures: Evidence from Florida', *Health Affairs*, 24, 802–10.
- Dubay, Lisa, Robert Kaestner and Timothy Waidmann (1999), 'The Impact of Malpractice Fears on Cesarean Section Rates', *Journal of Health Economics*, 18, 491–522.
- Dubay, Lisa, Robert Kaestner and Timothy Waidmann (2001), 'Medical Malpractice Liability and its Effect on Prenatal Care Utilization and Infant Health', *Journal of Health Economics*, 20, 591–611.
- Eaton, Thomas A., David B. Mustard and Susette M. Talarico (2005), 'The Effects of Seeking Punitive Damages on the Processing of Tort Claims', *Journal of Legal Studies*, 34, 343–69.
- Eaton, Thomas A. and Susette M. Talarico (1996), 'A Profile of Tort Litigation in Georgia and Reflections on Tort Reform', *Georgia Law Review*, 30, 627–729.
- Eaton, Thomas A., Susette M. Talarico and Richard E. Dunn (2000), 'Another Brick in the Wall: An Empirical Look at Georgia Tort Litigation in the 1990s', *Georgia Law Review*, 34, 1049–154.
- Eisenberg, Theodore, John Goerd, Brian Ostrom, David Rottman and Martin T. Wells (1997), 'The Predictability of Punitive Damages', *Journal of Legal Studies*, 26, 623–61.
- Eisenberg, Theodore, Paula L. Hannaford-Agor, Michael Heise, Neil LaFountain, G. Thomas Munsterman, Brian Ostrom and Martin T. Wells (2006), 'Juries, Judges, and Punitive Damages: Empirical Analyses Using the Civil Justice Survey of State Courts 1992, 1996, and 2001 Data', *Journal of Empirical Legal Studies*, 3, 263–95.
- Eisenberg, Theodore and James A. Jr. Henderson (1992), 'Inside the Quiet Revolution in Products Liability', *UCLA Law Review*, 39, 731–810.
- Eisenberg, Theodore, Neil LaFountain, Brian Ostrom, David Rottman and Martin T. Wells (2002), 'Juries, Judges, and Punitive Damages: An Empirical Study', *Cornell Law Review*, 87, 743–82.
- Epstein, Richard A. (1988), 'The Political Economy of Product Liability Reform', *American Economic Review*, 78 (2), 311–15.
- Farber, Henry S. and Michelle J. White (1991), 'Medical Malpractice: An Empirical Examination of the Litigation Process', *RAND Journal of Economics*, 22, 199–217.
- Farber, Henry S. and Michelle J. White (1994), 'A Comparison of Formal versus Informal Dispute Resolution in Medical Malpractice', *Journal of Legal Studies*, 23, 777–806.

- Feber, David J., Judith M. Feldmeier and Keith J. Crocker (2003), 'The Economic Effects of Road Safety Improvements: An Insurance Claims Analysis', *Journal of Risk and Insurance*, 70, 651–64.
- Felstiner, William L.F., Richard L. Abel and Austin Sarat (1981), 'The Emergence and Transformation of Disputes: Naming, Blaming, Claiming . . .', *Law and Society Review*, 15, 631–54.
- Fenn, Paul, Alastair Gray and Neil Rickman (2007), 'Liability, Insurance and Medical Malpractice', *Journal of Health Economics*, 26, 1057–70.
- Fishback, Price V. (1987), 'Liability Rules and Accident Prevention in the Workplace: Empirical Evidence from the Early Twentieth Century', *Journal of Legal Studies*, 16, 305–28.
- Galanter, Marc (1996), 'Real World Torts: An Antidote to Anecdote', *Maryland Law Review*, 55, 1093–160.
- Garber, Steven (1993), *Product Liability and the Economics of Pharmaceuticals and Medical Devices*, Santa Monica, CA: RAND Institute for Civil Justice.
- Gaudry, Marc (1992), 'Measuring the Effects of the No-fault 1978 Quebec Automobile Insurance Act with the DRAG model', in Georges Dionne (ed.), *Contributions to Insurance Economics*, Norwell, MA: Kluwer Academic Publishers, pp. 471–98.
- Grabowski, Henry, W. Kip Viscusi and William Evans (1989), 'Price and Availability Tradeoffs of Automobile Insurance Regulation', *Journal of Risk and Insurance*, 56, 275–99.
- Grayston, Richard W. (1973), 'Deterrence in Automobile Liability Insurance: The Empirical Evidence', *Insurance Counsel Journal*, 40, 117–29.
- Greene, William H. (2008), *Econometric Analysis*, Upper Saddle River, NJ: Prentice Hall, 6th edition.
- Harrington, Scott E. (1994), 'State Decisions to Limit Tort Liability: An Empirical Analysis of No-fault Automobile Insurance Laws', *Journal of Risk and Insurance*, 61, 276–94.
- Harris, Catherine T., Ralph Peeples and Thomas B. Metzloff (2006), 'Placing "Standard of Care" in Context: the Impact of Witness Potential and Attorney Reputation in Medical Malpractice Litigation', *Journal of Empirical Legal Studies*, 3, 467–96.
- Harvard Medical Practice Study (1990), *Patients, Doctors, and Lawyers: Medical Injury, Malpractice Litigation, and Patient Compensation in New York*, Cambridge, MA: President and Fellows of Harvard College.
- Helland, Eric and Alexander Tabarrok (2000), 'Runaway Judges? Selection Effects and the Jury', *Journal of Law, Economics, and Organization*, 16, 306–33.
- Henderson, James A. Jr and Theodore Eisenberg (1990), 'The Quiet Revolution in Products Liability: An Empirical Study of Legal Change', *UCLA Law Review*, 37, 479–553.
- Hensler, Deborah R. (1987), 'Trends in Tort Litigation: Findings from the Institute for Civil Justice's Research', *Ohio State Law Journal*, 48, 479–96.
- Hensler, Deborah R., M. Susan Marquis, Allan F. Abrahamse, Sandra H. Berry, Patricia A. Ebener, Elizabeth G. Lewis, E. Allan Lind, Robert J. MacCoun, Willard G. Manning, Jeannette A. Rogowski and Mary E. Vaiana (1991), *Compensation for Accidental Injuries in the United States*, Santa Monica, CA: RAND Institute for Civil Justice.
- Hersch, Joni and W. Kip Viscusi (2004), 'Punitive Damages: How Judges and Juries Perform', *Journal of Legal Studies*, 33, 1–36.
- Hersch, Joni and W. Kip Viscusi (2007), 'Tort Liability Litigation Costs for Commercial Claims', *American Law and Economics Review*, 9, 330–69.
- Higgins, Richard S. (1978), 'Producers' Liability and Product-Related Accidents', *Journal of Legal Studies*, 7, 299–321.
- Jacobson, Mireille (2003), 'Drug Testing in the Trucking Industry: The Effect on Highway Safety', *Journal of Law and Economics*, 46, 131–56.
- Kabler, Brent (1999), 'The Case Against Auto Choice', *Journal of Insurance Regulation*, 18, 53–79.
- Kakalik, James S. and M. Nicholas Pace (1986), *Costs and Compensation Paid in Tort Litigation*, Santa Monica, CA: RAND Institute for Civil Justice.

- Karpoff, Jonathan M. and John R. Jr. Lott (1999), 'On the Determinants and Importance of Punitive Damage Awards', *Journal of Law and Economics*, 42, 527–73.
- Kessler, Daniel and Mark McClellan (1996), 'Do Doctors Practice Defensive Medicine?', *Quarterly Journal of Economics*, 111, 353–90.
- Kessler, Daniel and Mark McClellan (2002), 'Malpractice Law and Health Care Reform: Optimal Liability Policy in an Era of Managed Care', *Journal of Public Economics*, 84, 175–97.
- Kessler, Daniel P., William M. Sage and David J. Becker (2005), 'Impact of Malpractice Reforms on the Supply of Physician Services', *Journal of the American Medical Association*, 293, 2618–25.
- Klick, Jonathan and Thomas Stratmann (2004), 'Does Medical Malpractice Reform Help States Retain Physicians and Does It Matter?', Working Paper available from <http://papers.ssrn.com>.
- Klick, Jonathan and Thomas Stratmann (2007), 'Medical Malpractice Reform and Physicians in High Risk Specialties', Working Paper available from <http://papers.ssrn.com>.
- Kochanowski, S. Paul and Madelyn V. Young (1985), 'Deterrent Aspects of No-fault Automobile Insurance: Some Empirical Findings', *Journal of Risk and Insurance*, 52, 269–88.
- Koenig, Thomas (1998), 'The Shadow Effect of Punitive Damages on Settlements', *Wisconsin Law Review*, 169–209.
- Kötz, Hein and Hans-Bernd Schäfer (1993), 'Economic Incentives to Accident Prevention: An Empirical Study of the German Sugar Industry', *International Review of Law and Economics*, 13, 19–33.
- Krueger, Alan B. (1990), 'Incentive Effects of Workers' Compensation Insurance', *Journal of Public Economics*, 41, 73–99.
- Landes, Elisabeth M. (1982), 'Insurance Liability and Accidents: A Theoretical and Empirical Investigation of the Effect of No-fault Accidents', *Journal of Law and Economics*, 25, 49–65.
- Landes, William M. (2003), 'The Empirical Side of Law & Economics', *University of Chicago Law Review*, 70, 167–80.
- Landes, William M. and Richard A. Posner (1987), *The Economic Structure of Tort Law*, Cambridge, MA and London: Harvard University Press.
- Law, Marc T. (2006), 'How do Regulators Regulate? Enforcement of the Pure Food and Drugs Act', *Journal of Law, Economics, and Organization*, 22, 459–89.
- Leape, Lucian L. et al. (1991), 'The Nature of Adverse Events in Hospitalized Patients: Results of the Harvard Medical Practice Study II', *New England Journal of Medicine*, 324, 377–84.
- Lee, Han-Duck, Mark J. Browne and Joan T. Schmitt (1994), 'How does Joint and Several Tort Reform Affect the Rate of Tort Filings?' Evidence from the State Courts', *Journal of Risk and Insurance*, 61, 295–316.
- Liang, Lan, Frank A. Sloan and Emily M. Stout (2004), 'Precaution, Compensation, and Threats of Sanction: The Case of Alcohol Servers', *International Review of Law and Economics*, 24, 49–70.
- Liao, Yu-Ping and Michelle J. White (2002), 'No-fault for Motor Vehicles: An Economic Analysis', *American Law and Economics Review*, 4, 258–94.
- Localio, A.R., A.G. Lawthers, T.A. Brennan, N.M. Laird, L.E. Hebert, L.M. Peterson, J.P. Newhouse, P.C. Weiler and H.H. Hiatt (1991), 'Relation between Malpractice Claims and Adverse Events due to Negligence: Results of the Harvard Medical Practice Study III', *New England Journal of Medicine*, 325, 245–51.
- Localio, A.R., A.G. Lawthers, J.M. Bengtson, L.E. Hebert, S.L. Weaver, T.A. Brennan and J.R. Landis (1993), 'Relationship between Malpractice Claims and Cesarean Delivery', *Journal of the American Medical Association*, 269, 366–73.
- Loughran, David S. (2001), 'The Effect of No-fault Automobile Insurance on Driver Behavior and Automobile Accidents in the United States', in Edward L. Lascher Jr and Michael R. Powers (eds), *The Economics and Politics of Choice No-fault Insurance*, Norwell, MA: Kluwer Academic Publishers, pp. 95–138.

- Magat, Wesley A. and Michael J. Moore (1996), 'Consumer Product Safety Regulation in the United States and the United Kingdom: The Case of Bicycles', *RAND Journal of Economics*, 27, 148–64.
- Males, Mike A. (1986), 'The Minimum Purchase Age for Alcohol and Young-driver Fatal Crashes: A Long-term View', *Journal of Legal Studies*, 15, 181–211.
- Manning, Richard L. (1994), 'Changing Rules in Tort Law and the Market for Childhood Vaccines', *Journal of Law and Economics*, 37, 247–75.
- Manning, Richard L. (1997), 'Products Liability and Prescription Drug Prices in Canada and the United States', *Journal of Law and Economics*, 40, 203–43.
- Mast, Brent D., Bruce L. Benson and David W. Rasmussen (1999), 'Beer Taxation and Alcohol-related Traffic Fatalities', *Southern Economic Journal*, 66, 214–49.
- McEwin, R. Ian (1989), 'No-fault and Road Accidents: Some Australian Evidence', *International Review of Law and Economics*, 9, 13–24.
- Medoff, H. Marshall and Joseph P. Magaddino (1982), 'An Empirical Analysis of No-fault Insurance', *Evaluation Review*, 6, 373–92.
- Mello, Michelle M. and Troyen A. Brennan (2002), 'Deterrence of Medical Errors: Theory and Evidence from Malpractice Reform', *Texas Law Review*, 80, 1595–637.
- Mello, Michelle M., David M. Studdert, Catherine M. DesRoches, Jordon Peugh, Kinga Zapert, Troyen A. Brennan and William M. Sage (2005), 'Effects of a Malpractice Crisis on Specialist Supply and Patient Access to Care', *Annals of Surgery*, 242, 621–28.
- Mills, Don H. (1978), 'Medical Insurance Feasibility Study – A Technical Summary', *Western Journal of Medicine*, 128, 360–65.
- Moore, Michael J. and W. Kip Viscusi (1989), 'Promoting Safety through Workers' Compensation: The Efficacy and Net Wage Costs of Injury Insurance', *RAND Journal of Economics*, 20, 499–515.
- Moore, Michael J. and W. Kip Viscusi (1992), 'Social Insurance in Market Contexts: Implications of the Structure of Workers' Compensation for Job Safety and Wages', in Georges Dionne (ed.), *Contributions to Insurance Economics*, Norwell, MA: Kluwer Academic Publishers, pp. 399–422.
- Ostrom, Brian J., Neal B. Kauder, Robert C. LaFountain, Richard Y. Schauffler and Shauna M. Strickland (2004), *Examining the Work of State Courts, 2003*, Williamsburg, VA: National Center for State Courts.
- Peltzman, Sam (1975), 'The Effects of Automobile Safety Regulation', *Journal of Political Economy*, 83, 677–725.
- Polinsky, A. Mitchell (1997), 'Are Punitive Damages Really Insignificant, Predictable, and Rational? A Comment on Eisenberg et al.', *Journal of Legal Studies*, 26, 663–77.
- Posner, Richard A. (1972), 'A Theory of Negligence', *Journal of Legal Studies*, 1, 29–96.
- Posner, Richard A. (1997), 'Explaining the Variance in the Number of Tort Suits across U.S. States and between the United States and England', *Journal of Legal Studies*, 26, 477–89.
- Priest, George L. (1987), 'The Current Insurance Crisis and Modern Tort Law', *Yale Law Journal*, 96, 1521–90.
- Priest, George L. (1991), 'The Modern Expansion of Tort Liability: Its Sources, its Effects, and its Reform', *Journal of Economic Perspectives*, 5 (3), 31–50.
- Priest, George L. and Benjamin Klein (1984), 'The Selection of Disputes for Litigation', *Journal of Legal Studies*, 13, 1–55.
- Rapp, Geoffrey Christopher (2006), 'Doctors, Duties, Death and Data: A Critical Review of the Empirical Literature on Medical Malpractice and Tort Reform', *Northern Illinois University Law Review*, 26, 439–68.
- Rock, Steven M. (1988), 'Malpractice Premiums and Primary Cesarean Section Rates in New York and Illinois', *Public Health Reports*, 103, 459–63.
- Rubin, Paul H. (2005), 'Public Choice and Tort Reform', *Public Choice*, 124, 223–36.
- Rubin, Paul H. and Joanna M. Shepherd (2007), 'Tort Reform and Accidental Deaths', *Journal of Law and Economics*, 50, 221–38.
- Ruhm, Christopher J. (1996), 'Alcohol Policies and Highway Vehicle Fatalities', *Journal of Health Economics*, 15, 435–54.

- Ruser, John W. (1985), 'Workers' Compensation Insurance, Experience-rating, and Occupational Injuries', *RAND Journal of Economics*, 16, 487–503.
- Saffer, Henry and Michael Grossman (1987a), 'Beer Taxes, the Legal Drinking Age, and Youth Motor Vehicle Fatalities', *Journal of Legal Studies*, 16, 351–74.
- Saffer, Henry and Michael Grossman (1987b), 'Drinking Age Laws and Highway Mortality Rates: Cause and Effect', *Economic Inquiry*, 25, 403–12.
- Saks, Michael J. (1992), 'Do We Really Know Anything about the Behavior of the Tort Litigation System – And Why Not?', *University of Pennsylvania Law Review*, 140, 1147–292.
- Schauffler, Richard Y, Robert C. LaFountain, Shauna M. Strickland and William E. Raftery (eds) (2006), *Examining the Work of State Courts, 2005*, Williamsburg, VA: National Center for State Courts.
- Schwartz, Gary T. (1994), 'Reality in the Economic Analysis of Tort Law: Does Tort Law Really Deter?', *UCLA Law Review*, 42, 377–444.
- Schwartz, Gary T. (2000), 'Auto No-fault and First-party Insurance: Advantages and Problems', *Southern California Law Review*, 73, 611–76.
- Schwartz, Gary T. (2002), 'Empiricism and Tort Law', *University of Illinois Law Review*, 1067–82.
- Shanley, Michael G. and Mark A. Peterson (1987), *Posttrial Adjustments to Jury Awards*, Santa Monica, CA: RAND Institute for Civil Justice.
- Shavell, Steven (1987), *Economic Analysis of Accident Law*, Cambridge, MA and London: Harvard University Press.
- Shavell, Steven (2004), *Foundations of Economic Analysis of Law*, Cambridge, MA and London: Harvard University Press.
- Sloan, Frank A. (1990), 'Experience Rating: Does it Make Sense for Medical Malpractice Insurance?', *American Economic Review*, 80, 128–33.
- Sloan, Frank A., Stephen S. Entman, Bridget A. Reilly, Cheryl A. Glass, Gerald B. Hickson and Harold H. Zhang (1997), 'Tort Liability and Obstetricians' Care Levels', *International Review of Law and Economics*, 17, 245–60.
- Sloan, Frank A. and Thomas J. Hoerger (1991), 'Uncertainty, Information and Resolution of Medical Malpractice Disputes', *Journal of Risk and Uncertainty*, 4, 403–23.
- Sloan, Frank A. and Chee Ruey Hsieh (1990), 'Variability in Medical Malpractice Payments: Is the Compensation Fair', *Law and Society Review*, 24, 997–1039.
- Sloan, Frank A., Lan Liang, Emily M. Stout and Kathryn Whetten-Goldstein (2000), 'Liability, Risk, Perceptions, and Precautions at Bars', *Journal of Law and Economics*, 43, 473–501.
- Sloan, Frank A., Bridget A. Reilly and Christoph M. Schenzler (1994), 'Tort Liability versus Other Approaches for Deterring Careless Driving', *International Review of Law and Economics*, 14, 53–72.
- Sloan, Frank A., Bridget A. Reilly and Christoph M. Schenzler (1995), 'Effects of Tort Liability and Insurance on Heavy Drinking and Drinking and Driving', *Journal of Law and Economics*, 38, 49–77.
- Sloan, Frank A., Kathryn Whetten-Goldstein, Stephen S. Entman, Elizabeth D. Kulas and Emily M. Stout (1997), 'The Road from Medical Injury to Claims Resolution: How No-fault and Tort Differ', *Law and Contemporary Problems*, 60, 35–70.
- Sloan, Frank A., Kathryn Whetten-Goldstein, Penny B. Githens and Stephen S. Entman (1995), 'Effects of the Threat of Medical Malpractice Litigation and Other Factors on Birth Outcomes', *Medical Care*, 33, 700–14.
- Smith, Steven K., Carol J. DeFrances, Patrick A. Langan and John Goerdts (1995), *Tort Cases in Large Counties, 1992*, Special Report NCJ 153177, Washington, DC: Bureau of Justice Statistics.
- Spelman, William (2000), 'What Recent Studies Do (and Don't) Tell Us about Imprisonment and Crime', in Michael Tonry (ed.), *Crime and Justice: A Review of Research*, vol. 27, Chicago, IL: University of Chicago Press, pp. 419–94.
- Spence, Michael (1977), 'Consumer Misperceptions, Product Failure and Product Liability', *Review of Economic Studies*, 44, 561–72.

- Studdert, David M., Troyen A. Brennan and Eric J. Thomas (2000), 'Beyond Dead Reckoning: Measures of Medical Injury Burden, Malpractice Litigation, and Alternative Compensation Models from Utah and Colorado', *Indiana Law Review*, 33, 1643–86.
- Studdert, David M., Michelle M. Mello and Troyen A. Brennan (2004), 'Medical Malpractice', *New England Journal of Medicine*, 350, 283–92.
- Studdert, David M., Michelle M. Mello, Atul A. Gawande, Tejal K. Gandhi, Allen Kachalia, Catherine Yoon, Ann Louise Puopolo and Troyen A. Brennan (2006), 'Claims, Errors, and Compensation Payments in Medical Malpractice Litigation', *New England Journal of Medicine*, 354, 2024–33.
- Studdert, David M., Eric J. Thomas, Helen R. Burstin, Brett I.W. Zbar, E. John Orav and Troyen A. Brennan (2000), 'Negligent Care and Malpractice Claiming Behavior in Utah and Colorado', *Medical Care*, 38, 250–60.
- Swan, Peter L. (1984), 'The Economics of Law: Economic Imperialism in Negligence Law, No-fault Insurance, Occupational Licensing and Criminology', *Australian Economic Review*, 67, 92–108.
- Tabarrok, Alexander and Eric Helland (1999), 'Court Politics: The Political Economy of Tort Awards', *Journal of Law and Economics*, 42, 157–88.
- Takaoka, Sumiko (2006), 'Product Defects and the Value of the Firm in Japan: The Impact of the Product Liability Law', *Journal of Legal Studies*, 35, 61–84.
- Taragin, M.I., L.R. Willett, A.P. Wilczek, R. Trout and J.L. Carson (1992), 'The Influence of Standard of Care and Severity of Injury on the Resolution of Medical Malpractice Claims', *Annals of Internal Medicine*, 117, 780–84.
- Thomas, Eric J., David M. Studdert, Helen R. Burstin, E. John Orav, Timothy Zeena, Elliott J. Williams, K. Mason Howard, Paul C. Weiler and Troyen A. Brennan (2000), 'Incidence and Types of Adverse Events and Negligent Care in Utah and Colorado', *Medical Care*, 38, 261–71.
- Thorpe, Kenneth E. (2004), 'The Medical Malpractice "Crisis": Recent Trends and the Impact of State Tort Reforms', *Health Affairs – Web Exclusive*, W4 20–30 (available at <http://content.healthaffairs.org/cgi/reprint/hlthaff.w4.20v1.pdf>).
- Tillinghast-Towers Perrin (2003), *U.S. Tort Costs: 2002 Update: Trends and Findings on the Costs of the U.S. Tort System* (available at http://www.towersperrin.com/tp/getwebcache?doc=TILL/USA/2003/200302/Tort_Costs_2002_Update_rev.pdf).
- Tussing, A. Dale and Martha A. Wojtowycz (1992), 'The Cesarean Decision in New York State, 1986: Economic and Noneconomic Aspects', *Medical Care*, 30, 529–40.
- Viscusi, W. Kip (1979), 'The Impact of Occupational Safety and Health Regulation', *Bell Journal of Economics*, 10, 117–40.
- Viscusi, W. Kip (1985), 'Consumer Behavior and the Safety Effects of Product Safety Regulation', *Journal of Law and Economics*, 28, 527–53.
- Viscusi, W. Kip (1986), 'The Determinants of the Disposition of Product Liability Claims and Compensation for Bodily Injury', *Journal of Legal Studies*, 15, 321–46.
- Viscusi, W. Kip (1988), 'Product Liability Litigation with Risk Aversion', *Journal of Legal Studies*, 17, 101–21.
- Viscusi, W. Kip (1989), 'The Interaction between Product Liability and Workers' Compensation as Ex Post Remedies for Workplace Injuries', *Journal of Law, Economics, and Organization*, 5, 185–210.
- Viscusi, W. Kip (1991a), 'The Dimensions of the Product Liability Crisis', *Journal of Legal Studies*, 20, 147–77.
- Viscusi, W. Kip (1991b), *Reforming Products Liability*, Cambridge, MA: Harvard University Press.
- Viscusi, W. Kip (1998a), 'The Social Costs of Punitive Damages against Corporations in Environmental and Safety Torts', *Georgetown Law Journal*, 87, 285–345.
- Viscusi, W. Kip (1998b), 'Why There is No Defense of Punitive Damages', *Georgetown Law Journal*, 87, 380–95.
- Viscusi, W. Kip and Patricia H. Born (2005), 'Damages Caps, Insurability, and the Performance of Medical Malpractice Insurance', *Journal of Risk and Insurance*, 72, 23–43.

- Viscusi, W. Kip and Michael J. Moore (1993), 'Product Liability, Research and Development, and Innovation', *Journal of Political Economy*, 101, 161–84.
- Viscusi, W. Kip and Robert L. Scharff (1996), 'The Structure of the Legal Bargaining Game', in David A. Anderson (ed.), *Dispute Resolution: Bridging the Settlement Gap*, Greenwich, CT: JAI Press, pp. 145–66.
- Viscusi, W. Kip, Richard J. Zeckhauser, Patricia Born and Glenn Blackmon (1993), 'The Effect of 1980s Tort Reform Legislation on General Liability and Medical Malpractice Insurance', *Journal of Risk and Uncertainty*, 6, 165–86.
- Weiler, Paul C., William G. Johnson and Lucian L. Leape (1993), *A Measure of Malpractice: Medical Injury, Malpractice Litigation and Patient Compensation*, Cambridge, MA: Harvard University Press.
- Whetten-Goldstein, Kathryn, Frank A. Sloan, Emily M. Stout and Lan Liang (2000), 'Civil Liability, Criminal Law, and Other Policies and Alcohol-related Motor Vehicle Fatalities in the United States: 1984–1995', *Accident Analysis and Prevention*, 32, 723–33.
- White, Michelle J. (1989), 'An Empirical Test of the Comparative and Contributory Negligence Rules in Accident Law', *RAND Journal of Economics*, 20, 308–30.
- White, Michelle J. (1994), 'The Value of Liability in Medical Malpractice', *Health Affairs*, 13 (4), 75–87.
- White, Michelle J. (2004), 'Asbestos and the Future of Mass Torts', *Journal of Economic Perspectives*, 18 (2), 183–204.
- Wilkinson, James T. (1987), 'Reducing Drunken Driving: Which Policies are Most Effective', *Southern Economic Journal*, 54, 322–34.
- Yoon, Albert (2001), 'Damage Caps and Civil Litigation: An Empirical Study of Medical Malpractice Litigation in the South', *American Law and Economics Review*, 3, 199–227.
- Yoon, Albert (2004), 'Mandatory Arbitration and Civil Litigation: An Empirical Study of Medical Malpractice Litigation in the West', *American Law and Economics Review*, 6, 95–134.
- Young, Douglas J. and Thomas W. Likens (2000), 'Alcohol Regulation and Auto Fatalities', *International Review of Law and Economics*, 20, 107–26.
- Zador, Paul and Adrian Lund (1986), 'Re-analysis of the Effects of No-fault Auto Insurance on Fatal Crashes', *Journal of Risk and Insurance*, 53, 226–41.
- Zuckerman, S., R. Bovbjerg and F.A. Sloan (1990), 'Effects of Tort Reforms and Other Factors on Medical Malpractice Insurance Premiums', *Inquiry*, 27, 167–182.

Index

- Abel, Richard 461
Abraham, Kenneth 50, 172, 239, 307
 environmental liability 264, 266
 joint and several liability 129, 130
accidents
 automobile *see* automobile
 bilateral *see* bilateral accidents
 catastrophic and dangerous *see*
 catastrophic
 costs *see* costs
 estimating likelihood of 35–6
 fatal *see* fatal accidents
 model 54–7, 85
 prevention costs *see under* costs
 secondary, cost reduction 180–81
 unilateral *see* unilateral accidents
activities, dangerous *see under*
 dangerous
Adams, John
Adams, Michael 15, 163–4
 non pecuniary loss 216–17, 219,
 221–2, 224
Adler, Matthew 162
administrative costs *see under* costs
adverse selection 265, 297, 348, 381,
 388–9, 391, 422
advertising 293–4
agents and principals 344, 386
 vicarious liability *see* vicarious
Aickin, Mikel 98
Akerlof, G. 265, 292, 388
Alberini, A. 249, 270
Aldy, Joseph 161, 223, 224
allocation of risks 33–5
alternative care model 54–8
American
 Food and Drug Administration 162
 Law Institute 307, 311, 314
 Insurance Association 342
 Medical Association 342–3, 355
antitrust 117, 291
Antoniolli, Luisa 436
Arcuri, A. 254
Aristotle 245
Arlen, Jennifer
 damages 155–6, 160, 172
 medical malpractice 342, 349, 350
 vicarious liability 137–9, 142–3
Arnold, Frank 98, 257
Arrow, Kenneth 377, 383, 386, 389,
 390, 401
asbestos cases 36, 182, 258, 287, 308,
 484–5
Ashenfelter, Orley 162
Ashford, Robert 406
Ashford, Nicholas 305
Atkins, F. J. 406, 413
auditors *see* gatekeepers
Ault, R. W. 273
Austin, D. 249
Australia 408, 412–13, 474–5
automobile accidents 50, 181, 406,
 412–16, 437, 457, 474–9
Avraham, Ronen 172, 352, 361–2, 357
Bagenstos, Samuel 162
Bagga, Shalini 487
Baicker, Katherine 342, 354–5, 356
Baker, Tom 241, 307, 389–90, 399, 401
 medical malpractice 342, 353, 355,
 359, 360, 365
Baldwin, L. M. 487
Banakas, Stathis 442
Bar-Gill, Oren 25, 54, 65–6, 72, 77,
 316
Barnes, David 407
Baron, Jonathan 437
Baumol, William 22, 251
Beard, T. Randolph 29, 175
Bebchuk, Lucian 103
behavioral incentives 153, 155, 160,
 165–6, 177, 178–9, 249
see also incentives
Becker, David 486
Beider, Perry 487
Ben-Shahar, Omri 25, 315–16
 causation 91, 99, 101,
 negligence 54, 65–6, 77

- Benson, Bruce 477, 479
 Bergkamp, Lucas 129, 179, 248, 258–9, 266, 270
 Berliner, Baruch 399, 418
 Bernard, Andrew 294
 Bernstein, Lisa 112
 Bertram, R. 253, 263, 301, 305
 Best, Arthur 50, 52–3
 Biddle, Jeff 481
 Biggar, Darryl 234
 Bilandic, Michale 406
 bilateral accidents 15–24, 33, 37, 48, 421
 cheapest cost avoider 16–17
 damages, and 155–6
 economic loss, and 208–9
 negligence 17–19, 37
 comparative negligence rule 18–19
 contributory negligence, defence of 18
 simple 17–18
 relaxing assumptions 20–24
 non pecuniary loss 219
 rule of no liability 17
 strict liability 19–20
 contributory negligence, defence of, and 20, 37
 losses, division of 19
 relative negligence, defence of, and 20, 37
 simple 19
 binary care 63–5
 Binswanger, Hans 305
 Bishop, William 168, 204, 205, 435
 Bisso, Juan 143
 Black, Bernard 154, 472
 Blackburn, Joseph 157–8
 Blair, Roger 342
 Bluffstone, R. A. 262
 Bocken, H. 269
 Bode, S. 262
 Bohm, P. 256
 Bond, V. 272
 Bongaerts, J. C. 273
 Borch, Karl 383, 388–9, 401
 Borgo, John 85
 Born, Patricia 308, 399, 410, 473
 Bouchaert, B. 251
 Bovbjerg, Randall 473
 Boyd, James 125, 175
 environmental liability 256, 259, 260–61, 263, 267, 273
 products liability 296, 312, 316
 Boyer, M. 254, 261, 413
 Bradford, T. 256
 brand names 293–4
 Braskin, Aaron 63
 Brennan, Troyen 342, 459, 463, 472, 486
 Brissette, S. 421
 Brockett, P.L. 306
 Brooks, Jennifer 158, 306
 Brown, Craig 413, 415, 475
 Brown, John 15, 54–7, 59, 85, 154, 473
 environmental liability 251, 253
 medical malpractice 342, 349
 Browne, Mark 473
 Bruce, Christopher 406, 474
 Bruggeman, V. 258
 Budden, Mark 117
bonus-malus insurance 348
 Burrows, Paul 89, 254, 272, 294, 295, 342
 Bussani, Mauro 201, 202, 203, 209, 211, 435
 but-for cause 83, 85, 86
 see also causation
 Butler, Richard 480, 481
 bystander injuries 317–18
 Caldwell, Daniel 410
 Calebresi, Guido 4, 16, 234, 401, 412, 453
 causation 84, 85, 100, 101
 damages 153
 environmental liability 251, 253, 257
 harmonizing tort law 436, 438
 medical malpractice 342, 346
 non pecuniary loss 216, 220, 224
 Calfee, John 13, 91, 155, 318, 482
 California
 Hospital Association study 352
 Medical Association study 351
 Caminiti, Donald 413
 Campbell, Thomas 306
 Canada 357–8, 408, 412–13, 423, 474
 Cane, P. 254
 caretaking *see* monitoring *under* precautions

- Carney, William 137
 Carroll, Stephen 409–10, 413, 485
 Cascao, Rui 436
 catastrophic injury and mass exposure
 34, 35, 92, 96–7, 269
 no-fault compensation schemes 410,
 417–18, 420–27
 Caterina, Raffaele 443
 causal uncertainty 266, 272
 causation
 causal apportionment among joint
 tortfeasors 97–100
 early economic analysis of law 84–5
 foreseeability, and 83–104
 contract law, foreseeability in 102–4
 litigation costs 104
 negligence rule, under 89–91, 94–5
 optimal standard of care 89
 scope of liability
 care level, and 89
 imperfect system, in 89–91
 magnitude and scope of liability 87–9
 proportional liability rule 93–6,
 176–7, 258, 266
 prospective causation 85–6, 103–4
 retrospective causation 85–6
 risk-based liability and safety
 regulation 96–7
 socially optimal care, and 86–7
 strict liability, under 87–9, 94–5
 scope of liability
 activity level, and 88–9
 care level, and 87–9
 threshold probability rules 92–3,
 94–6
 tort law, foreseeability in 100–102
 uncertainty over 91–3
 cause in fact 83–4
 Celli, Andrew 97
 Chaloupka, Frank 477, 478
 Chandra, Amitabh 342, 354–5, 356
 Chang, Tai-Yeong 117, 118
 channelling of liability 260, 273, 423,
 424, 425
 Chapman, Bruce 137, 140, 406
 Chapman, D. J. 256
 Che, Yeon-Koo 164, 318
 cheapest cost avoider 16–17
 Chelius, James 406, 410, 456, 479–80
 Cheney F. W. 353, 465, 468,
 Chernobyl 421
 Choharis, Peter 317
 Choi, Albert 143, 145, 165
 Chu, C.Y. Cyrus 142
 Chung, Tai-Yeong 54, 64
 ‘claims made policy’ 265
 climate change 276
 Coase, Ronald 16, 30–31, 84, 135, 216,
 419, 479
 environmental liability 248, 249–51,
 260
 medical malpractice 342, 347
 Coffee, John 138, 145
 Coghlin, T. G. 268
 Cohen, Alma 413, 457, 476, 478
 Cohen, George 342
 Cohen, M. A. 272
 Cohen, Thomas 465, 466, 471
 co-insurance *see under* insurance
 Colpitts, Jeffrey 124
 Comande, Giovanni 217
 comparative negligence 3, 18–19, 38,
 456–7
 contributory negligence, and *see*
 under contributory negligence
 criticised 73–4
 pure and modified forms 52–3, 74–7
 compensation *see* damages; no-fault
 compensation schemes
 funds 268, 274, 408, 414–15, 426
 mechanisms 262–4, 267–9
 competition 291, 292, 443–4
 compulsory insurance *see under*
 insurance
 conduct *see* consumers; corporations;
 reprehensible
 Congressional
 Budget Office 308, 458, 473, 489
 Office of Technology Assessment
 354, 355
 consequential loss 201
 ‘consumer awareness test’ 32
 consumers 237, 240, 441, 458
 information *see under* information
 doctors and patients 343–4, 458
 products liability 288, 297–8, 305,
 316–18
 product safety, and 292–3, 304
 professional advice 210
 contingent valuation 256

- contracts law 30–31, 102–4, 168–9, 204, 344, 441
 - products liability 289–90, 318
- contribution actions 109–11
- contributory negligence
 - comparative negligence, and 46–77, 456–7
 - comparative negligence criticised 73–4
 - defence of 18, 19, 20, 21
 - economic performance 54–8
 - empirical studies 74–7
 - equivalence, comparative negligence and 58–9
 - incentives to take care 53–73
 - least-cost avoider, and 53–8
 - origins and development 48–52
 - rule criticised 49–50
 - relaxing assumptions 59–73
 - equilibrium, convergence to 72–3
 - evidentiary uncertainty and court error 59–66
 - heterogenous agents and parties 67–72
 - liability rules and revealing information 70–72
 - stochastic due care and losses 66–7
 - summary 77
- Cook, Philip 220, 222, 478
- Cooter, Robert 436
 - causation 83, 84, 85, 87, 88, 91, 97
 - contributory and comparative negligence 59–63, 66, 71, 77
 - damages 154–6, 158, 159, 163, 170, 174, 179–80
 - environmental liability 252
 - medical malpractice 362
 - non pecuniary loss 219
 - products liability 317, 319
 - punitive damages 166–7, 232, 234, 239
 - strict liability and negligence 7, 12, 15, 24
- copyright 234–5
- corporations and firms 146, 304–6, 379, 442
 - civil liability *see* vicarious
 - conduct 234, 236–7, 239, 253, 396–8, 401
 - crime *see* crime
 - liability
 - innovation and productivity, impact on 304–6
 - limited 139–40, 394, 396–8
 - managers, personal 144, 396–8
 - product safety, and 303–4
 - non-profit 139
- costs
 - accident 19–20, 22, 46, 84, 153, 174, 216
 - administrative 11, 153, 210, 453, 457–8, 470–71
 - causation, and 93, 97, 100, 104
 - damages, and 153, 163, 165, 168
 - liability insurance 379, 381–2, 384, 385–6, 391–2, 458
 - medical malpractice 347, 362
 - negligence, and 57, 59
 - no-fault compensation schemes 412–13
 - products liability 292
 - punitive damages 235
 - vicarious liability 143
 - care 14, 24–7, 29–30, 36, 56–7, 71–2
 - damage compensation, of 36
 - due care, of 36
 - enforcement 138
 - externalities 16
 - funeral 160, 161
 - information 309–10, 314, 417
 - innovation and production 304–5
 - litigation 24, 36, 57, 74, 297
 - damages, and 154–6, 179
 - economic loss, pure 203–4
 - joint and several liability 104, 115, 128
 - punitive damages 23, 240–41
 - vicarious liability 137
 - medical malpractice 346
 - mitigation 156
 - monitoring 136
 - preventions and precautions 4, 5, 12, 22, 241, 346, 391–2, 453
 - primary 153, 216–17, 225
 - secondary 153, 217, 225, 437
 - social and welfare 12, 13, 37, 93, 154, 346
 - strict liability, and 19
 - tertiary costs 153, 217, 225, 436–7

- transaction 16, 30–31, 250–51, 347, 409–10, 480
 harmonizing tort law 438, 441, 446–7
- Courbage, C. 418
- courts 409
 due care level *see under* due care
 errors 13, 19, 56, 89–90, 93–4, 143, 252, 319, 380
 damages 155, 159, 166–7, 171–2
 evidentiary uncertainty, and 59–66, 77
 punitive damages 230, 233
- Cousy, H. 264
- Cowell, J. 265
- Coyte, Peter 342, 352, 357–8, 361
- Craig, Andrew 305
- Craswell, Richard 13, 91, 155, 319
 harmonizing tort law 437, 440
 punitive damages 232, 240
- Crevier, Stephanie 63
- crime and criminal liability 22, 385
 corporate civil liability, and 145–7, 398
 vicarious liability, and 134, 141–3
- Croley, Steven 137, 164, 308, 381, 406
 non pecuniary loss 216, 217, 220, 222–5
- Cross, Gary 294
- Crouch, Edmund 437
- Cummins, J. David 307, 413, 476,
- Curran, Christopher 17, 54, 58–60, 77
 ‘customary practice test’ 263
- customers *see* consumers 237, 240
- damage 3, 29–30, 255–7
- damages and compensation 12, 14, 37, 153–84
 assessment of losses 159–60
 basis of compensation 170–71
 behavioral incentive, as 153, 155, 160, 165–6, 177, 178–9
 chance, loss of 176–8
 compensation mechanisms 267–9
 compensatory 12
 not perfectly 11–12, 21, 38
 products liability, and 318–19
 costs of 36
 economic loss, pure 168–70
 empirical research 181–2
- environmental liability 255–7
- fairness in 73
- fatal accidents 160–63, 182
 optimal amount
 injurers should pay 160–61
 relatives should receive 162–3
- full compensation of harm 156–8
- future 171–2, 182
- harm equaling 229–31
- indirect 411
- limitation and moderation of 174–6
- medical malpractice 344–5
- mitigation of losses 173–4
- multiple tortfeasors 178–80
- no-fault compensation system 409, 411
- non-pecuniary losses
 compensation for 163–5
 pecuniary losses, and 158–9
- optimal *see under* punitive damages
- over-compensation 3, 14–15, 37
 deterrence and 8
- principles, assessment of 182–3
- punitive damages *see* punitive damages
- secondary accident cost reduction 180–81
- uncompensated losses 165–6
- under-compensation 14–15, 21, 29, 30, 37, 97, 182, 417, 419
- wealth of defendants 172–3
- workers compensation 480–82
- dangerous
 activities, abnormally 27, 34, 220, 398, 437–8
- see also* catastrophic
- Danzon, Patricia 164, 318, 381, 412–13
 empirics 463–4, 468, 472, 485, 489
 medical malpractice 342–6, 351–2, 354–5, 357–61, 364
- D’Arge, R. 251
- Dari-Mattiacci, Guiseppe 16, 57, 95, 140, 435
 damages 168, 169–70, 175, 176
 economic loss, pure 203, 204, 205, 206, 207
- Daughety, Andrew 241, 295, 305, 319
- Davis, R. K. 256
- Dawar, N. 293
- De Bievre, A. F. M. 273

- De Geest, Gerrit 57, 175, 176
 De Smedt, K. 270
 decentralisation effect of strict liability and negligence 24–7
 deductibles *see* partial *under* insurance
 Dee, Thomas 478
 defective rationality 137
 defects *see under* products liability
 defences
 - comparative negligence rule 18–19, 38
 - contributory negligence 3, 18, 20, 38, 48–52
 - relative negligence 3, 20
 defensive medicine 354–6, 458, 472, 486–8
 Dehejia, Rajeev 413, 457, 476–8
 Delgado, Richard 94, 95
 delictual liability 344
 Demougin, Dominique 28–30
 Demsetz, H. 406
 Denmark 362
 Derrig, Richard 408, 413, 476
 design defects *see* product liability
 Designated Compensable Event 350, 364
 deterrence 8, 29, 37–8, 153, 210, 453–4
 - comparative negligence 73, 76
 - contracts and liability 30–31
 - corporations, and 146
 - damages, and 160, 162–3, 167, 177, 179
 - environmental liability 249, 252–3, 256–7, 259
 - errors, and 93–4
 - joint and several liability 118, 119–25
 - legal rules, of 13
 - liability insurance 308, 379–80, 382, 385–6
 - medical malpractice 344, 485
 - non pecuniary loss 220
 - punitive damages 228–31, 237–8, 468–9
 - over 13–15, 37, 146, 158, 259, 353–4
 - standard of care, changes in 262–3
 - strict liability 23
 - theory of 229–31
 - under 13–15, 29–30, 37–8, 94, 97, 146
 - damages, and 160
 - environmental liability 252–3, 256–7, 266
 - no-fault liability 413, 415, 418–20, 424–6
 development *see* innovation
 DeVille, Kenneth 342
 Devlin, Nancy 162
 Devlin, Rose 409, 412–13, 475–6, 489
 Dewar, Marvin 342
 Dewees, Nancy 181–2, 269, 302, 384–5
 - empirics 456, 484
 - no-fault compensation 410, 413
 - medical malpractice 342, 352–3, 355, 357–8, 361–3
 Dhankhar, Praveen 487
 Diamond, Peter 56, 238
 difference principle *see* partial liability
 Dionne, Georges 413
 disaster insurance and relief 267, 269
 disclosure 313–15
 Djamaludin, I. 295
 doctors *see under* consumers
 Dodge, Joseph 158
 Doherty, N. 267
 Donohue, John 488–9
 Dowdell, T. D. 303
 Drake, J. 256
 Dranove, David 486
 Dubay, Lisa 486–7
 Dubin, J. A. 272
 due care 6, 17
 - causation, and 89–91
 - costs of 36
 - courts, and 20, 25, 27, 36, 38
 - efficient standard of care 47, 54
 - experts 25
 - inducing 46
 - legal standards, uncertainty of 13–15
 - medical malpractice 351, 485
 - negligence 87
 - comparative 18–19, 54–8
 - contributory 54–8
 - public information 27
 - reasonable man 25–6, 47
 - socially optimal level *see* optimal level
 - standard of care 47–8, 58
 - changes in 262–3
 - stochastic, losses and 66–7
 - strict liability 10, 87–9

- Duff, David 181–2, 269, 302, 384–5, 456
 no-fault compensation system 410, 413
 medical malpractice 342, 352–3, 355, 357, 363,
- Duggan, Anthony 166
- Dunford, R. 272
- Dunn, Richard 465
- Dworkin, Ronald 23
- Eads, George 303
- Earnhart, D. 253, 262
- earnings, loss of *see under* loss
- Easterbrook, Frank 112, 379, 395, 398
- Eaton, Thomas 240, 465, 469
- Eckert, A. 253, 270
- economic loss, pure 8, 14, 168–70, 201–11, 435, 441
 categories of cases 202–3
 analysis of 209–11
 definition 201
 intentional versus negligent torts 209
 justifications for 203–4
 private versus social loss 204–6
 products liability, and 318
 professional advice cases 202–3, 210–11
 public service, closure of cases 202, 210
 ricochet loss cases 202, 209
 strict liability versus negligence 207–9
 transferred loss cases 202, 209–10
- economic rationale of insurance 377–84
- Edlin, Aaron 61
- efficiency equivalence theorem 19
- Efroymsen, R. A. 256
- ‘eggshell skull’ doctrine 101 66
- Egon, Zehnder International 303, 305
- Eisen, Roland 377, 379, 388–9
- Eisenberg, Theodore 166, 228, 469
- Ekelund, R. B. 273
- Ellis, Dorsey 1, 232–3, 234
- empirics of tort 74–7, 453–90
 cost-benefit analysis 488–90
 empirical analysis, pre-requisites for 456–61
 data 458–9
 methods 459–61
 variation 456–8
 safety effects 473–88
 automobile accidents 474–9
 no-fault 474–7
 other changes in liability rules 477
 other safety measures 477–9
 industrial accidents 479–82
 workers compensation 480–82
 medical malpractice 485–8
 defensive medicine 486–8
 products liability 482–5
 asbestos 484–5
 empirical findings 483–4
 tort litigation system 461–71
 administrative costs 470–71
 base rate 462–3
 claiming rate 463–5
 disposition of claims 465–8
 punitive damages 468–70
 tort reform, effects of 471–3
- employment 236, 239
 scope of and liability *see* vicarious
- Endres, Alfred 8, 18, 379, 389, 391
 environmental liability 249, 251–3, 263–4, 266, 269
 product liability 299, 301, 305
- England *see* United Kingdom
- Enron 145
- environmental liability 110–11, 182, 247–76
 assessment of 274–6
 compensation mechanisms 267–9
 damage and damages 255–7
 environmental federalism, and 269–70
 goals 249
 insurance of 263–7, 397–8, 399
 adverse selection 265
 causal uncertainty 266
 compulsory 266–7
 disaster 267
 latency and retroactive liability 265, 396, 397
 moral hazard 264–5
- latency 261, 265
- lenders and producers, liability of 260–61
- marine oil pollution 268, 269, 272–4

- moving beyond original polluter 257–61
 - causal uncertainty 257–8, 259
 - channelling of liability 260, 273
 - joint and several liability 258–60
- negligence versus strict liability 252–3
- nuclear risk 260, 268–9, 270–72
- regulation
 - compliance and liability 254–5
 - criteria 253
 - influence on liability, and 253–5
 - liability and incentive based instruments 255
 - tort system, combined with 253–4
 - violation of regulation and liability 254
- retroactive liability 261–3, 266
 - latency, and 265
- standard of care, changes in 262–3
- risks 35
- vicarious liability, and 143
- Epple, D. 272, 290
- Epstein, Richard 85, 96, 104, 417, 422, 455
 - environmental liability 267, 269
 - medical malpractice 342–3, 349, 350, 365
 - products liability 297, 317
 - vicarious liability 136–7
- equilibrium, convergence to 72–3
- equivalence theorem 19
- errors 60, 347
 - court *see* court
- Estep, E. 258, 272
- Europe 46, 51, 402, 485
 - economic loss, pure 201, 203, 209, 210
 - European Union 31, 270, 442
 - liability insurance 384, 393–4
 - product liability 287, 308–9, 318
 - tort law systems, harmonization and 438, 439–47
- Evans, William 221
- evidentiary
 - privileges 143
 - uncertainty and court error 59–66, 77
- excess and deductibles *see under* insurance
 - ‘exclusionary rule’ 201, 207–9, 435
 - exogenous solvency 124–5
 - experts 25
 - externalities 16, 88, 158, 163, 169, 295, 439
 - cross-border externalities 444–5
 - pollution 249–51
 - Exxon Valdez 273
 - fairness and joint liability 125–30
 - ‘false positives’ and ‘false negatives’ 353–4, 364, 385, 464, 482
 - Farber, Henry 342, 353–4, 465, 468
 - Farber, Michael 94
 - fatal accidents 352, 413, 415, 484
 - damages 160–63, 181–2, products liability 287, 302, 304
 - Faure, Michael 54, 95, 224, 402
 - damages 159, 174, 179
 - environmental liability 248, 251–2, 254, 257–8, 261, 263–4, 266–71, 273, 276
 - harmonizing tort law 435–6, 439–40, 442–3, 445
 - medical malpractice 342, 344–5, 347, 365
 - no-fault compensation schemes 417–19, 420, 422, 424, 426
 - products liability 315
 - Fedtke, Jorg 436
 - Fees, Eberhard 27, 259
 - Feinstein, J. S. 270
 - Feldman, Allan 156
 - Feldman, Roger 342–3
 - Feldthusen, Bruce 203, 413
 - Felsteiner, William 461
 - Fenn, Paul 261, 315, 418
 - Ferguson, William 76, 77
 - financial caps 256–7, 393–4, 399, 418–21, 424–6, 457–8, 473
 - Finland 362, 411
 - Finsinger, Jorg 9, 11, 268
 - Fiore, K. 272
 - firms *see* corporations
 - first party insurance *see under* insurance
 - Fischel, Daniel 144–6, 379, 395, 398
 - Fischer, Charles 177
 - Fishback, Price 480
 - Flanigan, George 76, 77

- Fluet, Claude 28–30
 foreseeability
 causation, and *see under* causation
 contract law, in *see under* causation
 tort law, in *see under* causation
 France 3, 51, 385, 412, 424, 435, 437, 441
 medical malpractice 342, 344, 350–52, 362–4
 see also medical malpractice
 Franklin, Marc 410
 Franzoni, Luigi 145
 Frasca, Ralph 176–7
 Fraser, Clive 164
 Frech, H. E. 318
 Freeman, P. 264
 Frey, B. S. 251
 Friedman, Daniel 63, 163–4, 167, 221
 Frontier Insurance Group 359
 Froot, Kenneth 307
 Frost, C. 249, 270
- Galanter, Marc 181, 455, 461
 Galligan, Thomas 233, 238
 Garber, Steven 303, 483
 Gardner, Steven 50
 Garoupa, Nuno 16, 95
 gatekeepers 139, 144–5
see also professional advice
 Gaudry, Marc 413, 475
 Geistfeld, Mark 164
 products liability 288, 295, 297–8, 308–9, 311, 314, 317–18
 Germany 3, 7, 51, 226, 344, 384, 435
 Gigerenzer, Gerd 35
 Gilead, Israel 435
 Gimpel-Hinteregger, M. 249
 Goldberg, Victor 178, 204, 273, 291
 Gollier, C. 269
 Gomez, Fernando 168–9, 204, 435
 Gotanda, John 228
 Government 139
 Gowda, R. 264
 Grabowski, Henry 409
 Grady, Mark 47, 85, 89–90, 101, 155
 Graf von der Schulenburg, J. 386, 388
 Graham, Daniel 164, 220, 222, 302–3, 305
 Grayston, Richard 474
 greater degree of blame exception 50
- Greene, William 461
 Greenwald, B. 355
 Grimaud, D. 264
 Gron, A. 269, 486
 Grossman, D. A. 276, 296
 Grossman, Michael 477–8
 guarantee funds 268
 Guppy, A. 35
- Haazen, Olav 441
 Haddock, David 17, 54, 58–60, 77, 234
 Hagen, Stuart 487
 Hamada, Koichi 289
 Hamdani, Assaf 139
 Hand, Learned 6, 32, 47–8, 351
 Haneman, W. M. 256
 Hankey, S. 265
 Hansmann, Henry 140, 396
 Hanson, John 164, 381, 406
 non pecuniary losses 216, 217, 220, 222–5
 products liability 292, 292–3, 308
 Hansson, I. 267
 harm, damages equaling 229–31
 harmonization *see* tort law
 Harrington, Scott 476
 Harris, Catherine 342, 351, 353, 465, 468
 Harrison, D. 256
 Hart, H.L.A. 83, 85
 Hartlief, T. 252, 267, 424, 437, 439, 442, 443
 Harvard Medical Practice study 341, 352, 353, 355, 459, 463
 Hausman, J. A. 256
 Havighurst, Clark 364
 Hay, Bruce 304, 318
 Hay, J. 273
 Hazen, O. A. 265
 Heal, Geoffrey 290
 health
 damages, and 158
 healthcare measures, value of 161–2
 insurance *see under* insurance
 medical malpractice *see* medical malpractice
 risks 35
 hedonic price technique 155–6
 Hege, U. 259

- Heine, G. 273, 426
 Helland, Eric 182
 Hellwig, Martin 383, 386, 388, 390
 Henderson, James 288, 300, 312
 Hendrickx, Ruud 273, 274, 436
 Hensler, Deborah 181, 287, 316, 406, 459, 462
 Hersch, Joni 154, 303, 409
 Hershey, Nathan 354
 heterogenous agents and parties 67–72
 Heyes, A 248, 272
 Higgins, Richard 302, 457, 482, 484
 history of liability 3, 406, 456–8, 471
 Hoch, I. 256
 Hoerger, Thomas 468
 Hoffer, George 303
 Hogarth, H. R. 265
 Honore, Tony 83, 85, 86
 Housmann, Michael 354
 Hsieh, Chee Ruey 353
 Howells, Geraint 443
 Hu, J. 426
 Huber, Peter, 302
 human life, value of 160–63, 223–4
 Hurst, Ady 353
 Huybrechts, M. A. 426
 Hyde, C. E. 259
 Hylton, Keith 154, 167, 241, 254, 301
 Hyman, David 345, 352, 353, 354
 medical malpractice 349
- Iceland 362
 immunity 143
 imperfectly competitive markets 290–91
 incentives to take care 53–73, 412, 415, 424, 473–88, 485–6
 environmental liability 255, 269
 liability insurance 389–90, 393–5
 medical malpractice 344–5, 349–50
see also behavioural incentives
 independent
 contractors 139–49
 probabilities 113–15
 industrial accidents *see* workers
 information 97, 101, 422
 asymmetry 386–8, 390–91, 410, 485
 concealing and liability 138, 142
 consumers, and 291–3, 301, 309–11, 317, 468, 482–3
 costs *see under* costs
 insurance, for 263, 268
 liability rules revealing 70–72
 mechanisms in products markets 293–5
 medical malpractice 346–7
 patients 341
 misleading, capital markets in 206
 perfect information 56–8, 60, 72, 77
 safety technologies 27–8, 38
 warning defects 313–15
see also preventions; safety
 Ingberman, Daniel 125, 175, 259, 261, 263
 products liability 296, 312, 316
 innovation and productivity 304–6
 induced innovation 305
 research and development 305–6, 417, 483–4
 insolvency *see* solvency
 insurance 4, 12, 16, 21, 57, 97, 267, 453
 automobile 412–13
 bonus-malus 348
 ‘claims made policy’ 265
 co-insurance 348, 384, 426
 compulsory 266–7, 299, 362, 397–8, 408, 421–2, 425–6
 costs and warranty liability 297–8, 309
 damages, and 158, 174, 180–81
 disaster 267
 efficient distribution, and 220–21
 environmental liability 256, 263–7
 excess and deductibles 348, 391–2
 first party 12, 297–8, 402, 457
 liability insurance 377, 381, 384–5
 medical malpractice 345, 350–51
 no-fault compensation system 406, 408, 410, 412, 421–2, 475
 health 292–3, 297, 385
 insolvency 268
 joint and several liability 129–30
 liability *see* liability insurance
 ‘long tail risk’ 261, 265, 360
 markets 19
 medical malpractice 343, 345, 348–9, 350–51, 357–60, 486
 non-pecuniary loss 163–4, 217, 220–23, 225

- pain and suffering *see* pain and suffering
- pecuniary loss 163
- products liability 3, 225, 296–300, 305, 306–8, 315
- punitive damages 241
- re-insurance 384
- risk aversion *see under* risk aversion
- self 362, 379, 402, 408, 410, 423, 486
- social 12
- terrorism 307, 359
- third party 73, 297–8, 350–51, 377, 410, 421–2
- underwriting, and 359–60, 383
- see also* compensation mechanisms
- Insurance Information Institute study 354
- intellectual property 170–71
- intentional harm or tort 3, 50, 143, 400
- negligence, and 209
- interest 157, 360, 394, 458
- International Organization for Standardization 217
- Italy 342, 344, 438
- Jackson, Howell 145
- Jarrell, Gregg 303
- Jeffries, John 172, 239
- Johnson, Gary 12, 253, 254, 255
- Johnson, Joseph 76, 77
- Johnson, Rollin 305
- Johnson, William 406
- joint and several liability 109–30, 458
- deterrence 118, 119–25
- endogenous solvency 124–5
- full solvency 120–22
- negligence 120–21
- strict liability 122
- limited, exogenously determined solvency 122–3
- environmental liability 258–60
- fairness 125–30
- insolvency, division of burden 128–9
- insurance 129–30
- legal regimes 10
- litigation costs 128
- plaintiff's recovery
- division of 126–7
- size 126
- settlements, effects of 112, 127–8
- several only liability 112
- two defendants, 113–17
- effects of limited solvency 116–17
- independent probabilities 113–15
- more than 117–18
- perfectly correlated probabilities 115
- joint tortfeasors, causal apportionment *see under* causation
- Jolls, Christine 35
- Jones, P. 317
- Jost, Peter 174, 266, 397
- judgment-proof
- agents 143, 144, 146
- tortfeasors 29–30, 38, 68, 97, 139, 175–6, 394, 421
- judicial moderation and damages 174–6
- Jung, M. 262
- juries 50, 60, 73, 74, 314, 318, 399, 467, 469
- Kabler, Brent 413, 476
- Kaestner, Robert 486–7
- Kahan, Marcel 7, 26, 47, 90–91, 120
- damages 155, 158, 159, 176, 241
- Kahneman, Daniel 292
- Kakalik, James 409, 410, 413, 470, 488–9
- Kalss, Susanne 207
- Kanning, Arnold 436
- Kaplow, Louis 172, 234, 438
- causation 94, 101, 102,
- environmental liability 261, 269
- non pecuniary losses 221, 224,
- products liability 315
- Kapp, W. 251
- Karpoff, Jonathan 147, 166, 470
- Karten, W. T. 264
- Katzman, M. 265, 266
- Kavanaugh, Karen 480
- Kaye, David 92, 98, 257
- Keeton, R. 406, 412,
- Keeton, W. P. 1, 83
- Kelman, Mark 98
- Kennedy, Duncan 437, 440
- Kerkmeester, Heico 257, 436

- Kessler, Daniel 306, 342, 356, 486–7
 Ketchum, L. 272
 Khan, M. Mahmud 487
 Khanna, V. S. 147
 Kim, Jeonghyun 58, 156
 King, Elizabeth 177
 Kirmani, A. 294
 Klee, Elizabeth 124, 125
 Kleffner, A. 267
 Klein, Benjamin 293, 466
 Klerman, Daniel 111, 112
 Klevorick, Alvin 306
 Klevorick, K. S. 412
 Klick, Jonathan 356, 486
 Knoll, Michael 157
 Kochanowski, Paul 413, 476
 Koenig, Thomas 469
 Kolstad, Charles 12, 253, 254, 255
 Kornhauser, Lewis 32
 damages 178, 179
 environmental liability 259, 260
 joint and several liability 109–30
 vicarious liability 135, 136
 Kotowitz, Yehnda 386
 Kotz, Hein 3, 177
 Kraakman, Reinier 396
 vicarious liability 138, 140, 143, 144,
 145
 Kramer, Larry
 vicarious liability 136, 137, 139, 143
 Krier, James 159
 Krueger, Alan 480
 Kruskal, William 98
 Krutilla, J. V. 256
 Kunreuther, H. 261, 264, 265, 267, 307
 Kysar, Douglas 292
- Landeo, Claudia 241
 Landes, Elizabeth 413
 Landes, William 4, 10, 32, 204, 216,
 310, 342
 causation 84–5, 87–90, 94, 96, 99,
 101–2, 104
 damages 154, 168, 175, 179
 empirics 453, 455, 476, 488–9
 environmental liability 256–7, 258
 joint and several liability 112, 119
 punitive damages 229, 234
 Langevoort, Donald 138
 Laroque, Francois 344
- Lasagna, Louis 305
 last clear chance doctrine 50
 latency 261, 265
 Latin, Howard 292, 314
 Laurent, C. 421
 law of large numbers 382–3, 400
 Lawrence, B. A. 287
 lawyers *see* gatekeepers
 least-cost avoider 53–8, 63–4, 84
 Leape, Lucian 463
 Lee, Han-Duck 473
 Leebron, David 396
 Leffler, Keith 293
 legal
 aid 182
 malpractice 178, 210
 Legrand, P. 444
 lenders and producers, liability of
 260–61
 Levmore, Saul 92–3, 94
 Lewis, Christopher 307
 Lewis, Richard 171–2, 175, 261, 401
 liability insurance 377–402, 454
 definition 377
 compensation as purpose of 384–6
 economic problems of 386–93
 adverse selection 388–9
 asymmetric information and
 imperfect insurance 386–8
 moral hazard 389–93
 incentives, destruction of
 389–90
 informational asymmetry 264,
 390–91
 insurance, partial 391–2
 levels of activity 392–3
 economic rationale of 377–84
 demand for insurance 377–82
 deterrence function,
 consequences of 379–80
 insuring liability for fault
 380–81
 non-pecuniary losses 381–2
 risk aversion 377–9
 supply of insurance 382–4
 pooling: law of large numbers
 382–3
 sub-division of risk 383–4
 economic virtues of 393–8
 alternative means 398

- limited liability 393–8
 - activity levels 397
 - compulsory insurance 397–8
 - incentives to
 - take care 394–5
 - insure 395–7
 - impact, tort law on 401–2
 - limits of insurance: insurability
 - elements of 399–400
 - flexible concept, as 400–401
- Liang, Bryan 342
- Liang, Lan 477
- Libecap, G. D. 273
- Lidgren, K. 261
- Liedtke, P. M. 418
- Likens, Thomas 477, 479
- Lillard, Lee 468
- limited liability 139–40, 393–8
- Liston-Heyes, C. 272
- Litan, Robert 302
- litigation costs *see under* costs
- Little, Joseph 73
- Lloyds 383, 401
- Localio, A. R. 464, 465, 487
- Logue, Kyle 293
- Lomas, O. 273
- 'long tail risk' 261, 265, 360
- Lopuci, Lynn 296, 394
- loss 3
 - assessment of 159–60
 - chance, of 176–8
 - earnings and wages 157, 171
 - emotional and psychological 163, 233
 - future 171–2
 - income 161
 - life, of *see* human life
 - mitigation of 156–7, 173–4, 207
 - private 204–6, 206–7, 210
 - social welfare 157, 167, 168, 182, 210, 379, 389
 - private, and 204–6, 206–7
- Lott, John 147, 166, 182, 470
- Loughran, David 413, 477
- Ludeke, A. 299
- lump sum 171–2
- Lund, Adrian 413, 476

- MacLeod, W. Bentley 139
- MacKay, Murray 303
- MacMinn, R. D. 306

- Magaddino, Joseph 413, 476
- Magat, Wesley 313
- Magnus, Ulrich 160, 170, 437, 440, 441, 442
- Mahshigian, L. 406
- Makdisi, J. 258
- Maler, K. G. 256
- Mankiw, N. Gregory 206
- Manning, Richard 182, 304, 483
- marine oil pollution 268, 269, 272–4, 425–7
- Marino, Anthony 95, 291
- Markesinis, Basile 342
- marketplace and transactions 167, 206, 209
 - constraints 139
 - damages, and 234–5, 240
 - imperfectly competitive 290–91
 - informational mechanisms in 292–5
 - products liability, and 288–9, 292, 298
 - structure, private and social loss and 206–7
- Marks, Stephen 90
- Martin, Robert 305
- Mary Carter agreements 112
- Mason, M. 426
- Mason, Robin 296
- mass exposure torts *see under* catastrophic
- Mast, Brent 477, 479
- Mattei, Ugo 436
- Mayers, David 379
- McAfee, D. 253, 270
- McChesney, Fred 234
- McClellan, Mark 342, 356
- McEwin, R. Ian 362, 475, 478
 - no fault compensation system 406, 409–11, 413–15, 421–2
- McGuire, E. Partrick 303
- McLeod, Bentley 342, 349
- McKeen, Roland 287, 291
- Meddler, F. 272
- Medical Adversity Insurance 364
- medical malpractice 178, 181, 238, 341–65, 462–8, 485–8
 - assessment 364–5
 - crisis, in 356–60
 - proposals to end 360–64
 - tort reforms 360–62

- defensive medicine 354–6
- definition 341, 342, 351, 353
- insurance and underwriting 359–60
- liability
 - development 342–3
 - economic analysis of 343–9
 - doctor-patient relationship 343–4
 - incentive and compensation 344–5
 - law and economics approach 346–7
 - tort law, regulation and insurance 347–9
 - negligence versus strict liability 349–51
 - no-fault compensation schemes 410–11
 - standard of care 351
 - tort system, relevance of 351–4
- Medoff, Marshall 413, 476
- Melamed, A. Douglas 234, 342, 438
- Mello, Michelle 342, 472, 486
- Merolla, A. Todd 296, 306
- Meszaros, J. 265
- Metzloff, Thomas 351, 353
- Miceli, Thomas 122, 155, 241
 - causation 85, 86, 99
 - damages 167, 172
 - negligence and strict liability 25, 26, 29
- Michelman, F. I. 251
- Miller, C. 258
- Miller, Dan 351, 359
- Mills, Don 459, 463
- minimum asset requirement 398
- Mishan, E. J. 251
 - mitigation of loss *see under* loss
- mobility, tort law as obstacle to 442–3
- moderation of damages 174–6
- monitoring *see under* precautions
- Monti, A. 249
- Moore, Michael 305, 481, 483
- moral hazard 264–5, 297, 348, 360, 381, 389–90, 397, 400, 481
- Moselly, R. 272
- Mueller, Marnie 343, 355,
- multiple
 - agents 136
 - parties *see* joint and several
 - tortfeasors 32–3, 38, 178–80
- Murthy, D. N. P. 295
- Mustard, David 240, 469
- Nagel, Thomas 223
- Nash equilibrium 18, 22, 23, 64, 121
- National
 - Association of Insurance Commissioners 358
 - Health Service 344, 352
 - Institute for Clinical Excellence 162
- natural risks 406, 409, 422–3
- negligence
 - apportionment of 73
 - bilateral accidents *see* bilateral accidents
 - causation, and *see under* causation
 - comparative *see* comparative negligence
 - contributory *see* contributory negligence
 - costs 24
 - damages, and 154–6, 165–6, 176, 179–80
 - design defects *see* product liability
 - due care *see* due care
 - economic loss, pure and 207–9
 - environmental liability 252–3
 - exclusionary rule 207
 - history 3
 - information generating consequence 27–8, 38
 - insurance 380–81
 - intentional, negligent torts and 209
 - joint and several liability *see under* joint and several
 - judgment-proof tortfeasors 29–30, 38
 - liability, magnitude and scope 87
 - medical malpractice 349–51
 - products liability 300–301, 309–16
 - punitive damages 230
 - reasonable care *see* due care
 - recovery rule 207
 - relative 3, 20, 21
 - strict liability, and 3–8
 - summary of 36–8

- unilateral accidents *see* unilateral accidents
- vicarious liability, and 134, 141–2, 142–4
- Nell, Martin 34
- Nelson, B. J. 256
- Net Environmental Benefit Analysis 256
- New Zealand 262, 406, 408, 411
 - universal no-fault system 413–16, 474–5
- Nichols, E. 270
- Nikitin, Maxim 241
- no-fault compensation system 262–4, 406–27, 436, 457, 474–7
 - advantages 409–11
 - higher compensation 409
 - lower
 - insurance premiums 410–11
 - transaction costs 409–10
 - automobile insurance 412–13
 - definition of 407–8
 - disadvantages 411–12
 - protection of victims, priority of 407–16
 - strict liability, and 416–22
 - universal no-fault system 413–16
- no-liability rule 6, 22
- Noll, Juergen 296
- Nollkaemper, A. 276
- non-legal sanctions *see* sanctions
- non pecuniary losses 3, 158–9, 160, 163–5, 215–26, 399
 - awards, risk of high 224–5
 - definition 215
 - insurance 381–2
 - justification for compensating 217–18
 - insurance
 - demand for 222–3
 - efficient distribution, and 220–21
 - no demand for 221
 - prevention 218–20
 - valuation 223–4
 - tort law and economics 216–17
- non-profit corporations 139
- Norway 362
- nuclear risk 260, 268, 269, 270–72, 421, 423–5
- Nussim, Jacob 159–60, 175
- Oates, Wallace 22, 251
- occupational diseases 182
 - see also* asbestos; workers
- O’Connell, Jeffrey 406, 410, 412, 413
- O’Connell, Paul 307
- Ogburn, Paul 353
- Ogus, A. 253–4, 344, 436–7, 439, 441, 444–5
- Ohl, C. 269
- Oi, Walter 299
- oil pollution *see* marine oil
- Olsen, Reed Neil 343
- ONIAM 364
- optimal damages *see under* punitive damages
- optimal level of care
 - causation, and 86–7, 94
 - contributory and comparative negligence 54–8
 - damages, and 12, 153–6, 158, 178, 179–80
 - economic loss, pure 207–9
 - environmental liability 255–7
 - medical malpractice 344–5, 346, 351
 - risk spreading 153
 - strict liability and negligence 6–10, 13, 16–31, 36–8, 417
 - vicarious liability *see* vicarious
- optimality condition 5, 11–12, 19–20
- optimistic behaviour 35–6, 38
- Orr, Daniel 19, 63–5
- Ostrom, Brian 471
- Ott, Claus 205, 263, 381, 436
 - damages 154, 156, 168, 171, 175
 - strict liability and negligence 5, 7, 15, 27
- over-compensation *see under* damages
- over-compliance and investment in care 13, 94, 472
- over-deterrence *see under* deterrence
- Owen, David 272, 310
- Pace, Nicholas 409, 470, 488–9
- pain and suffering 181, 233, 297, 318–19, 474
- Painter, Christopher 397
- Palmer, G. 406, 414, 415
- Palmer, Vernon 201, 202, 203, 209, 211, 435
- Panayotou, T. 262

- parasitic loss 201
- partial insurance *see under* insurance
- patients *see under* consumers
- Parisi, Francesco 140, 435
- Parker, Jeffrey 146
- Parkin, David 162
- partial liability 7, 26
- Pate-Cornell, M. E. 270
- Patell, James 157
- Pauly, Mark 9, 390
- pecuniary and non-pecuniary losses 158–9
- Peeples, Ralph 342, 351, 353
- Peirce, Ellen 164
- Peltzman, Sam 303
- perfect information *see under* information
- perfectly correlated probabilities 115, 120
- periodic payments 171–2
- pessimistic behaviour 35–6, 38
- Peterson, Mark 467
- PHICO 359
- Phillips, Richard 476
- Physicians Insurers Association of America 357
- Pigou, A. C. 22, 250
- Pinna, Andrea 363, 438
- Png, I. P. L. 241
- Polborn, Mattias 397
- Polinsky, A. Mitchell 13
 - damages 154, 156, 159, 164, 170, 172
 - joint and several liability 112, 141, 144
 - medical malpractice 342, 349
 - punitive damages 166, 167, 232–3, 236, 238, 239–41, 469
 - products liability 300, 318, 319
 - vicarious liability 136, 141, 144
- pollution *see under* environmental
- Pomata, Gianna 342
- Pommerehne, W. W. 256
- pooling of risks 382–3
- Popp, David 305
- Porat, Ariel 96, 99, 100, 158, 179–80
- Porrini, D. 254, 261
- Posner, Eric 136, 139, 161, 162, 163
- Posner, Richard 204, 310, 406
 - causation 84–5, 87–90, 94, 96, 99, 101–2, 104
 - contributory and comparative negligence 49, 53, 56, 57
 - damages 154, 156, 168, 175, 179
 - empirics 453, 455
 - environmental liability 251, 256–7, 258
 - joint and several liability 112, 119
 - medical malpractice 342, 346, 349
 - non pecuniary loss 216, 219, 221
 - punitive damages 229, 232, 234
 - strict liability and negligence 4, 6, 7, 10, 27, 32, 37
- Pozzo, B. 252
- precautions and preventions 7–10, 11, 19, 21, 47, 386, 390
 - contributory negligence, and 49, 60
 - costs of *see under* costs
 - damages 159
 - equaling harm 229–31
 - economic loss, pure and 206, 207–9
 - environmental liability 259, 264
 - level of 229–31
 - monitoring and regulating 220, 259, 390–91, 396
 - vicarious liability, and 136–44, 146
 - non pecuniary loss 216, 218–20
 - products, in 146
 - standard of care, changes in 262–3
- see also* information; safety
- premiums 357–60, 410–11, 415, 422, 438, 472–3
 - liability insurance 378, 384, 386–9, 400–401
- Price, L. J. 293
- Priest, George 3, 164, 222, 241, 381, 406
 - empirics 456–7, 466, 471
 - environmental liability 265, 267, 269
 - no-fault compensation schemes 410, 422
 - products liability 287, 290, 297, 301–4, 306
- primary costs 153, 216–17, 225
- Prince, David 303
- principals and agents *see under* agents; vicarious
- private loss *see under* loss
- privilege 143

- producers and lenders, liability of
 - 260–61
 - limited 139–40
 - productivity and innovation 304–6
 - products liability 63, 182, 225, 240, 287–320, 482–5
 - bystander injuries 317–18
 - consumer information about
 - product risk 291–2
 - contracting and tort liability, efficiency properties of 289–90
 - damages
 - compensatory 318–19
 - punitive 319–20
 - defects
 - construction and manufacturing 310–11
 - design 311–12
 - requirement of 309–10
 - warning 313–15
 - doctrines of 308–20
 - empirics, liability and product safety on 301–4
 - European Union Directive 393–4
 - harmonization of laws 443–5
 - informational mechanisms in
 - product markets 292–5
 - imperfectly competitive markets 290–91
 - innovation and productivity, impact of liability on 304–6
 - insurance 3, 385, 396, 482–5
 - costs and warranty liability 297–8
 - market for 306–8
 - regulatory problem 298–300
 - liability 315–16
 - enforceability of contractual
 - waivers of 316–17
 - extended seller 315–16
 - negligence, and 31–2
 - product safety, consumers
 - undervaluing 292–3
 - purpose 287–9
 - regulatory problem 298–300
 - strict liability 3, 31–2, 457
 - negligence, and, choice between 300–301
 - warranties 295–6
 - insurance costs and warranty liability 297–8
 - professional
 - advice cases 202–3, 210–11
 - liability *see* chance *under* loss
 - proof 29–30
 - proportional liability rule *see under* causation
 - prospective
 - causation *see under* causation
 - overruling 263
 - Protection and Indemnity Clubs 268, 273, 426
 - proximate cause 83–4
 - see also* causation
 - public
 - compensation mechanism *see* compensation mechanism
 - information on safety technology 27–8, 38
 - service, closure of cases 202, 210
 - Puelz, Robert 473
 - punishment 228, 235, 238, 239, 385
 - punitive damages 3, 12, 158, 166–8, 175, 182, 228–41
 - damages equaling harm 229–31
 - definition 228
 - deterrence, theory of 229–31
 - empirics 468–70
 - insurability 241, 399
 - litigation costs 240–41
 - optimal damages 237–8
 - harm underestimated, and 232–3
 - injurers escaping liability, and 231–2
 - marketplace, transacting and bargaining in, and 234–5
 - punishment, and 235–7, 239
 - socially illicit gains, and 233–4
 - products liability, and 319–20
 - reprehensible conduct 238
 - tax treatment 241
 - victims, strangers or customers as 240
 - wealth 239
- Quality Adjusted Life Years 161–2
 - Querner, Immo 18
 - Qian, Yingyi 142
 - race to the bottom 445–6
 - Rachlinski, Jeffrey 437

- Radetzki, M. and M. 269
 Randow, von Philipp 11
 Rao, A. 294
 Rapp, Geoffrey 472,
 Rasmussen, David 477, 479
 rational choice, behavioural
 assumptions of 35–6
 Raviv, Artur 290
 Rawls, John 223
 Rea, Samuel 67–70, 77, 171, 381
 reasonable care *see* due care
 recovery *see* recovery *under* joint and
 several
 plaintiffs 126–8
 rule 207, 208
 regulating *see* monitoring *under*
 precautions
 regulation 253–5, 298–300, 317, 347–9,
 398, 443, 485
see also safety
 Rehme, D. 251
 Reilly, Bridget 50, 76, 457, 465, 476–8
 Reinganum, Jennifer 241, 295, 305, 319
 re-insurance *see under* insurance
 relative negligence *see under* negligence
 relatives 160, 162–3
 remoteness test 102–3
 reprehensible conduct 236, 238
 research and development *see*
 innovation
 retroactive liability 261–3, 265, 266
 retrospective causation *see under*
 causation
 Reuter, Peter 303
 Revesz, Richard 109–30, 178, 179, 224,
 248
 environmental liability 259, 260, 268
 Reynolds, R. A. 355
 Rhoads, T. A. 251
 Richter, Andreas 34
 ricochet loss cases 202, 209
 right of contribution *see* contribution
 Riley, John 293
 Ringleb, Al 124, 296, 306
 risk
 allocation of 33–5, 73
 aversion 33–5, 135–6, 141, 180, 398,
 401, 453
 insurance, and 163, 174, 220–21,
 239, 297, 377–80, 389, 392
 based liability and safety regulation
 96–7
 ‘risk utility test’ 32, 310, 311, 313, 314
 Rizzo, Mario 168, 257, 435
 causation 86, 87, 98, 100
 economic loss, pure 204, 205,
 Roberts, Karen 481
 Robinette, Christopher 51, 73, 76–7
 Robinson, Glen 94, 96, 258
 Rock, Steven 487
 Roe, Mark 97
 Rogers, W. V. Horton 134, 215, 217,
 224
 Rogerson, William 293, 294
 Rogge, J. 265
 ‘role-type uncertainty’ 156
 Rolph, John 411
 Rose-Ackerman, Susan 22, 95, 98, 254,
 255
 Rosenberg, David 27, 37, 93, 94, 257
 Rosenblatt, Roger 353
 Rossato, Andrea 436
 Rothschild, Michael 388
 Rothwell, G.S. 272
 Rowley, C. K. 272
 Rubin, Paul 225, 303–4, 317–18, 455,
 458, 483–4
 Rubinfeld, Daniel 319
 damages 154, 156, 165
 environmental liability 256
 negligence 52, 56, 70–72, 77
 strict liability, and 19, 25
 Ruegg, M. 254
 Ruhm, Christopher 477, 478
 Ruiz, Juan 168, 169, 204, 435
 rule of no liability 6, 17, 31
 Rundshagen, B. 269
 Ruser, John 480, 481
 Rustad, Michael 319
 Ruttan, Vernon 305
 safety 50, 57, 137, 301–6, 349, 390, 411,
 413
 products liability 289–95, 296, 297,
 301, 484–5
 regulation 254, 267, 417, 420–21,
 423–4, 454–6, 477–9
 risk-based liability, and 96–7, 220
see also information; preventions
 Saffer, Henry 477, 478

- Sage, William 342, 354, 359, 360, 486
- Saks, Michael 455, 458, 461
- Samuelson, P. A. 383
- Sanchirico, Chris 165, 172
- sanctions and enforcement 143, 147, 239, 419
- non-legal 158
 - private 138, 141, 237
- Sappington, David 175, 261
- Sarat, Austin 461
- satisfaction 3
- Schafer, Hans-Bernd 263, 381, 435–6
- damages 154, 156, 167, 168, 169, 171, 177
 - economic loss, pure 203, 204, 205, 207
 - strict liability and negligence 5, 7, 15, 27
- Schauffler, Richard 465, 471
- Schelling, Thomas 224
- Schenzler, Christoph 50, 76, 457, 465, 476–8
- Schlanger, Margo 162
- Schmitt, Joan 473
- Schmitz, P. W. 254
- Schmookler, Jacob 305
- Schulze, W. 251
- Schwab, Stewart 15
- Schwartz, Alan 292, 295, 312, 317, 320, 381
- Schwartz, Gary 3, 57–8, 406
- economic loss, pure 201
 - empirics 454, 455, 456, 457, 489
 - environmental liability 249, 252, 255
 - non pecuniary loss 222
 - products liability 303
 - vicarious liability 137
- Schwartz, Victor 406
- Schwartz, Raimund 264, 266, 267, 379, 389, 391,
- Schweizer, Urs 206, 207
- Sclar, David 354
- scope of liability 87
- secondary
- accident cost reduction 180–81
 - costs *see under* costs
 - liability, strict *see* vicarious
- Segerson, Kathleen 29, 99, 122, 124, 172, 261
- self-
- insurance *see under* insurance
 - regulation 348
 - selection effect 24–7
- Sen, Amartya 223
- set-off 110, 118
- Settle, C. T. M. Hurley 248
- settlements 110–18, 127–8, 182
- several only liability 112
- Shanley, Michael 467
- Shapiro, Carl 293
- shareholders and investors 139–40, 231, 237, 262, 379, 396–7, 398
- Shavell, Steven 112, 204, 438, 453
- causation 54, 58–9, 85–91, 93–5, 97, 100–104
 - damages 154–60, 163–4, 168, 170, 172–5, 178–9, 180–81
 - environmental liability 251–4, 257, 262, 264, 266
 - medical malpractice 342, 345, 346, 347, 349
 - no-fault compensation system 409, 412, 417, 420, 421
 - non-pecuniary loss 218, 219, 220, 221, 222, 223, 224
 - products liability 289, 300, 301, 310, 315, 318, 319
 - punitive damages 166, 167, 229, 232–4, 236, 238–41
 - strict liability and negligence 5, 10, 11, 13, 15, 22
 - tort law and liability insurance 377, 379–82, 384, 386, 389, 392, 394–8
 - vicarious liability 135, 136, 137, 141, 142
- Shepherd, George 306
- Shepherd, Joanna 225, 304, 458, 484
- Sher, Noam 349
- Sherland, Paul 51, 73, 76–7
- Shogren, J. F. 251
- Shukaitis, Marc 163
- Sigman, Hilary 117, 118, 249, 259, 261
- Silver, Charles 345, 352, 353, 354
- Simon, Marilyn 301
- Singh, Ram 158, 159
- Skogh, Goran 397, 418, 424
- environmental liability 251, 261, 266, 267, 268, 271

- Sloan, Frank 303, 413
 empirics 457, 465, 468, 473, 476–8, 485, 487
 medical malpractice 349, 353, 356, 358
 negligence 50, 76
- Slovic, Paul 267, 437
- Smith, Adam 218
- Smith, Clifford 379
- Smith, Michael 379
- Smith, R. T. 253, 270
- Smith, Steven 465
- Smits, Jan 436, 440, 442, 444, 445, 447
- social
 costs *see under* costs
 loss *see under* loss
 welfare 33–4, 123, 172, 180, 206–7, 264, 439
 effects of liability regimes 4, 33–5
 illicit gains 167, 233–4
 medical malpractice 344–5, 346
 products liability 306, 316
- socially optimal level of care *see*
 optimal level
- solvency and insolvency 109, 112, 347, 418, 421–2
 damages, and 174–6, 179, 397
 environmental liability 252, 253, 259, 268
 joint and several liability 116–17, 119–25, 120–26
 vicarious liability 135, 136
- Spelman, William 461
- Spence, A. 291
- Spence, Michael 388, 482
- Spiegel, Menahem 234
- Spier, Jaap 98, 120, 203, 265, 276, 441
- Spier, Kathryn 318
- Spulber, Daniel 289, 291
- Stahel, W. R. 264
- Staiger, B. 249, 251, 252
- standard of care *see due care*
- Stein, Alex 96, 99
- Stewart, R 248, 268
- Stiglitz, Joseph 388
- stochastic due care and losses 66–7
- stock value 303–4
- Stone, Robert 305
- Stool, H. 228
- Stout, Emily 477
- Stout, Lynn 407
- St-Paul Travelers Companies 359
- Stratmann, Thomas 356, 486
- strict liability 402, 457
 accidents *see* accidents; bilateral; unilateral
 causation, and *see under* causation
 costs 24
 damages, and 155–6, 165–6, 176, 178, 180
 defences *see* defences
 design defects *see* product liability
 economic loss, pure and 207–9
 environmental liability 252–3
 exclusionary rule 207, 208
 information 27, 38
 insurance 380
 joint and several liability *see under*
 joint and several
 judgment-proof tortfeasor 29–30
 liability, magnitude and scope of 87
 medical malpractice 349–51
 negligence, and 3–38
 summary of 36–8
 no-fault compensation system, and 416–18
 products liability 3, 31–2, 300–301, 308–11, 314–18
 punitive damages, and 229–30
 rule of 10–13
 vicarious liability, and *see* vicarious
- Studdert, David 353, 409
 empirics 459, 463–5, 468, 470, 472
 subdivision of risk 383–4
- Sudman, Michael 50
- Sugarman, Stephen 128
- Summers, John 175
- Sunstein, Cass 35, 161, 162, 163, 437
 superfund 249, 258, 259–60, 261, 266, 268, 275
- Suurmond, Guido 221
- Swan, Peter 413, 415, 475, 478
- Swazey, Judith 305
- Sweden 362, 363, 364, 411
- Switzerland 344
- Sykes, Alan
 environmental liability 269
 vicarious liability 135, 136, 137, 139, 142–6

- Tabbach, Avraham 159–60, 175
- Tabarrok, Alexander 182
- Takaoka, Sumiko 303, 305
- Takeda, Keith 110, 117, 118
- Talarico, Susette 240–41, 465, 469
- Tancredi, Laurence 364
- Taragin, Mark 353, 465, 468
- Tauchen, George 478
- taxes and tax laws 145, 157, 165, 172–3, 206, 241
 environmental liability 254
 Pigovian taxes 250
- ‘technological advancement test’ 263
- Teitelbaum, Joshua 35, 36
- terrorism 307, 359, 406, 409, 422–3
- tertiary costs *see under* costs
- Thaler, Richard 35
- ‘thin skull plaintiff rule’ 157
- third party
 defendant 110
 insurance *see under* insurance
- Thirtle, Colin 305
- Thomas, Eric 459, 463
- Thorpe, Kenneth, 357–8, 360, 361, 410, 473
- threshold
 liability 258
 probability rules *see under* causation
- Tiebout, Charles 439
- Tietenberg, T. 119, 179, 259
- Tillinghast-Towers Perrin 217, 459, 470–71
- Tirole, Jean 293
- Tol, R. S. J. 276
- tort law, harmonizing 435–47
 cross-border externalities 444–5
 domestic preferences 436–8
 market for tort law systems 438–9
 economic analysis and
 harmonization 440–41
 European tort law systems,
 differences in 439–47
 mobility, tort law as obstacle to
 442–3
 race to the bottom 445–6
 regulatory competition 443–4
 transaction costs, reduction of 446–7
- tort litigation system 461–71, 471–3
- transaction costs *see under* costs
- transferred loss cases 202, 209–10
- Trebilock, Michael 129–30, 181–2, 456
 environmental liability 252–3, 260, 269, 271
 liability insurance 384–5, 402,
 medical malpractice 342, 345, 352–3,
 355, 357–8, 361–3
 no-fault compensation system 406,
 410, 412, 413, 417
 products liability 302, 307
- Tribe, B. 258
- trilateral precaution accidents 208–9
- Tuckman, Bruce 241
- Tunc, A. 406, 412
- Tussing, A. Dale 487
- Twerski, Aaron 300, 312
- Ulen, Thomas 97, 219, 362, 436
 contributory and comparative
 negligence 59–63, 66, 71, 77
 damages 154, 155, 156, 159, 174
 environmental liability 253, 254, 255
 strict liability and negligence 7, 12,
 15, 24
- uncertainty 24, 156, 252–3, 307–8, 453
 causation, over 91–3, 96, 97, 176–7,
 266, 272
 environmental liability 257–8, 259
- under-
 compensation *see under* damages
 compliance and investment in care
 13, 95
 deterrence *see under* deterrence
 investment 88–9
 writers *see* gatekeepers; *see under*
 insurance
- unilateral accidents 5–15, 16, 36–8,
 47–8, 349, 409
 damages, and 154–5, 164
 economic loss, and 207–8
 environmental liability 252–3
 legal standards of due care 13–15, 20
 negligence 6–7
 relaxing assumptions 7–10
 non pecuniary loss 219
 punitive damages 235
 rule of no liability 6
 strict liability 10, 20–22
 relaxing assumptions 10–13
 rule of 10–13
 unilateral care 63–5

- United Kingdom 3, 49, 51, 134, 211, 385, 437
 - medical malpractice 342, 344, 352, 357
 - see also* medical malpractice
- United States 3, 46, 408
 - automobile accidents 412–13, 474–7
 - see also* automobile
 - catastrophic risks 92, 423
 - see also* catastrophic
 - compensation 157, 161, 171, 224, 225
 - see also* damages
 - contributory and comparative negligence 49, 50, 51–2, 77
 - see also* contributory negligence
 - corporate crime 134, 143, 145, 146
 - see also* corporations; crime
 - data 458–9
 - Department of Transportation 413
 - economic loss, pure 201, 209
 - see also* economic loss
 - empirics 455–8, 461–73, 480, 484–9
 - see also* empirics
 - environmental liability 110–11, 253, 256, 261, 266
 - nuclear risk 269, 271–2, 276
 - oil pollution 272–3
 - see also* environmental liability;
 - marine oil; nuclear
 - insurance 224–5, 226, 385
 - see also* insurance
 - juries, role of 74
 - see also* juries
 - medical malpractice 342–3, 351–9, 361, 362
 - see also* medical malpractice
 - products liability 287–8, 294, 296, 304, 306–10, 314, 318, 320
 - see also* products liability
 - punitive damages 3, 228
 - see also* punitive damages
 - standard of care 48
 - see also* due care
 - vicarious liability 134
 - see also* vicarious
- valuation
 - contingent 256
 - environmental damage 255–7
 - human life of *see* human life
- Value of a Statistical Life 161, 162, 224, 226
 - Year 161–2
- Van Aaken, Anne 167
- Van Boom, William 363, 438, 440
- Van Dam, Cees 51
- Van Damme, K. N. 426
- Van den Bergh, Roger 174, 266, 271, 424, 439–46,
- Van den Borre, T. 260, 271–2
- Van Egteren, H. 253, 270
- Van Mieghem, E. 272
- Van Randow, Philipp 219
- van Velthoven, Ben 221, 406, 413
- Van Wijck, Peter 158
- Venezian, E. C. 307
- van't Veld, Klaus 306
- Veljanovski, Cento 342, 345
- Verheij, A. 248, 273
- Verheyen, R. 276
- Vertinsky, Ilan 437
- vicarious liability and corporate civil liability 27–8, 38, 134–47
 - alternative liability targets 144–5
 - gatekeepers 144
 - personal liability 144
 - criminal liability, and 145–7
 - definition 134
 - factors militating against 137–40
 - negligence and composite regimes 142–4
 - principal and agent liability, interaction between 140–42
 - standard case for 135–7
- Viney, Genevieve 342
- Viscusi, W. Kip 265, 361, 399, 437, 471, 473, 481, 483
 - damages 154, 161, 181
 - economic loss, pure 217, 221, 223–5
 - no-fault compensation schemes 409, 410
 - products liability 303, 305, 307–8, 310, 313, 319–20
- Visscher, Louis 166, 174, 272, 436, 440, 442–6
- Von Bar, Christian 51
- Von Weizsacker, Carl 206

- wages *see under* loss
- Wagner, Gerhard 437, 439–41
 environmental liability 249, 266–7
 liability insurance 386, 396, 398–9, 402
- Wagner, Wendy 315
- Waidmann, Timothy 486–7
- Waldman, Steven 313
- Wang, H. 273, 426
- warranties 295–8
- Watts, Alison 124
- wealth
 defendants, of 171–2
 injurers 239
 lower than damage 29–30, 38
- Weber, Nathan 303
- Wehrung, Donald 437
- Weil, Roman 157
- Weinstein, Neil 35, 162
- Weir, Tony 203
- Weisbach, David 172
- Weiss, Mary 413, 476
- welfare effects of liability regimes *see under* social welfare
- Wheeler, Malcolm 146
- Whetten-Goldstein, Kathryn 477, 479
- Whinston, Michael 206
- White, G. 267
- White, Michelle 19, 457
 empirics 468, 477, 484–5
 medical malpractice 342, 352, 353, 354
 negligence 67, 73, 74–5
- Wickelgren, Abraham 298
- Wiggins, Steven 124, 273, 296, 306
- Wildavsky, A. 270
- Wilde, Louis 295
- Wilkins, David 145
- Wilkinson, James 478
- Wilson, Charles 388
- Wilson, Richard 437
- Winkler, Daniel 76, 77
- Winter, Jan Kees 158, 260, 271
- Winter, Ralph 307
- Witt, Robert 379
- Wittman, Donald 17, 63, 72–3, 74, 99
 damages 156, 170, 173
 environmental liability 253
- Wohlschlegel, Ansgar 27
- Wojtowycz, Martha 487
- Wolinsky, Asher 294
- Wolson, Mark 157
- Woodhouse Royal Commission Report 414
- workers and workplaces 136, 182, 352, 362, 406, 456–7, 479–82
 asbestos claims *see* asbestos
- Worldcom 145
- Worrall, John 480, 481
- Wren, J. 426
- Wright, Richard 89, 119, 125–6
- Yahya, M. 124, 125
- Yoon, Albert 472
- Young, Douglas 477, 479
- Young, Madelyn 413, 476
- Young, Robert 99
- Yun, John 167, 319
- Zador, Paul 413, 476
- Zeckhauser, R. 264
- Zelizer, Viviana 222
- Zervogianni, Eleni 153, 159
- Zolt, Eric 241
- Zuckerman, Stephen 355, 358, 410, 473,
- Zweifel, Peter 377, 379, 388, 389
- Zweigert, Konrad 3