NUST BUSINESS SCHOOL

Research Paper

MONETARY POLICY AND INFLATION

Is Monetary policy significant? Impact of Monetary policy on Inflation

Submitted To

Sir Haroon Rasheed

Submitted By

Saleena Beg

Sehrish Nawaz Khan

Date: 23rd January 2009

ABSTRACT:

Pakistan is in an economic crisis, owing to a slowdown in the world economy for a good two years. One major issue Pakistan is dealing with is that of rising price levels. State Bank of Pakistan (SBP) is taking several measures to curb this growing inflation. Monetary policy enforced by SBP now will primarily be dependent on the trend in inflation i.e, focussed on curtailing inflation in the future. The tools of Monetary policy under SBP's control include discount rate, cash reserve requirement ratio (CRR) and open market operations. Using these tools SBP is not only controlling the supply of funds but also the availability of money and the cost of money, in line with achieving a certain set of goals related to economic stability and growth, to be specific, lower inflation. In the process of studying the current monetary policy i.e, measures taken by SBP to curtail inflation, monthly data was obtained on CPI index, discount rate, CRR and 3-month T-bill rate for 4 years. This data was then graphically represented to analyse the trend. In addition to that, the data was also regressed so as to develop proper models. The data analysis clearly indicates the extent to which each tool's use was focussed on controlling inflation and bringing it back to normal levels.

PROBLEM STATEMENT:

Inflation in Pakistan has negative consequences not for the people alone but also for the whole country as it hampers economic growth and may very well result in collapse of the country; this therefore reflects on the role of monetary policy in curbing inflation.

LITERATURE REVIEW:

It is usually assumed that money has a symmetric effect on real variables therefore; monetary policy can have negative or positive impacts on inflation in an economy. There are a number of studies which have already been conducted to study the impact of monetary policy on the inflation in a country. Inflation

outcomes of 1970s can be understood as a combination of monetary policy neglect which implied that policymakers did not let interest rates respond strongly to the take-off of inflation-and mismeasurement of the degree of excess demand in the economy (Edward Nelson and Kalin Nikolov, 2004). In the Journal of Money credit banking Tobin in 1979 developed a model through which he explained that how tightening of monetary policy results in increased inflation. A number of alternative hypotheses also explain how changes in monetary policy in different periods resulted in increasing and decreasing inflation. Successful monetary policy requires a strong response to expected inflation (Taylor 1999). The instability associated with great inflation was the unintended outcome of the excessively activist monetary policies (as policymakers were overconfident about the desirable results) (Taylor 1998). The behavior of inflation since 1960s, offers indisputable evidence that that monetary policy was highly accommodative during the Great inflation but much less so afterwards (Orphanides 2004). In addition, our research paper will also emphasize on how changes in the monitory policy tools including discount rate, open market operations and cash reserve requirements ratio bring change in the macroeconomic performance of an economy in consideration to the research work of Clarida, Gali, Gertler(2000). Therefore, there is another food for thought for us to conduct this research paper that how monetary policy brought improvement in economy during the boom of Great inflation.

RESEARCH DESIGN:

Analysis Techniques: Our primary analysis technique is regression analysis. All the models have been developed by regressing the data.

Assumptions: One major assumption on the basis of which models have been developed showing the impact of increased discount rate, CRR ratio and T-bill rates is that they do not have an immediate impact on inflation, rather their

impact comes with a lag. For this research paper the lag has been assumed to be 6 months.

Limitations: The major limitation of our research paper is the access to data. Another limitation is that of considering only the monetary policy tools in developing models while ignoring other economic variables that effect inflation.

HYPOTHESIS:

The objectives of this research are primarily directed towards finding the extent to which monetary policy can control inflation in Pakistan both in isolation and in combination with a few other factors:

- Rising inflation is an indication that the discount rates will be increased
- Rising price level implies that the monetary policy will involve an increase in t-bill rates
- Rising inflation implies that the Cash reserve requirement ratio must be increased to curtail inflation
- Sum of the above variables i.e, high discount rates, high t-bill rate, high cash reserve requirement ratio, make most sense in a situation of rising inflation

Hypothesis 1:

Rising inflation is an indication that the discount rates will be increased to curb inflation

The hypothesis under discussion states that based on theory when inflation is on the rise discount rates, being an important tool of monetary policy, are increased to get a control on price levels in the future. Pakistan's current economic situation is quite similar and

therefore is well suited to explain practical application of this phenomenon.

Data gathered for the purpose of testing this hypothesis is that of CPI index, change in CPI index and discount rates on a monthly basis for the last four years. Let us test the hypothesis in a stepwise manner i.e, by analysing all the graphs one by one.

The graph (*Refer to Exhibit:1a*) is reflecting on the direction of movement of CPI and discount rates. The graph reinforces the fact that both inflation and discount rates move in the same direction i.e, with higher inflation there is a corresponding increase in discount rates to reduce inflation. The graph shows that over the last four years, with increasing inflation SBP also raised the discount rates so as to curb inflation. It is evident from the graph that when CPI index increased from 24.33% in July 08 to 25.33% in August 08, which was its highest, the discount rate was also increased from 12% to 13% so as to get a hold of the rising inflation. With higher discount rates, the intention of the central bank is to implement a tight monetary policy. Increase in discount rates reduces the monetary base which implies contraction of the money supply and tightening of the money supply results in reduction in inflation.

The model developed for establishing a relation between the discount rates and inflation i.e, showing whether rising inflation results in rising discount rates as a response, is as follows:

$$Y^{\text{Discount rate}} = 0.23061X^{\text{YoY CPI index}} + 7.319687$$

Here X represents CPI index and Y represents discount rate. The model clearly indicates that when CPI is high the discount rates tend to increase. Reason being; SBP's focus on reduction of inflation. The coefficient of CPI index is 0.23061 which means that with an increase in inflation by 1% the discount rates should be increased by 0.23061% so as to curtail inflation. F-test and t-test gives the value greater than 2.5 which shows that this model is very significant. This proves the fact that when inflation is on the rise the discount rates are

increased with the hope of getting a grip on them. However, the point left unexplained by this model is whether the increased discount rates, in real, get a control on the rising inflation.

In order to test this part of the hypothesis another model has been developed which incorporates percentage change in CPI index and discount rates over the last 12 months i.e, 2008 being the most critical year for Pakistan. The data for % change in CPI index has been corresponded with 6-month preceding data of discount rates i.e, % change in CPI of January 08 has been corresponded with discount rate July 07. The data has been organised in this manner to take into consideration the fact that any tool of monetary policy does not have an immediate impact on inflation rather its effect comes to surface with a lag. The model is as follows:

$$Y^{\%\text{change in CPI}} = -1.40139X^{\text{Discount rate}} + 16.24518$$

Here X represents discount rate and Y represents % change in CPI index. The model clearly establishes an inverse relationship between % increase in CPI index and discount rate. This relation represents that as the discount rates are increased inflation is expected to reduce. The coefficient of discount rate is -1.40139 which means that with an increase in discount rate by 1% the change in inflation is expected to decrease by 1.40139%. This adds logic to the previously proven fact that when inflation is on the rise the discount rates are increased, by showing the impact of increase in discount rates on percentage increase of CPI index in Pakistan over the year 2008. The percentage by which the CPI index had been increasing earlier in 2008 somewhat decreased in the later months owing to increased discount rates in the previous periods. Therefore, both models together explain that when inflation is increasing there is an expectation that the discount rates will be increased to curtail inflation in the future.

Hence proved, *rising inflation is an indication that the discount rates will be increased to curb inflation.*

Hypothesis 2:

Rising price levels imply that the monetary policy will involve an increase in T-bill rates to get a grip on inflation

The above hypothesis states that based on theory when inflation is increasing the T-bill rates, being another important tool of monetary policy, are increased to get a grip on future price levels. As mentioned earlier Pakistan is in such a condition today, where rising inflation is one major issue and therefore it is well suited to describe practical application of this phenomenon.

Data gathered for the purpose of testing this hypothesis is that of CPI index, change in CPI index and 3-month T-bill rates on a monthly basis for the last four years.

The graph (*Refer to Exhibit:1b*) shows the direction of CPI and 3-month T-bill rate movement. The graph reinforces the fact that both inflation and T-bill rates move in the same direction i.e, with high CPI there is a corresponding increase in T-bill rates to reduce inflation. The graph shows that over the last four years, with increasing inflation SBP also incrementally raised the T-bill rates so as to curb inflation. The graph represents that periods of relatively high rates of inflation usually are associated with relatively high interest rates on T-bills.

The model developed for establishing a relation between the 3-month T-bill rates and inflation i.e, representing whether rising inflation results in increased T-bill rates as a response, is as follows:

$$Y^{\text{T-bill rate}} = 0.243685X^{\text{YoY CPI index}} + 6.094798$$

Here X represents CPI index and Y represents 3-month T-bill rate. The model clearly indicates that when CPI is high the T-bill rates are also raised. The reason is that SBP focuses on reduction of inflation. The coefficient of CPI index is 0.243685 which means that with an increase in inflation of 1% the T-bill rates should be increased by 0.243685% so as to limit inflation. F-test and t-test gives the value

greater than 2.5 which shows that this model is very significant. This proves the fact that when inflation is on the rise the T-bill rates are raised with the intention of controlling inflation. Up till now the one aspect left unexplained by this model is whether the increased T-bill rates actually play a role in curbing inflation.

In order to test this part of the hypothesis a second model has been developed which includes percentage change in CPI index and T-bill rates over the last 12 months i.e, 2008 being the most critical year for Pakistan. The data for % change in CPI index has been corresponded with 6-month preceding data of T-bill rates i.e, % change in CPI of January 08 has been corresponded with T-bill rate July 07. This way of arranging data has been followed to take into context the fact that no monetary policy tool has an immediate impact on inflation rather it effects inflation with a reasonable lag. The model is as follows:

$$Y^{\%\text{change in CPI}} = -1.4853^{\text{discount rate}} + 15.66038$$

Here X represents 3-month T-bill rates and Y represents % change in CPI index. The model clearly determines an inverse relationship between % increase in CPI index and T-bill rate. This relationship reflects on the fact that when the T-bill rates are raised the percentage increase in inflation is expected to reduce. The coefficient of T-bill rate is -1.4853 which means that if the T-bill rate is increased by 1% the change in CPI index decreases by 1.4853%. This substantiates the logic of the earlier proven fact that when inflation is on the rise the T-bills will go up, by establishing the relation of impact of increase in T-bill rates on percentage increase in CPI index in Pakistan over 2008. The percentage by which the CPI index had been increasing in the early months of 2008 rather showed a reduction in the later months owing to several measures taken by SBP one of which involved raising the T-bill rates. Therefore, both models in entirety explain that when inflation is increasing there is anticipation that the T-bill rates will also increase to restrict inflation in the future.

Hence proved, *rising price levels imply that the monetary policy will involve an increase in T-bill rates to get a grip on inflation.*

Hypothesis 3:

Rising inflation implies that the Cash reserve requirement ratio must be increased to curtail inflation

Cash reserve requirement ratio is another tool of monetary policy thereby; third hypothesis suggests that to get a control on price levels in the future, cash reserve requirement ratios can be increased.

In order to examine the impact of increasing inflation on the cash reserve requirement ratio, the data collected is that of CPI index and CRR on a monthly basis for the last four years. The CPI index and CRR for the last four years are shown in the graph.

The graph (*Refer to Exhibit:1c*) shows the direction of movement of CPI and cash reserve requirement ratio. It is obvious from the graph that CPI and CRR move in the same direction which means that in order to bring down price levels during the inflationary pressure, CRR needs to be increased. Basically, in the last four years Pakistan has been facing high price levels therefore; to stabilize inflation SBP has been increasing CRR from time to time. It can be clearly seen from the graph that from January 08 onwards there was a sharp increase in inflation up till October 08, likewise there was a corresponding increase in CRR as well. It is evident that when inflation was at its peak i.e, 25.33% in August 08, CRR was also the highest i.e, 9.00%. Therefore, it may be stated that in order to overcome high inflation in Pakistan, the target of SBP is to implement a tight monetary policy.

As the cash reserve requirement ratio is increased banks are required to hold more reserves with SBP. This reduces the monetary base and leads to contraction of money supply resulting in lower inflation. One noticeable fact is that although the CPI index increases from 11.86% in January 08 to 24.33% in July 08, the increase in CRR is only 2% i.e, from 7% to 9%.

This is because raising reserve requirements can cause immediate liquidity problems for banks with low excess reserves; therefore, considering the liquidity crunch in Pakistan almost parallel to rising inflation SBP had to look into this limitation as well.

The model established for the purpose of relating CRR ratios with inflation i.e, showing whether rising inflation results in increased CRR ratios to overcome it, is as follows:

$$Y^{CRR} = 0.110614X^{YoY\ CPI\ index} + 5.114635$$

Here X represents CPI index and Y represents CRR ratio. The model evidently puts forward the relation that when CPI is on the rise the CRR ratios are also raised as a response. The reason is that SBP focuses on reduction of inflation through tightening of the monetary policy. The coefficient of CPI index is 0.110614 which means that with an increase in inflation of 1% the CRR ratio must be raised by 0.110614% so as to curb inflation. F-test and t-test gives the value greater than 2.5 which shows that this model is very significant. This proves the fact that when inflation is on the rise SBP is expected to raise the CRR ratio to control inflation. The one aspect that is still not explained by this model is if the increased CRR ratio really lends a hand in lowering inflation.

For the purpose of testing this part of the hypothesis another model has been developed a second which includes percentage change in CPI index and CRR ratio over the last 12 months i.e, 2008 being at the heart of Pakistan's economic downturn. The data for % change in CPI index has been corresponded with 6-month preceding data of CRR ratio i.e, % change in CPI of January 08 has been corresponded with CRR ratio July 07. This way of arranging data has been followed to take into consideration the fact that no monetary policy tool has an instantaneous impact on inflation rather it effects inflation with a fair lag. The model is as follows:

$$Y^{\%change\ in\ CPI} = -1.31702^{CRR} + 11.68115$$

Here X represents CRR ratio and Y represents % change in CPI index. The model clearly

determines an inverse relationship between % increase in CPI index and CRR. This relationship highlights the fact that when the CRR ratio is increased, the percentage increase in inflation is expected to lessen. The coefficient of CRR ratio is -1.31702 which means that if the CRR ratio is increased by 1% the change in CPI index decreases by 1.31702%. This substantiates the logic of the formerly proven fact that when inflation is on the rise the CRR ratio will go up, by establishing the relation of impact of increase in CRR ratio on percentage increase in CPI index in Pakistan over 2008. The rate at which the CPI index had been increasing in the early months of 2008 showed a reduction in the later months owing to several measures taken by SBP one of which involved raising the CRR ratio. Therefore, both models together explain that when inflation is increasing there is expectation that the CRR ratio will also increase to curtail the growing inflation condition the country is not facing a liquidity crunch.

Hence proved, *rising inflation implies that the Cash reserve requirement ratio must be increased to curtail inflation.*

Hypothesis 4:

Sum of the previous variables i.e, high discount rates, high t-bill rate, high cash reserve requirement ratio, make most sense in a situation of rising inflation as they can curb inflation

The above hypothesis incorporates the relation of all monetary policy tools including discount rate, CRR and T-bill rates with inflation. For testing this hypothesis we have collected data for the last four years of the four variables and the graph is showing their direction of movement.

The graph (*Refer to Exhibit:1d*) shows the trend in CPI, T-bill rates, discount rates and CRR over the last four years on a monthly basis. The graph provides evidence of the fact that all four variables move in the same direction which means that discount rate, T-bill rate and CRR

ratio, being important monetary tools in SBP's control, have been incrementally increased from time to time so as to get a grip on the rising inflation. The graph highlights the fact that in July 08 when the CPI index stood at 25.33%, the discount rate was increased from 12% to 13%, likewise the CRR ratio was 9% and the 3-month T-bill rates stood at 12.23%. Therefore, it can be stated that during periods of high inflation these monetary policy tools are increased to curtail inflation. One important part of the hypothesis left unexplained is whether high discount rate, high CRR ratio and high 3-month T-bill rates result in lower inflation.

In order to explain this aspect, data for percentage change in CPI from January 08 onwards has been regressed with data for discount rate, CRR ratio and T-bill rates from July 07 onwards, so as to take into consideration that changes in monetary tools do not immediately impact inflation. Rather their impact is seen always with a lag, and in this case the lag has been assumed to be of 6 months. The model developed for the purpose of establishing a relation between all these variables and rate of change in inflation, is given below, however due to our constraint of having access to data for limited number of years the model partly explains the relation correctly.

$$Y^{\%\text{Change in CPI Index}} = 0.23225X^{\text{Discount rate}} - 0.95119X^{\text{CRR}} - 0.73232\,X^{\text{T-bill rate}} + 13.37765$$

Here Y represents CPI Index and three independent variables are discount rate, CRR and 3-month T-bill rates. The model should have ideally developed an inverse relation between discount rate and % change in CPI, however due to limited access to data the model explains correct relation only for the other two variables i.e, CRR ratio and 3-month T-bill rates. In order to study the relationship between discount rate and percentage change in CPI a graph will be analyzed as we follow. The coefficient of CRR ratio is -0.95119 which means that if the CRR ratio is increased by 1% the change in CPI index decreases by 0.95119%. Likewise, the coefficient of T-bill

rates is -0.73232 which means that if the T-bill rates are increased by 1% the change in CPI index decreases by 0.73232%. F-test and t-test gives the value greater than 2.5 which shows that this model is very significant. This substantiates the logic of the formerly proven fact that when inflation is on the rise the CRR ratio and T-bill rate will be increased, by establishing the relation of impact of increase in CRR ratio and T-bill rates on percentage increase in CPI index in Pakistan over 2008. The rate at which the CPI index had been increasing in the early months of 2008 showed a reduction in the later months owing to several measures taken by SBP two of which involved raising the CRR ratio and T-bill rates. Therefore, this model explains that when inflation is increasing there is expectation that the CRR ratio and T-bill rates will be increased to curtail the growing inflation condition the country.

The graph (*Refer to Exhibit:1e*) is based on the twelve months data of 2008 for percentage change in CPI change, discount rate, CRR and t-bills rate. We have selected year 2008 for our model because in 2008 Pakistan faced various economic problems, one of the major being inflation. The graph highlights that discount rate, CRR and T-bill rates are moving in the same direction from July 07 to June 07 while impacting the rate of change in CPI index with a lag of 6 months, i.e, percentage change in CPI index shows a downward trend represented from the trendline owing to the increases in discount rate, CRR ratio and T-bill rates in the prior months.

It is evident from the graph that in from January 08 to February 08 there was a decline in the rate of increase of CPI index from 1.91% to 0.49%. Reason being, SBP's measure of raising the discount rate from 9.5% in August 07 to 10% in September 07 and also the T-bill rate increased from 8.69% in August 07 to 9.05% in September 07. Another noticeable time frame is that of October 08 onwards with the corresponding period of April 08 onwards, assuming a time lag of 6 months; when rate of change in CPI index was 2.12% and the three

monetary tool i.e, discount rate, CRR ratio and T-bill rates showed a raise in their values. The increased discount rate, CRR ratio and T-bill rates in May 08 were 11%, 8.3% and 9.7% respectively, which on the basis of our assumption caused a decline in rate of change in CPI index in November 08 when it declined to -0.12% from 2.12% in October 08.

Hence proved, s*um of the previous variables i.e, high discount rates, high t-bill rate, high cash reserve requirement ratio, make most sense in a situation of rising inflation as they can curb inflation.*

ANALYSIS:

Economic situation in Pakistan and all over the world in the recent years has worsened. The years 2007 and 2008 have been extremely difficult for the global economy and for the emerging countries including Pakistan. The subprime mortgage crisis in U.S in 2007, hike in global commodity prices and depreciation of Pakistani currency against dollars have been three major issues for Pakistan.

After having studied and analyzed data of Pakistan for the last four years on a monthly basis, we have made efforts to test application of theory into a real time framework so as to measure its effectiveness. Our analysis shows that in order to encounter the economic distress, specifically inflation, in Pakistan SBP has focused on maintaining a tight monetary stance. As stated by IMF: *"……..in many emerging economies, tighter monetary policy and greater fiscal restraint are required, combined in some cases with more flexible exchange rate management. In the major advanced economies, the case for monetary tightening is seen as less compelling, given that inflation expectations and labor costs are projected to remain well anchored while growth is weakening, but inflation pressures need to be monitored."*

Through our data, we have found that in order to limit inflation SBP has used the three

monetary tools, which we have many at times studied in theory, i.e, discount rates, CRR ratio and OMOs.

From time to time SBP has been increasing the discount rate in periods of high inflation as increased discount rate allows sterilization of excessive foreign inflows and curtails anticipated inflationary pressures. In 2008, policy rates of many other countries were also increased for curtailing inflation (*Refer to Table:10*). SBP also followed this stance; however, several other factors diminished the impact of its policy movements. Therefore while analyzing the strength of monetary policy tools in curbing inflation it must be kept in mind that there are several other factors which may contribute to furthered price levels and nullify the policy's impact. Even for our data analysis we have not given importance to such periods where inflation kept on increasing despite the use of monetary policy tools by SBP. For example, in June 08 though the discount rate from 11% to 12% with the expectation of positive contribution towards limiting inflation and in improving other economic variables, however it had adverse results owing to other factors. As stated by SBP: *"Massive liquidity was injected in the system as the Government borrowed from SBP almost Rs178 billion in November and December 2007. This led to softening of key interest rates and money growth accelerated. At the same time, rising international oil and food prices impacted the inflation outlook and in absence of adjustment in domestic prices the financial burden of subsidies and high spending in other areas resulted in rising economic stress."*

Hence, discount rates are raised to squeeze monetary supply from the economy when inflation is high with the intent of curbing future price levels.

According to our data analysis, SBP has also been using Open market operations to curtail inflation. The increasing trends in t-bill rates are also observed where there are high inflationary pressures. When t-bill rates are raised, prices of t-bills decrease and the

demand of t-bills increases. As a result liquidity in the economy is squeezed and inflationary pressures are reduced. This phenomenon is evident by the inverse relation of increased T-bill rates with percentage increase in CPI index for the year 2008.

Our analysis shows that CRR ratio and SLR ratio has been also increased by SBP during this period. Increase in CRR and SLR has an immediate impact on interbank interest rates by drying up excess liquidity; thereby impacting the rising inflation to a certain limit. Increase in CRR is almost always in parallel with the increase in SLR because if CRR is increased in isolation, banks are more likely to liquidate their investments to make up for the liquidity shortages due to CRR increase, thereby diluting the impact of policy measures. Therefore, as has been proved from the model developed for relating increased CRR with rate of change of CPI index, increased Cash reserve requirement is another way of curbing inflation by drying up excess liquidity.

CONCLUSION:

Pakistan's macroeconomic vulnerabilities magnified in the year 2008 primarily as a result of global adversities. Inflation became a major issue in this regard as it surged up to unprecedented levels raising the need of getting a grip on it as early as possible. The impact of rising international oil and food prices and increasing demand coupled with reduced supply furthered inflationary pressures. SBP therefore kept its focus on curtailing inflation by flexing its monetary policy tools, these monetary policy tools being the discount rate, CRR ratio and OMO. After having studied the relationship between CPI index of Pakistan for the past four years with monthly discount rate, CRR ratio and 3-month T-bill rates, it may be concluded that in periods of high inflation it is most logical for SBP to tighten the monetary policy by raising either one or a combination of the monetary policy tools i.e, policy rate, cash requirement reserve ratio and T-bill rates in order to reduce the monetary base that leads to

a contraction of the money supply. In the process of evaluating the effectiveness of monetary policy in curtailing inflation, however, there is a need to recognize several other economic realities such as energy shortages, low productivity etc, which continue to dominate the supply side issues and therefore may diminish the impact of monetary tightening.

LITERATURE CITED:

Clarida, Richard, Jordi Gali, and Mark Gertler(1998). "Monetary Policy Rules and Macroeconomic Stability: Evidence and Some Theory." NBER Working Paper No. 6442.

Clarida, Richard, Jordi Gali, and Mark Gertler (1999). "The Science of Monetary Policy." Journal of Economic Literature 37, 1661-1707.

Clarida, Richard, Jordi Gall, and Mark Gertler (2000). "Monetary Policy Rules and Macroeco- nomic Stability: Evidence and Some Theory." Quarterly Journal of Economics 115, 147-180

Edward.N and Kalin Nikolov. (2004). “Monetary Policy and Stagflation in the UK”, Journal of Money, Credit and Banking, Vol. 36, No. 3, Part 1 (Jun., 2004), pp. 293-318

Ehrmann.M and Marcel Fratzscher,(2004),” Taking Stock: Monetary Policy Transmission to Equity Markets”, Journal of Money, Credit and Banking, Vol. 36, No. 4 (Aug., 2004), pp. 719-737

Orphanides, Athanasios, and Simon van Norden (2002). "The Unreliability of Output Gap Estimates in Real Time." Review of Economics and Statistics 84, 569-583

Taylor, John B., (1998). "The Long Boom." Federal Reserve Bank of St Louis Review (November/December 1998), 3-11

Taylor, John B. (1999a). "An Historical Analysis of Monetary Policy Rules." In Monetary Policy Rules, edited by J. B. Taylor, pp. 319-341

Taylor, John B. (1999b). "The Robustness and Efficiency of Monetary Policy Rules as Guidelines for Interest Rate Setting by the European Central Bank." Journal of Monetary Economics 43, 655-679

APPENDIX:

Exhibit: 1(a)

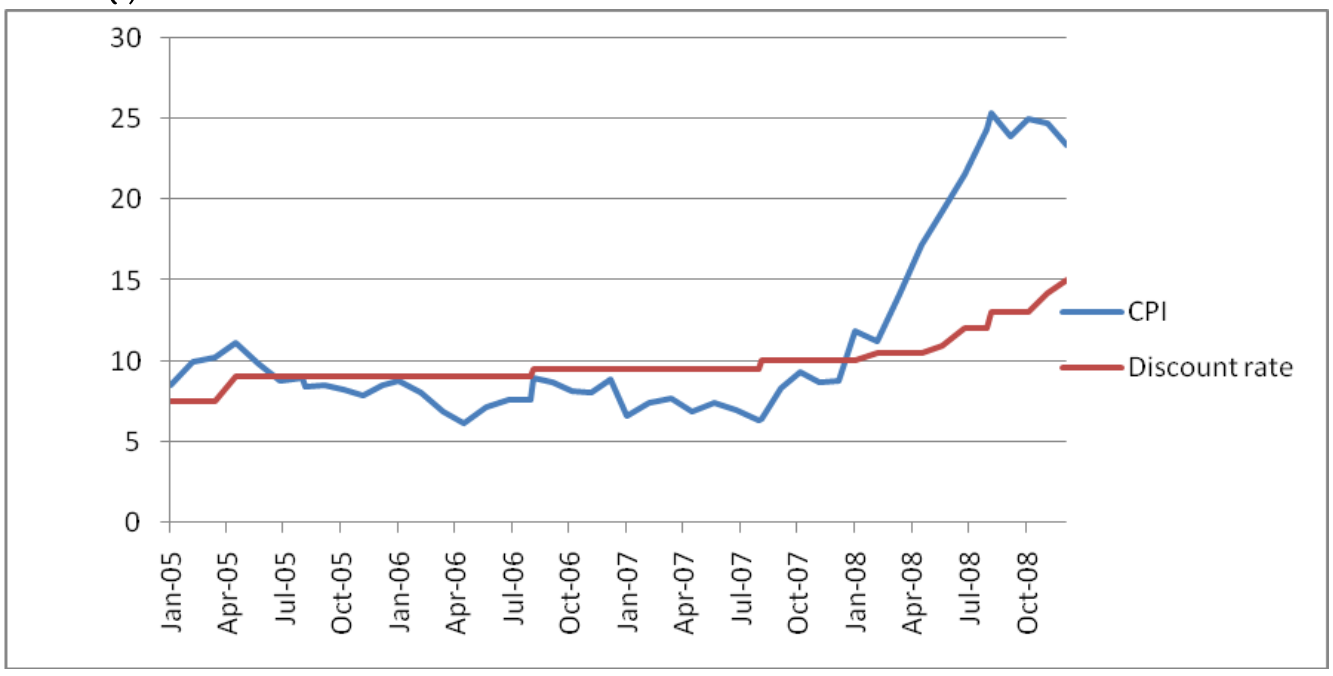


Exhibit: 1(b)

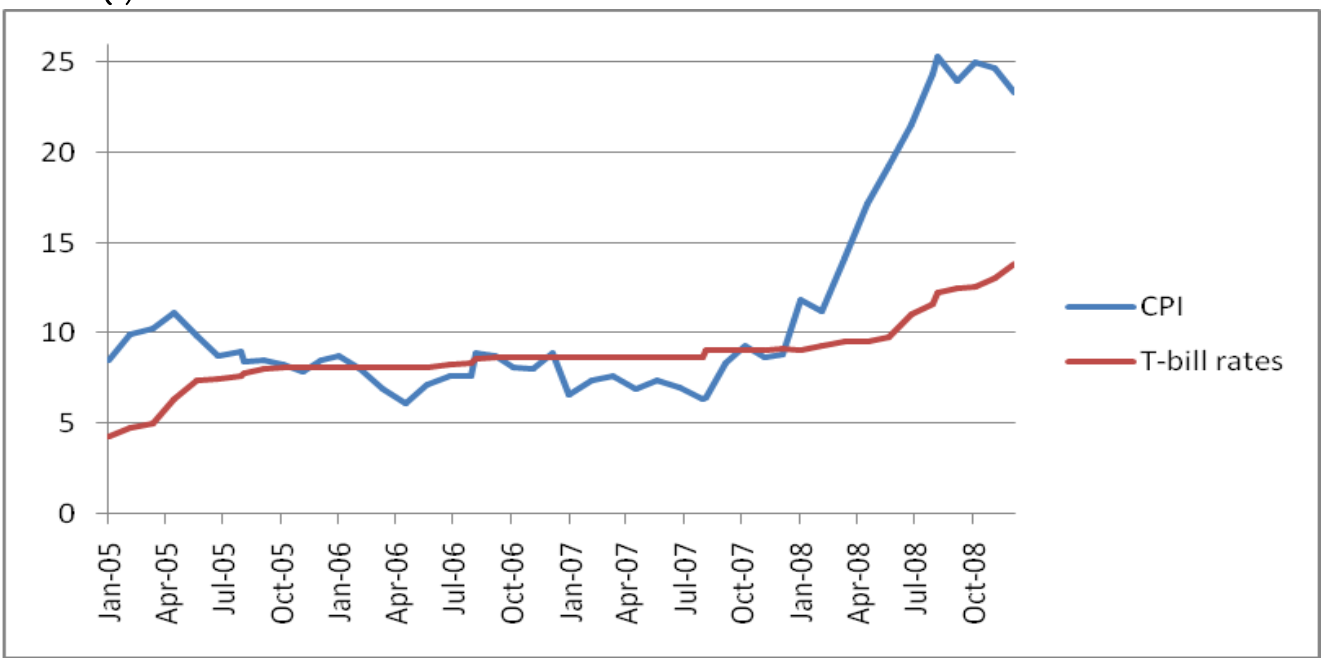


Exhibit: 1(c)

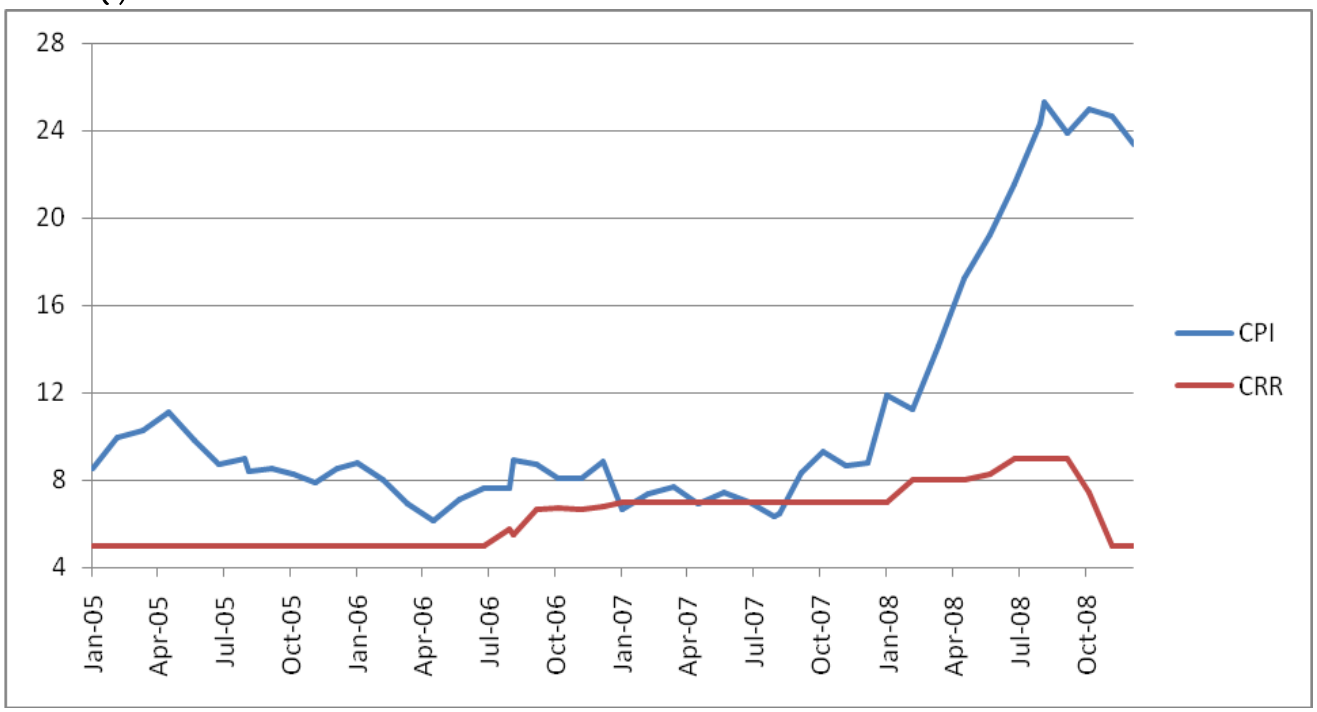


Exhibit: 1(d)

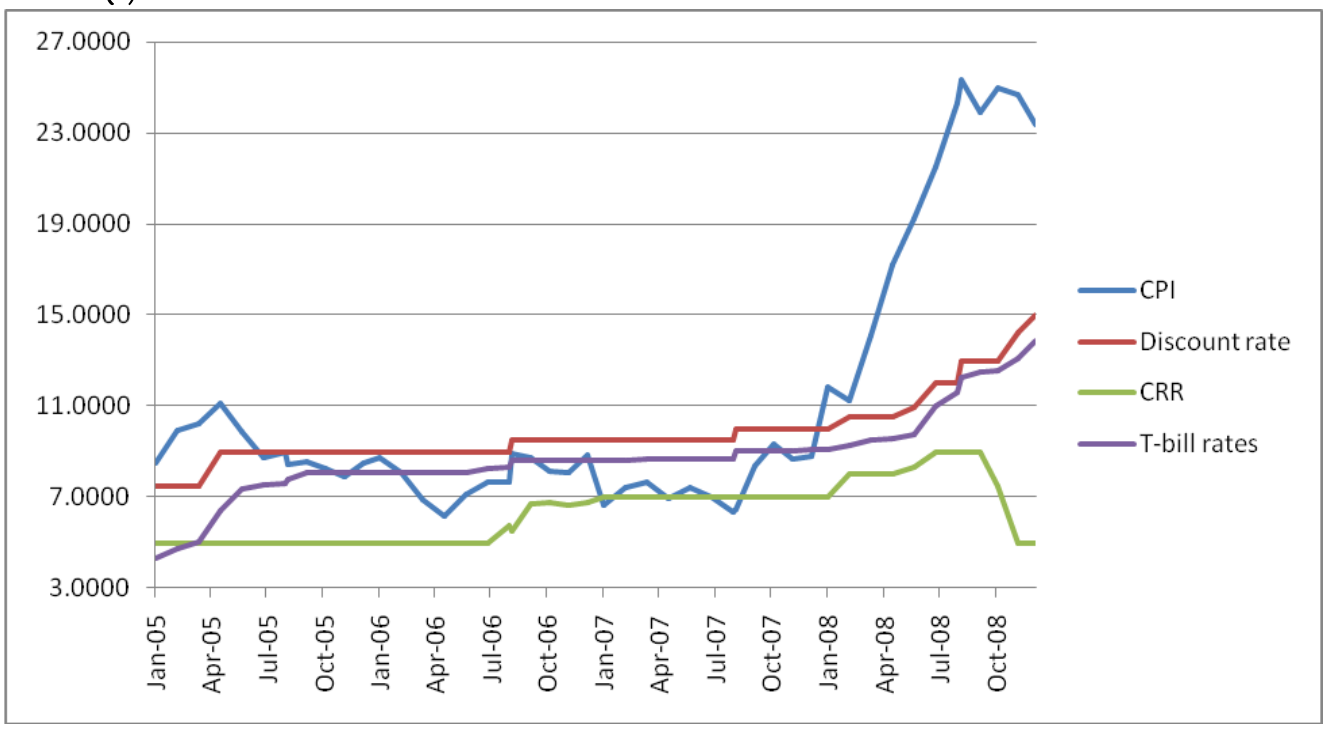


Exhibit: 1(e)

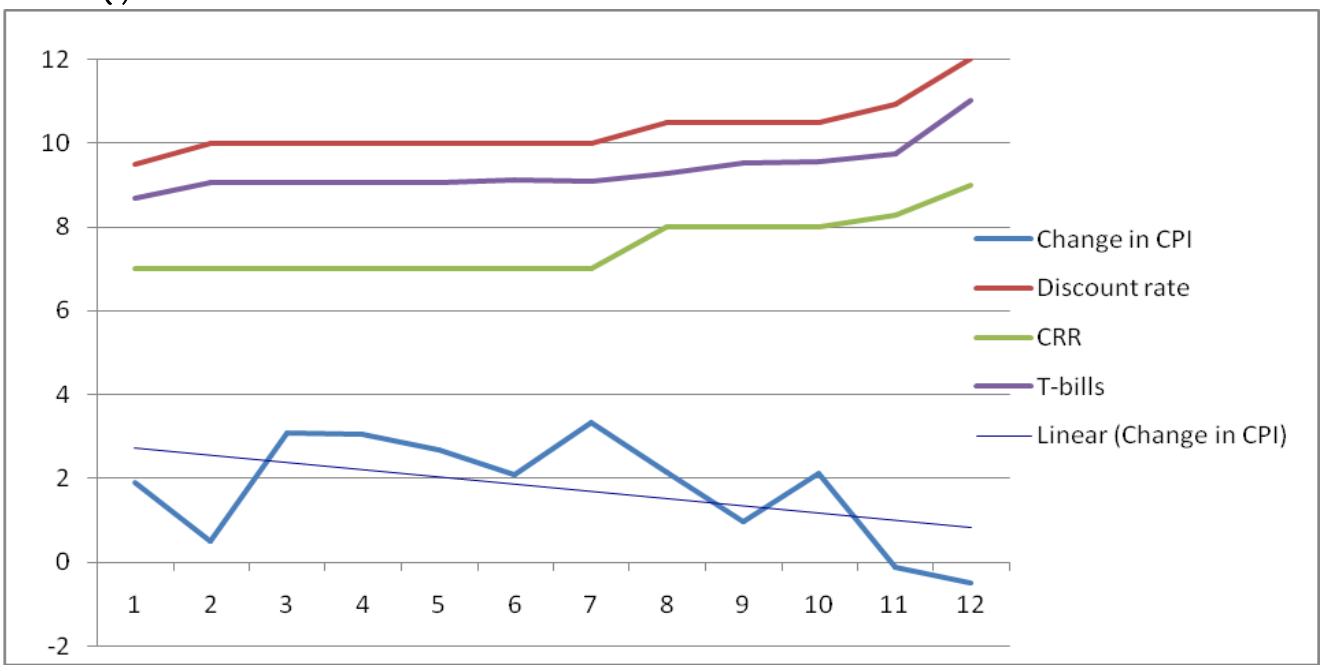


Exhibit: 2

Month	CPI index	Discount rate	CRR	3month T-bill rate
Jan-05	8.5100	7.5000	5.0000	4.32940000
Feb-05	9.9500	7.5000	5.0000	4.74410000
Mar-05	10.2500	7.5000	5.0000	5.01070000
Apr-05	11.1000	9.0000	5.0000	6.39330000
May-05	9.8400	9.0000	5.0000	7.37980000
Jun-05	8.7400	9.0000	5.0000	7.51470000
Jul-05	8.9900	9.0000	5.0000	7.60530000
Aug-05	8.4100	9.0000	5.0000	7.79595806
Sep-05	8.5300	9.0000	5.0000	8.05315667
Oct-05	8.2700	9.0000	5.0000	8.09910968
Nov-05	7.8900	9.0000	5.0000	8.09892667
Dec-05	8.5100	9.0000	5.0000	8.09627419
Jan-06	8.7600	9.0000	5.0000	8.09898387
Feb-06	8.0500	9.0000	5.0000	8.10000000
Mar-06	6.9100	9.0000	5.0000	8.10000000
Apr-06	6.1600	9.0000	5.0000	8.10000000
May-06	7.1200	9.0000	5.0000	8.10000000
Jun-06	7.6500	9.0000	5.0000	8.24375333
Jul-06	7.6300	9.0000	5.7413	8.32072258
Aug-06	8.9300	9.5000	5.5277	8.61230968
Sep-06	8.7300	9.5000	6.6907	8.64170000
Oct-06	8.1100	9.5000	6.7426	8.64170000
Nov-06	8.0700	9.5000	6.6607	8.63941333
Dec-06	8.8800	9.5000	6.7765	8.64170000
Jan-07	6.6400	9.5000	7.0000	8.64170000
Feb-07	7.3900	9.5000	7.0000	8.64170000
Mar-07	7.6700	9.5000	7.0000	8.64669355
Apr-07	6.9200	9.5000	7.0000	8.67470000
May-07	7.4100	9.5000	7.0000	8.68690000
Jun-07	7.0000	9.5000	7.0000	8.68690000
Jul-07	6.3700	9.5000	7.0000	8.68690000
Aug-07	6.4500	10.0000	7.0000	9.04890000
Sep-07	8.3700	10.0000	7.0000	9.04890000
Oct-07	9.3100	10.0000	7.0000	9.04890000
Nov-07	8.6700	10.0000	7.0000	9.04890000
Dec-07	8.7900	10.0000	7.0000	9.11019032
Jan-08	11.8600	10.0000	7.0000	9.09420000
Feb-08	11.2500	10.5000	8.0000	9.27708667
Mar-08	14.1200	10.5000	8.0000	9.51531613
Apr-08	17.2100	10.5000	8.0000	9.56100000
May-08	19.2700	10.9355	8.2903	9.74752258
Jun-08	21.5300	12.0000	9.0000	11.02134333
Jul-08	24.3300	12.0000	9.0000	11.58405484
Aug-08	25.3300	13.0000	9.0000	12.22740645
Sep-08	23.9100	13.0000	9.0000	12.51039000
Oct-08	25.0000	13.0000	7.4516	12.55780323

Nov-08	24.6800	14.2000	5.0000	13.07946000
Dec-08	23.3400	15.0000	5.0000	13.85490000

Exhibit: 3

Model: CPI index & Discount rates

Regression Statistics	
Multiple R	0.865067582
R Square	0.748341922
Adjusted R Square	0.742871094
Standard Error	0.798418789
Observations	48

ANOVA

	Df	*SS*	*MS*	*F*	*Significance F*
Regression	1	87.1984	87.1984	136.7877	2.22E-15
Residual	46	29.32374	0.637473		
Total	47	116.5221			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	7.31961696	0.248811	29.41843	1.77E-31	6.818787	7.820447
X Variable 1	0.230610215	0.019718	11.69563	2.22E-15	0.190921	0.2703

Exhibit: 4

Model: CPI index & CRR ratio

Regression Statistics	
Multiple R	0.486471
R Square	0.236654
Adjusted R Square	0.22006
Standard Error	1.186074
Observations	48

ANOVA

	Df	*SS*	*MS*	*F*	*Significance F*
Regression	1	20.06199	20.06199	14.26102	0.000455
Residual	46	64.71146	1.406771		
Total	47	84.77345			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	5.114635	0.369615	13.83773	5.21E-18	4.370638	5.858632
X Variable 1	0.110614	0.029291	3.776376	0.000455	0.051654	0.169574

Exhibit: 5

Model: CPI index & 3-month T-bill rates

Regression Statistics	
Multiple R	0.764032
R Square	0.583745
Adjusted R Square	0.574696
Standard Error	1.228552
Observations	48

ANOVA

	Df	*SS*	*MS*	*F*	*Significance F*
Regression	1	97.36627	97.36627	64.50914	2.66E-10
Residual	46	69.42967	1.509341		
Total	47	166.7959			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	6.094798	0.382853	15.91943	2.46E-20	5.324156	6.865441
X Variable 1	0.243685	0.03034	8.031758	2.66E-10	0.182613	0.304756

Exhibit: 6

Month	% Change in CPI index	Month	Discount rate	CRR ratio	3-month T-bill rates
Jan-08	1.910	Jul-07	9.5000	7.0000	8.68690000
Feb-08	0.490	Aug-07	10.0000	7.0000	9.04890000
Mar-08	3.080	Sep-07	10.0000	7.0000	9.04890000
Apr-08	3.040	Oct-07	10.0000	7.0000	9.04890000
May-08	2.690	Nov-07	10.0000	7.0000	9.04890000
Jun-08	2.100	Dec-07	10.0000	7.0000	9.11019032
Jul-08	3.340	Jan-08	10.0000	7.0000	9.09420000
Aug-08	2.140	Feb-08	10.5000	8.0000	9.27708667
Sep-08	0.970	Mar-08	10.5000	8.0000	9.51531613
Oct-08	2.120	Apr-08	10.5000	8.0000	9.56100000
Nov-08	-0.120	May-08	10.9355	8.2903	9.74752258
Dec-08	-0.500	Jun-08	12.0000	9.0000	11.02134333

Exhibit: 7

Model: CPI index & Discount rates

Regression Statistics	
Multiple R	0.706621
R Square	0.499314
Adjusted R Square	0.449245
Standard Error	0.950166
Observations	12

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	9.003412	9.003412	9.972594	0.010194
Residual	10	9.028154	0.902815		
Total	11	18.03157			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	16.24518	4.591411	3.538167	0.005373	6.014876	26.47548
X Variable 1	-1.40139	0.443767	-3.15794	0.010194	-2.39017	-0.41262

Exhibit: 8

Model: CPI index & CRR ratio

Regression Statistics	
Multiple R	0.718561
R Square	0.51633
Adjusted R Square	0.467963
Standard Error	0.933881
Observations	12

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	9.310237	9.310237	10.67525	0.008469

Residual	10	8.721329	0.872133		
Total	11	18.03157			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	11.68115	3.044884	3.836319	0.003285	4.896722	18.46557
X Variable 1	-1.31702	0.40309	-3.2673	0.008469	-2.21516	-0.41888

Exhibit: 9

Model: CPI index & 3-month T-bill rates

Regression Statistics	
Multiple R	0.695519
R Square	0.483747
Adjusted R Square	0.432122
Standard Error	0.964824
Observations	12

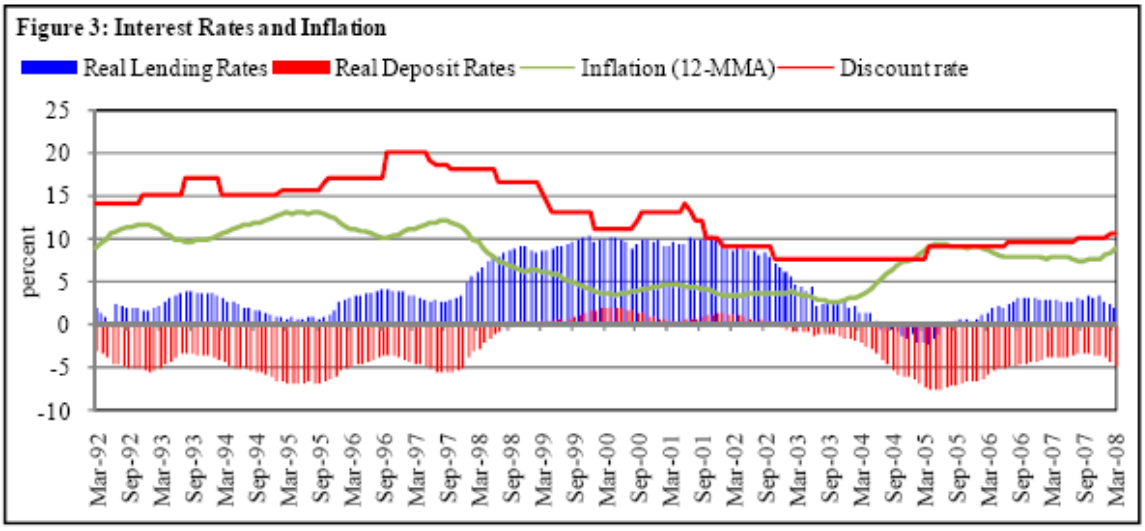
ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	8.722713	8.722713	9.370341	0.012022
Residual	10	9.308854	0.930885		
Total	11	18.03157			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	15.66038	4.545704	3.445095	0.006278	5.531924	25.78884
X Variable 1	-1.4853	0.485219	-3.0611	0.012022	-2.56644	-0.40417

Exhibit: 10

Relation between Inflation and Interest Rates



Source: State Bank of Pakistan Website

Exhibit: 11

Annexure I: Monetary Policy Rate Changes in Various Countries

	Policy Rates					Projections for 2008[6]	
	Current	W.e.f.	Prev.	Inflation*	Real Policy Rates	CAB as % of GDP	Fiscal bal. as % of GDP
Developed Countries							
Australia	7.25↑	4-Mar-08	7.00	3.20	4.05	-5.5	1.4
Canada	3.00↓	22-Apr-08	3.50	1.98	1.08	0.8	0.2
Denmark	4.25↑	4-Jul-08	4.00	2.47	1.78	0.9	3.8
Euro area	4.25↑	3-Jul-08	4.00	2.41	1.84	-0.3	-0.9
Japan	0.50↑	21-Feb-07	0.25	0.68	-0.18	4.1	-2.7
Korea	5.00↑	1-Aug-07	4.75	3.61	1.39	-0.8	1.1
N. Zealand	8.00↓	24-Jul-08	8.25	3.09	4.91	-	-
UK	5.00↓	10-Apr-08	5.25	4.12	0.88	-4.1	-3.6
USA	2.00↓	30-Apr-08	2.25	3.70	-1.70	-4.9	-2.4
Developing Countries							
Pakistan	**12.00↑**	**23-May-08**	**10.50**	**12.00**	**0.00**	**-8.6**	**-6.7**
Azerbaijan	14.00↑	10-Apr-08	13.00	-	-	-	-
Chile	7.25↑	10-Jul-08	6.75	7.24	0.01	0.5	8.9
China	7.47↑	21-Dec-07	7.29	7.10[3]	0.37	9.3	0.4
Egypt	10.50↑	26-Jun-08	10.00	15.56[4]	-5.06	0.2	-7.1
Ghana	16.00↑	19-May-08	14.25	18.42[3]	-2.42	-	-
Iceland	15.50↑	10-Apr-08	15.00	7.11	8.39	-	-
India	9.00↑	29-Jul-08	8.50	6.46[1]	2.54	-3.0	-3.4
Indonesia	8.75↑	3-Jul-08	8.50	7.87	0.88	2.7	-1.9
Malaysia	3.50↑	1-Apr-06	3.25	2.86	0.64	14.0	-3.1
Nigeria	10.25↑	2-Jun-08	10.00	10.5[3]	-0.25	-	-
Philippines	5.75↑	17-Jul-08	5.25	5.29	0.46	-	-
Romania	10.00↑	27-Jun-08	9.75	8.61[3]	1.39	-	-
S. Africa	12.00↑	13-Jun-08	11.50	8.99[1]	3.01	-8.0	0.4
Tajikistan	14.75↓	3-Apr-08	16.00	8.28[5]	6.47	-	-
Thailand	3.50↑	16-Jul-08	3.25	4.29	-0.79	-0.4	-3.0
Turkey	16.75↑	17-Jul-08	16.25	8.64	8.11	-6.4	-2.7
Vietnam	14.00↑	11-Jun-08	12.00	15.24	-1.24	-	-

* Average Inflation (July-June FY08) [1] July-May FY08 [2] July-March FY08 [3] June 2008 (YOY)
[4] Jan-Jun 08 [5] Jan-May 2008 [6] The Economist forecast

Source: Central Banks Web sites