THE IMPACT OF OPERATING LEVERAGE ON ASSET PRICING

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Master's Thesis submitted to NUST Business School (NBS), National University of Sciences and Technology, in partial fulfillment of the requirements for awarding the degree of Masters of Philosophy (M.Phil) Business Administration

August 2014

Acknowledgement

I owe my personal and intellectual debt to my parents whose prayers and consistent support has been bringing me invaluable accomplishments.

I would like to acknowledge my academic and personal indebtedness to Dr. Salim Batla, whose guidance and feedbacks helped me timely and effectively to complete all the phases of research work.

I would also like to express my heartfelt gratitude to my committee members; Mr. Tariq Abbasi, Mr. Saad Khan Al-Marwat and Dr. Hilal Anwar butt who introduced me to the domain of investment and financing behavior of firms and consistently reviewed this work.

Last but not the least; I am thankful to the Finance & Investments Department personnel for their immense cooperation in pursuance of this work.

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The Role of Operating Leverage in Asset Pricing

Abstract

This thesis examines the association between operating leverage and expected return, operating leverage and systematic risk and also among operating leverage and book-to-market ratio through an empirical approach. Financial leverage, as an interactive term of operating leverage, is also included as a main test variable throughout the research. The sample used in the empirical test is based on 184 textile firms listed on Karachi Stock Exchange with a time window of 5 years (2008-2012).

Keywords: operating leverage, financial leverage, expected return, systematic risk, book-to-market ratio, value premium.

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CHAPTER I

1. Introduction

The well-established Capital Asset Pricing Model (CAPM) provides an explanation of the cross-sectional variation of equilibrium asset returns. It predicts that the only asset specific explanation for the differences in asset returns is beta, or, systematic risk (Sharpe, 1964; Lintner, 1965; Black, 1972). Several empirical contradictions (Banz, 1981; Basu, 1983; Rosenberg, Reid, and Lanstein, 1985; Bhandari, 1988; Chan, Hamao, and Lakonishok, 1991, Lakonishok, Shleifer, and Vishny, 1994) seem to undermine the ground of CAPM, and the value effect (book-to-market ratio, BE/ME) and size effect (market equity, ME) are deemed as the most prominent amongst the others. Consequently Fama and French (1992) introduce two additional risk factors (HML, SMB) to the single factor (the market) asset pricing model, which gives us the well-known Fama-French three factor model.

Despite the CAPM and Fama-French three factor model's success in theory and empirical tests, some essential questions are left open. For example, the CAPM does not answer the question where the systematic risk a firm faces comes from, and the Fama-French three factor model does not give an explicit explanation to the real risk (or the economic sources of the value premium) behind the two risk factors (MHL, SMB) it proposes. On the one hand, some researchers (e.g. Lakonishok et al. (1994), La Porta (1996), Daniel et al. (1998)) argue that the premiums for the value, size and momentum effects are due to suboptimal behavior biases (investor irrationality). On the other hand, a number of studies (Fama and French (1993), Liew and Vassalou (2000), Berk et al. (1999), Carlson et al. (2004), Petkova

and Zang (2005)) try to use additional risk that is not captured by systematic risk to explian premiums. Where there are a number of financing/accounting variables that are considered relevant in the study of stock returns (to list a few, leverage, P/E ratio, dividend payout ratio, Book to Market ratio), this paper focuses on a firm specific variable which is closely related to a firms' investment decision: operating leverage. Firms face trade-off between fixed and variable operating costs. Operating leverage refers to the operating cost structure (fixed costs versus variable costs) a firm chooses for its business (Corporate Finance 9th ed., Ross, Westerfield, Jaffe). In general, a firm chooses an operating cost structure with high fixed costs and low variable costs is said to have a high operating leverage; on the contrary, a firm that adopts an operating cost structure with low fixed costs and high variable costs is said to have a low operating leverage. Outsourcing is a good example of the decision on operating cost structure a firm takes. A firm can outsource the production department to an external supplier, and bear higher variable costs but lower fixed costs. Alternatively, it may as well purchase the property and machinery for production, which incurs a high level of fixed costs but lower variable costs in turn. Operating leverage, i.e. the trade-off between fixed and variable costs a firm chooses, is an important capital investment decision made by the management of the company.

Firms generate variable revenues. Fixed operating costs however, by definition, have to be paid in a fixed amount under any circumstances (however low or high the sales is). This leaves the firm with the possibility of greater losses or gains. In other words, the sensitivity of profit to the sales of a firm is amplified by the level of fixed costs it chose for its operating cost structure.

Financial leverage refers to the extent to which firms rely on debt capital (Corporate Finance 9th ed., Ross, Westerfield, Jaffe). Similar to operating leverage, financial leverage is the trade-off between fixed and variable financial costs a firm faces. A firm that adopts debt in its capital structure has to make fixed interest payments regardless of the profits it makes. Therefore, financial leverage can also work as a gear in generating revenues as operating leverage does.

It has been broadly accepted that operating leverage as well as financial leverage magnifies the sales risk faced by a firm and therefore leads to higher systematic risk and expected return (Lev (1974), Hill and Stone (1980), Gahlon (1980), Gahlon and Gentry (1982), Mandelker and Rhee (1984), Chung (1987)). Nonetheless, as Novy-Marx (2007) suggests, the function of operating leverage in producing the across company variation of predictable returns is likely to be under-biased by two reasons. The first is a measurement problem as operating leverage is largely considered unobservable due to the lack of direct measures available from the observable accounting or market data. The second comes from the partial equilibrium models generally used in theory.

In this paper, the role of operating leverage in asset pricing is examined empirically in the following dimensions. First, the relation between expected return and operating leverage is reexamined. Second, the channel through which operating leverage explains the cross-sectional variation in expected return is discussed by empirical evidence, in specific, the relation of operating leverage with systematic risk as well as that of operating leverage with the value and size premiums. Third, the association between operating leverage and

financial leverage and a comparison of the impact they have on the expected rate of returns are also examined by empirical methods.

CHAPTER II

2. Literature review

2.1. The studies on real determinants of systematic risk

Following the establishment of Capital Asset Pricing Model (CAPM), a considerable number of studies have been conducted both theoretically and empirically to identify the real determinants of systematic risk.

Hamada (1972) is broadly deemed as the pioneer in the research category of real determinants of systematic risk. He links CAPM with the Modigliani and Miller (1963) proposition and reports in his empirical research that financial leverage accounts for approximately 21% to 24% of the across firms difference in observed systematic risk. Rubinstein (1973) shows the association between systematic risk and operating leverage of a company through the application of the mean-variance analysis in the modern portfolio theory. Lev (1974) decomposes the total operating cost into variable and fixed components and finds empirical evidence for a negative association between systematic risk and the variable cost component. However, a few researchers (e.g. Chung (1989), Toms, Salama and Nguyen (2005)) cast doubt on Lev's empirical approach, pointing out that the decomposition of operating cost may suffer from measurement problems.

By repetitive substitutions, Mandelker and Rhee (1984) analytically derive that systematic risk can be discomposed into three independent elements: DOL (degree of operating leverage), DFL (degree of financial leverage) and the intrinsic business risk. They investigate the combined effects of operating leverage and financial leverage on systematic risk. Their empirical findings report that, at portfolio level, approximately 40% of the difference across firms, in systematic risk can be attributed to DOL and DFL. However, they fail to introduce the intrinsic business risk into their empirical model.

Chung's (1989) study further enhances the Mandelker and Rhee (1984) model by adding demand beta as a determinant of the inherent risk in business. In the empirical test of his model, the coefficients of DOL and demand beta both are positive and significant, while the coefficient of DFL is positive but not significant. Approximately 20 percent of the cross-sectional variation in systematic risk is explained by the model. When using the instrumental variable technique, the significance of all three important independent variables improves dramatically, and the effect of DFL becomes significant. When the portfolio approach is adopted, the explanatory power of the model improves significantly from 20 percent to 54 percent.

Studies that examine the joint effect of leverage on systematic risk tend to conclude that the operating leverage effect is more significant than the financial leverage effect on systematic risk (Gahlon and Gentry (1982), Mandelker and Rhee (1984), Huffman (1989), Darrat and Mukherjee (1995), Li and Henderson (1991), Chung (1989), Lord (1996), Toms, Salama and Nguyen (2005)). In this thesis, the theoretical relationship between systematic risk and operating leverage and financial leverage is tested by empirical methods.

2.2. Studies on the value premiums of stock returns

The explanations for value and size effects have been a heated source of debate among financial researchers in the past decades, with a large number of studies involved in trying to reveal the underlying interpretation to the value premiums of the two effects. Fama and French (1992) suggest that the book-to-market ratio is associated with relative profitability. This means, on average, value firms have relatively high earnings while growth firms earn relatively low earnings. The evidence in Fama and French (1993) suggest that the risk factor HML captures the variation of relative profitability through time. "A high HML indicates that the difference in relative earnings performance is large during the certain period while a low HML means that difference in relative earnings is less significant during the time period. A stock with negative slope on HML has lower expected return as HML increases due to its hedge position against the common factor in returns related to relative profitability." Chen and Zhang (1998) show that the value premium of value stocks is a compensation to the additional risk induced by some characteristics of value stocks. Firms with high book-to-market ratio (value firms) typically face higher degree of financial distress, higher financial leverage and substantial uncertainty in future earnings performance. In addition, Chen and Zhang (1998) notice an interesting point of geographical difference in value effects4.

In contrast with the traditional view which holds that value effect is caused by the priced risk of financial distress in value firms, a new and growing literature is trying to explain the systematic risk and expected return evolutions through firm-level investment decisions by theoretical evidence. Berk, Green, and Naik (1999) are among the first in this line of

research. Through a dynamic model they develop, the authors show that optimal investment decisions account for a predictable change in firm's assets-in-place and growth opportunities and thus impacts the systematic risk and expected return of the firm stocks.

In spirit of Berk, Green, and Naik's (1999) theoretical approach, Carlson, Fisher and Giammarino (2004) construct two dynamic models to relate endogenous firm investment to expected stock returns. They discover an economic role of operating leverage in explaining the value premium effect: when demand drops by some certain reasons, market value of equity declines due to the unfavorable performance of the firm while book value of equity remains basically the same, leading to a higher value. And operating leverage can further amplify this dynamic by adding to the demand volatilities. They also show the impact of proportional growth opportunities on size effect with their dynamic models and find empirical support for these models.

Also from a perspective of real options, Zhang (2005) demonstrates that assets in place incorporate higher risk compared to growth options of the firm, especially in economic downturns where the risk premiums increase dramatically. This point of view is against the conventional wisdom which holds that growth options are riskier than assets in place due to their leverage feature on existing assets. His argument is based on an effect of "costly reversibility", which states that cutting is more costly than expanding in capital for firms. He argues that it is more difficult for value firms to disinvest its unproductive capital than for growth firms in bad times, while in good times growth firms have more flexibility to adjust investment to the favorable economic conditions. Thus, value stocks bear higher risk than growth stocks do.

Underlying most hypothetical models of value premium Novy-Marx (2010) discovers the immediate experimental proof for the "operating leverage hypothesis". His empirical findings suggest that operating leverage, especially market operating leverage (the difference between book and market operating leverage is discussed later in the “operating leverage measurement” part), plays an important role in the value premium of the stock returns. He sorts shares into five equal groups based on operating leverage and finds significant cross-sectional variation in expected returns and the HML loadings generated by Fama-French three factor model across the operating leverage quintiles. He also reaches a conclusion that there is no significant relationship among operating leverage and the book-to-market ratio by noticing that the sorting on operating leverage does not generate noticeable variation in the portfolios’ book-to-market ratios. This result contradicts with Garcia-Feijoo and Jorgensen’s (2010) empirical findings of a positive relation between the degree of operating leverage (DOL) and book-to-market ratio. This empirical contradiction is possibly due to the different operating leverage measures the two studies used. In addition, Novy-Marx (2010) develops an equilibrium model which suggests that the value premium is mostly a phenomena observed within industry and the relationship between expected returns and industry book-to-market is weak and non-monotonic. This prediction of the model is supported by the empirical results in his research.

Gulen, Xing and Zhang (2008) show a strong countercyclical variation pattern in expected value premium of stock returns through a Markov switching framework. They document that growth firms typically display stronger flexibility than value firms in adjusting to unfavorable economic conditions through a range of flexibility proxies such as operating and financial leverage, the percentage of non-current assets to current term assets and the

rate of recurrence of disinvestment. They demonstrate that anticipated surplus returns of value stocks are more severely affected than growth stocks in economic recessions, while in economic booms both stocks, value and growth, load insignificantly on economic condition measures. Their study sheds light on the cross-sectional expected returns from a perspective of the time-varying expected value premium.

From an accounting point of view, Penman, Richardson and Tuna (2007) raise an interesting point that the book-to-market ratio (or B/P ratio, as in their paper) is intrinsically an accounting phenomenon, which is determined solely by the accounting method accountants use to measure the book value rather than the risk of the equity. They decompose the book-to-market ratio into two components: an enterprise book-to-price component and a leverage component. The former, as measured by book value of net operating assets divided by its market value, is a reflection of firm operating activities and therefore used as a proxy for operating risk. The latter, as measured through percentage of book value to total leverage divided by market value of equity, is a commonly used determinant of financing leverage and therefore reflects financial risk. This decomposition of book-to-market ratio is consistent with the argument that book-to-market ratio absorbs the leverage effect in the model explaining the expected return of stocks. Their empirical results confirm that the enterprise book-to-price component (as proxy for operating risk) is positively associated to expected returns. However, a negative association between the leverage component (reflects financing risk) and expected return is detected in the empirical approach which constitutes an anomaly against the conventional theory that financial risk is supposed to be compensated by higher expected returns. But as noticed by the authors, it is possible that this empirical finding is sample-specific.

2.3. Measures of leverage

2.3.1. Definitions of leverage measures

The measurement of operating leverage has been a technical problem that plagues the researchers in this category of studies. This is due to the fact that fixed and variable costs are concepts in management accounting (internal accounting) rather than financial accounting (external accounting). This leads to substantial technical difficulties in accurately separating the variable and fixed costs from a firm's cost structure. And accordingly, operating leverage is unobservable from the firm's financial reports. In previous studies, researchers tried to use different proxies of operating leverage to examine the association among operating leverage and systematic risk or expected stock returns. For instance, Lev (1974) uses unit variable as a proxy for operating leverage and demonstrates empirically the positive relationship among operating leverage and systematic risk. Percival (1974) derives analytically that contribution margin is a component in the covariance between stock returns and the market return and thus concludes that systematic risk is amplified by operating leverage through a form of contribution margin. Gahlon (1980) criticizes these studies by pointing out that these operating leverage measures (i.e. unit variable cost and contribution margin) do not take into account the level of fixed costs incurred by the firm and thus are inappropriate measures of operating leverage. He analytically demonstrates through two models, for single-product and multiproduct firms respectively, that the influence of operating leverage on firm's systematic risk is fully captured by the measure of degree of operating leverage (DOL).

Degree of operating leverage is widely used in finance literature and theories. As a quantitative measure of operating risk, degree of operating leverage has two definitions.

$$\text{Degree of operating leverage (DOL)} = \frac{\%\Delta \text{EBIT}}{\%\Delta \text{Q}} \qquad (1)$$

The first definition of DOL contains an elasticity concept: the ratio of percentage change in operating income (EBIT) to percentage change in units sold (Q). We can rewrite the equation as following:

$$\text{DOL} = \frac{\%\Delta \text{EBIT}}{\%\Delta \text{Q}} = \frac{\Delta \text{EBIT}/\text{EBIT}}{\Delta \text{Q}/\text{Q}} = \frac{\Delta \text{EBIT}}{\Delta \text{Q}} \times \frac{\text{Q}}{\text{EBIT}}$$

If we denote P as price per unit (assumed that price does not change within the certain period), V as variable operating cost per unit and F as fixed operating cost, Q(P-V) is known as the contribution margin (units sold times the difference between unit price and unit variable cost). We can denote operating income as (P-V)Q-F (sales less variable operating cost less fixed operating cost). When units sold changes by , operating income changes by (P-V) . The above equation can be rewritten as following:

$$\text{DOL} = \frac{\Delta \text{EBIT}}{\Delta \text{Q}} \times \frac{\text{Q}}{\text{EBIT}} = \frac{(\text{P} - \text{V})\,\Delta \text{Q}}{\Delta \text{Q}} \times \frac{\text{Q}}{(\text{P} - \text{V})\text{Q} - \text{F}} = \frac{\text{Q}(\text{P} - \text{V})}{\text{Q}(\text{P} - \text{V}) - \text{F}} \qquad (2)$$

This gives us the second definition of DOL: the ratio of contribution margin to operating income.

Similarly, we can define degree of financial leverage (DFL), the quantitative measure of financial risk, as in the following equation (3) and (4):

$$\text{Degree of financial leverage (DFL)} = \frac{\%\Delta \text{NI}}{\%\Delta \text{EBIT}} \qquad (3)$$

In the first definition, DFL is the ratio of percentage change in net income (NI) to percentage change in operating income (EBIT). The second definition of DFL is as following:

$$\text{Degree of financial leverage (DFL)} = \frac{\text{EBIT}}{\text{EBIT} - \text{Interest}} \qquad (4)$$

The intuition of this second definition of DFL is straightforward: the higher the fixed financial cost (interest expenses), the higher financial risk the firm faces.

The firm's total leverage is a combination of operating leverage and financial leverage. In accordance with the two definitions of DOL and DFL, the degree of total leverage is defined in the following two ways:

$$\text{Degree of total leverage (DTL)} = \text{DOL} \times \text{DFL} = \frac{\%\Delta \text{EBIT}}{\%\Delta Q} \times \frac{\%\Delta \text{NI}}{\%\Delta \text{EBIT}} = \frac{\%\Delta \text{NI}}{\%\Delta Q} \qquad (5)$$

The first definition of total leverage can be interpreted as the percentage of change in net income when units sold change by 1 percent. In the second definition, degree of total leverage equals to the proportion of contribution margin in earnings before tax.

Novy-Marx (2010) argues that the operating leverage depends not on the amount of the expenditure and profits of the firm as commonly assumed, instead on the capitalized amount of all future expenses and profits of the firm. Accordingly, in his empirical research he uses the concepts of "book operating leverage" that is defined as the ratio between annual operating costs and book value of assets. This measure used by Novy-Marx has rarely been adopted by previous studies and little theoretical evidence can be found to support this approach, therefore the traditional and widely used DOL and DFL are adopted as the main variables throughout the empirical approach.

2.3.2. Estimation of DOL and DFL

Estimation approach used for the measure of DOL is the point-to-point method, which measures the DOL as the percentage changes in earnings to percentage changes in sales. Following this method, Ferri and Jones (1979) define the degree of operating leverage in their empirical study as: $\mathrm{DOL} = \frac{E_t - E_{t-1}}{E_{t-1}} / \frac{S_t - S_{t-1}}{S_{t-1}}$ where Et is the earnings before interest and taxes in year t and St represents the sales in year t. They also include two alternative measures of operating leverage which are based on the accounting data: 1) FA/TA, value of fixed assets to value of total assets; μ(FA)/ μ(TA), the average value of fixed assets to the average value of total assets in the preceding years (in their analysis they use the average value of the preceding four years). Another empirical study by Gulen, Xing and Zhang (2008) finds operating debt as a proportion of the percentage change in operating income before depreciation to the percentage change in sales.

Another approach in empirical researches to estimate the degree of operating leverage and degree of financial leverage is time-series regression. For degree of operating leverage

(DOL), this approach regresses the earnings before interest and tax (EBIT) on the sales (Q) in a time-series dimension. Accordingly, degree of financial leverage (DFL) is estimated by time-series regression of net income (NI) against earnings before interest and tax (EBIT). The variables (both dependent and independent) take the form of natural logarithm in the time-series regressions.

This logarithm form better captures the (first) definition of DOL and DFL but in the same time incorporates a problem with negative earnings (that the natural logarithm of a negative number does not exist). Researchers used a variety of methods to deal with the issue of negative numbers. For example, in Mandelker and Rhee (1984) a different estimation approach is activated if negative earnings are observed. Chung (1989) adopts the approach Mandelker and Rhee (1984) use for negative observations for his whole sample in order to avoid estimation biases caused by different treatments between positive and negative observations. Garcia-Feijoo and Jorgensen's (2010) used a special transformation technique to obtain the main variables in natural logarithm form.

O'Brien and Vanderheiden (1987) argue that the DOL estimated by the time-series regression as suggested in Mandelker and Rhee (1984) would bias towards a value of one when sales and EBIT grow on average at the same rate. To avoid this estimation bias, they propose a two-step regression method across time, which includes a detrending procedure before the time-series regression estimation for DOL. Dugan and Shriver (1992) compare these two estimation methods of DOL through an empirical approach and show that the O'Brien and Vanderheiden's estimation technique produces DOL estimates with less values of below one and the DOL estimate is more consistent with the ex-ante theory. This

approach is adopted by Garcia-Feijoo and Jorgensen's (2010) in their empirical research about operating leverage. However, as noticed by Lord (1998), the DOL estimate from the detrending approach of O'Brien and Vanderheiden (1987) is also problematic: it tends to produce more volatile series of DOL estimates than the Mandelker and Rhee approach.

CHAPTER III

3. Hypothesis and Data

3.1 Hypothesis

The main purpose of this thesis is to provide empirical proof for the previous theoretical studies on operating leverage and dynamics of expected returns. Thus, the hypotheses to be tested by empirical methods in this thesis are as below:

H1: Expected stock return is positively associated with operating leverage.

H2: Systematic risk is positively associated with operating leverage.

H3: Book-to-market ratio is positively associated with operating leverage.

H4: Size is positively associated with financial leverage.

3.2 Sample selection

The sample used in this empirical research is based on textile sector companies listed on Karachi Stock Exchange from year 2008 – 2012. Among the 183 textile sector companies listed on Karachi Stock Exchange financial data for only 155 companies was available. The sample was further decreased in size to 117 companies due to non-availability of data on company returns.

The monthly security data is obtained from Securities and Exchange Commission Pakistan (SECP). Security data includes monthly return (RET), stock price (PRC), number of shares

outstanding (SHROUT) and market return (MR). Annual financial statement data includes earnings before interest and taxes (EBIT), sales (SALE), net income (NI), total assets (AT), property, total common/ordinary equity (CEQ), debt in current liabilities (CL) and total long term debt (NCL).

3.3 Variable definition

3.3.1 DOL and DFL

Xing and Zhang (2008) approach that measure the operating debt by the proportion of the percentage change in operating income to the percentage change in sales is adopted for the estimation of DOL and DFL is calculated as percentage change in net income to percentage change in operating income , which are used as the main explanatory variables in the research.

The transformation technique used by Garcia-Feijoo and Jorgensen's (2010) to deal with negative values in estimation of DOL and DFL is adopted here. The transformation is as following:

$Y=\ln(1+X)$, if $X\geq 0$

$Y=-\ln(1-X)$, if $X<0$

Where X stands for EBIT, Sales or Net Income and Y is the value of the natural logarithm of the three variables after the transformation.

3.3.2 Systematic risk - beta

In order to investigate the association between systematic risk and operating leverage, the commonly used market model is adopted for the estimation of beta:

$$R_{it} = \alpha_{it} + \beta_{it} R_{mt}$$

Where R_{it} is the holding period return of company i in month t and is the return on value-weighted market portfolio.

3.3.3 Return, size and book-to-market ratio

Following Fama and French (1996), Garcia-Feijoo and Jorgensen (2010) average monthly return of calendar year t is calculated as equally weighted average of monthly returns from July (year t) to the next June (year t+1).

The market capitalization of the firm in year t is calculated as the product of price and number of shares outstanding by the end of June in year t.

The book-to-market variable is defined as the book value of common equity at the end of previous fiscal year (year t-1) divided by the market capitalization by the end of June in year t.

CHAPTER IV

4. Methodology

The main method used in the empirical test of this thesis is panel data regressions at firm level.

Panel data regressions aim to examine four theoretical relations regarding operating leverage: first, the expected stock returns and operating leverage; second, the systematic risk of stock and operating leverage; third, the book-to-market ratio and operating leverage; fourth, size and operating leverage. Econometric models to be tested are as following:

Expected return as dependent variable:

Average monthly return i

$$= \alpha o + \alpha 1 \text{Ln DOLi} + \alpha 2 \text{Ln DFLi} + \alpha 3 \text{Ln}\beta i + \alpha 4 \text{ Ln (BE/ME)I} + \alpha 5 \text{ Ln MEi} + \varepsilon i \quad (1)$$

Systematic risk as dependent variable:

$$\text{Ln}\beta i = b0 + b1\text{Ln DOLi} + b2\text{Ln DFLi} + b3\text{Ln (BE/ME)I} + b4\text{Ln MEi} + \text{ i} \quad (2)$$

Book to Market ratio as dependent variable:

$$\text{Ln(BE/ME)I} = c0 + c1\text{Ln DOLi} + c2\text{Ln DFLi} + c3\text{Ln MEi} + \text{ I} \quad (3)$$

Size as dependent variable:

$$\text{Ln ME}_i = d0 + d1\text{Ln DOL}_i + d2\text{Ln DFL}_i + d3\text{Ln (BE/ME)}_i + \ i \qquad (4)$$

Where:

DOL	$\gamma 1$ from: Ln EBIT = $\gamma 0 + \gamma 1$ Ln Sales + u
DFL	$\lambda 1$ from: Ln NI = $\lambda 0 + \lambda 1$ Ln EBIT + v
Beta	βi from: $R_i = i + \beta i R_m$
BE/ME	(CEQ)/ ME
ME	PRC* SHROUT

CHAPTER V

5. Empirical results

I run four panel data regressions at firm level of the following dependent variables: average monthly return, beta, book-to-market ratio (BE/ME) and size (ME). The average monthly return of the firm in year t equals the average return from July to the June of next year. Beta is estimated annually by running 5-year rolling regressions of the market model (coefficient of the value-weighted market return). The market capitalization of the firm in year t is calculated as the product of price and number of shares outstanding by the end of June in year t. The book-to-market ratio is defined as the book value of common equity at the end of previous fiscal year (year t-1) divided by the market capitalization by the end of June in year t if fiscal year end is between January and June. The average values of the coefficients from the panel data regressions are reported in Table 1.

5.1 Average monthly return

Table 1 Panel A shows the regression results of the average monthly return. I find that book-to-market ratio is positively but weakly associated to expected return consistent with Novy-Marx (2010) who developed an equilibrium model which predicts that the value premium is largely an intra-industry phenomena and the relationship between expected returns and industry book-to-market is weak.

Size is negatively associated to expected return. Even though no significant evidence is traced for the association between DOL and expected return, the sign of the coefficients of

DOL is consistently positive despite different control variables were added to the resgression. The insignificance of the regressions results for DOL is more or less expected due to some downward biases add to the difficulty for this association to be examined. These downward biases include the non-avoidable "error-in-variable" problem (Mandelker and Rhee (1984), Chung (1987) etc.) and the co-varying growth pattern in EBIT and sales (e.g. O'Berien and Vanderheiden (1987), Garcia-Feijoo and Jorgensen (2010)).

Associated between degree of financial leverage and stock returns is found to be positive and significant. if the level or point of financial leverage is high, the more rise is anticipated profit on company's equity. Thus, financial leverage is used in various circumstances as a means of altering the cash flow and financial position of a company.

Supporting the traditional theories of risk and return a positive association is found between risk and return.

Table 1

Panel A: Average monthly return as dependent variable

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DOL	0.016745	0.020669	0.229555	0.7643
DFL	0.023621	0.028706	2.564674	0.0107
BETA	0.216555	0.050447	4.292686	0.0000
BEME	0.143551	0.059885	2.397097	0.0121

ME	-0.101554	0.061195	-1.659524	0.0957

R-squared	0.696388	Mean dependent var	1.285116
Adjusted R-squared	0.589024	S.D. dependent var	2.265878
S.E. of regression	1.404438	Sum squared resid	680.4941
F-statistic	6.486219	Durbin-Watson stat	2.594383
Prob(F-statistic)	0.000000		

5.2 Systematic risk

In order to testify the association between systematic risk and operating (and financial) leverage, I run regressions of beta against DOL and DFL, using BE/ME and ME as control variable. The regression results are reported in Table 1 Panel B.

As suggested by the regression results, there is a significant positive association between DOL and systematic risk in line with. The changes in the firm's cost structure that are associated with greater operating leverage will make the firm's cash flows more sensitive to exogenous shocks, and therefore more volatile hence more risky.

For DFL the association with expected return is also significant, and positive. Hamada (1972) and Rubinstein (1973) demonstrate that a firm's beta should increase if the firm finances more heavily with debt. These theories are extension of the pre-CAPM work of Modigliani and Miller (1969), who show that use of debt increases equity return variability. As indicated by the coefficient of DOL (0.052056) and DFL (0.037801) DOL has more effect on returns. Operating leverage effect is more significant than the financial leverage effect on

systematic risk in line with (Gahlon and Gentry (1982), Mandelker and Rhee (1984), Huffman (1989), Darrat and Mukherjee (1995), Li and Henderson (1991), Chung (1989), Lord (1996), Toms, Salama and Nguyen (2005)).

These results are consistent with the conventional theory that systematic risk can be amplified by the leverage (operating and financial) the firm takes. In other words, other conditions being equal, firms with high operating leverage and financial leverage would have higher systematic risk. And it also suggests that operating leverage has a stronger effect on systematic risk of the firm compared with financial leverage.

Table 1

Panel B: Beta as dependent variable

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DOL	0.012062	0.005334	2.261253	0.0244
DFL	0.032841	0.015217	2.092487	0.0371
BEME	0.011985	0.031820	0.376666	0.5446
ME	-0.135765	0.043384	-3.129397	0.0019

R-squared	0.656591	Mean dependent var	0.404437
Adjusted R-squared	0.529503	S.D. dependent var	1.077047
S.E. of regression	0.755258	Sum squared resid	197.3634
F-statistic	5.009062	Durbin-Watson stat	2.385109
Prob(F-statistic)	0.000000		

5.3 Book-to-market ratio (BE/ME)

In Table 1 Panel C, I report the results of the panel data regressions of book-to-market ratio against DOL and DFL. Size (ME) is added as a control variable. Consisitent with the recent models of Carlson, Fisher and Giammarino (2004), Cooper (2006), Zhang (2005) and Garcia-Feijoo and Jorgensen's (2010) I find a statistically significant and positive relation between the degree of operating leverage (DOL) and book-to-market ratio. My results so far suggest that value stocks earn higher returns than growth stocks because they have higher levels of operating leverage.

As the regression results in Table 1 Panel C show, DOL is positively associated with book-to-market ratio and this association is statistically significant. Growth firms typically display stronger flexibility than value firms in adjusting to unfavorable economic conditions using a variety of flexibility proxies such as operating and financial leverage, the ratio of fixed assets to total assets and the frequency of disinvestment. They demonstrate that expected excess returns of value stocks are more severely affected than growth stocks in economic recessions.

Table 1

Panel C: Book-to-Market as dependent variable

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	7.338373	0.190487	38.52419	0.0000
DOL	0.006815	0.003363	5.000470	0.0000
DFL	0.018933	0.004809	1.857535	0.0639
ME	-0.501660	0.016050	-31.25513	0.0000
R-squared	0.957579	Mean dependent var		4.277091
Adjusted R-squared	0.946723	S.D. dependent var		3.887573
S.E. of regression	0.633884	Sum squared resid		186.8413
F-statistic	88.20720	Durbin-Watson stat		1.747517
Prob(F-statistic)	0.000000			

5.4 Size (ME)

Table 1 Panel D shows the regression results of size against DOL and DFL. In some specifications, control variable book-to-market ratio is added to the regression. As the results suggest, DFL is significantly positively associated to size (ME). That is to say, big firms tend to have higher debt ratio than small firms. This result is rather intuitive as big firms generally have more access to debt (more collaterals, higher credit ratings etc.) than small firms.

I find a significant positive association between size and operating leverage. The results show that 1% increase in operating leverage will cause a 1.7% increase in firm's size which is represented by market value.

Book to market is found to be negatively and significantly associated with firm's size (market value). A 1% increase in firm's book to market ratio will cause its value to reduce by 28%.

Table 1

Panel D: Size as dependent variable

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DOL	0.011956	0.003421	2.910647	0.0038
DFL	0.029688	0.005713	5.546872	0.0000
BEME	-0.541932	0.048387	-11.19988	0.0000
R-squared	0.987733	Mean dependent var		19.36148
Adjusted R-squared	0.983491	S.D. dependent var		16.27786
S.E. of regression	0.469328	Sum squared resid		76.43339
F-statistic	232.8325	Durbin-Watson stat		1.928939
Prob(F-statistic)	0.000000			

In summary, the empirical evidence from the regressions is consistent with the theories about operating leverage and financial leverage. The regression results suggest that DOL is

positively associated with expected return, and this positive association can be a result of higher systematic risk (higher beta) or higher value premium (higher book-to-market ratio). The association between DFL and expected return is less consistent as that between DOL and expected return. But DFL is positively associated with size which has a strong positive association with expected return.

CHAPTER VI

6. Conclusion

This thesis provides direct empirical evidence for the financial theories about the impact of operating leverage and financial leverage in asset pricing.

Evidence for the positive association between firm-level expected return and operating leverage is weak in the sample used by this empirical research. But as discussed in the previous sections, this result is more or less anticipated as some downward biases add to the difficulty for this association to be examined. These downward biases include the non-avoidable "error-in-variable" problem (Mandelker and Rhee (1984), Chung (1987) etc.) and the co-varying growth pattern in EBIT and sales (e.g. O'Berien and Vanderheiden (1987), Garcia-Feijoo and Jorgensen (2010)).

The positive association between beta and DOL in the sample suggests that operating leverage amplifies the systematic risk faced by the firms. As for financial leverage, the association between DFL and beta is statistically significant and positive in the empirical tests. My results indicate that financial leverage plays a more important role as a determinant of systematic risk than operating leverage.

Results of the empirical tests in this research suggest a strong positive association between DOL and book-to-market ratio (consistent with Garcia-Feijoo and Jorgensen's (2010) empirical findings and contradicts that of Norvy-Marx's (2010)) and between DFL and size in the sample employed by the empirical research in this thesis. This evidence lends support for the risk-related explanation.

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