Monetary Transmission Mechanism in Pakistan: Credit Channel or Interest Rate Channel

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Abstract

This study uses vector autoregressive approach to estimate the relative importance of credit and interest rate channels in the monetary transmission mechanism of Pakistan by covering the period from 1991-Q3 to 2012-Q2. The purpose of the study is to explore the role played by monetary policy shocks in economic fluctuations. The results based on variance decomposition analysis and impulse response function demonstrate that for the combine sample period covering from 1991-Q3 to 2012-Q2 both the credit and interest rate channels seem ineffective and it was difficult to distinguish which channel is more important during this period in Pakistan's case. The sample period was then divided into two subsample periods and both the channels were observed in two subsample periods. However, credit channel was dominant in the first sample covering 1991-Q3 to 2000-Q4 and interest rate channel performs a much greater role in transmitting policy shocks in the second sample period of 2001-Q1 to 2012-Q2. Hence, it is concluded that the role of both transmission channels changed during the last two decades. The role of the credit channel in transmitting monetary shocks has considerably weakened since the early 2000s, whereas interest rate channel is more important during this period. These results have important implications for policy design, supporting a greater emphasis on financial prices than the quantity of credit in order to accomplish the targets of monetary policy in Pakistan.

Keywords: *Monetary Transmission Mechanism, Credit Channel, Interest Rate Channel, VAR approach*

1. Introduction

Effective monetary policy is considered a strong tool for the stabilizing economy. Through monetary policy central bank influences the amount of lending and interest rate in the economy. The main intention of any country's monetary policy is to ensure stable prices and real income growth. From academic literature it is identified that monetary policy tends to change the real economic activities and the prices through transmission mechanisms.

Monetary transmission mechanism is closely related to how actually adjustments in monetary policy variables impinge on real income (output) and prices (Taylor, 1995). The monetary transmission mechanism labeled the way in which the monetary policy impacts the cumulative demand and prices by manipulating the consumption and investment of the organizations, household and financial mediators. Therefore transmission mechanisms are the key factors for monetary policy to recognize the direction of the real economy as well as to know the future prices (see Jiménez & Ongena, 2012; Ascarya, 2012). Monetary policies may be transmitted in the course of diverse channels that eventually affect the economic variables, markets at different speed and extent. The activity of the monetary transmission mechanism

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is different from country to country due to the different reasons like the scope, focus, and strength of the banking sectors, capital market and structural economic conditions (Baig, 2011).

The monetary transmission mechanism is being studied a lot not only by professionals but also by researchers for two important reasons. First, to understand how and at what level any country's economy is affected by the monetary policy. Also, how much time is required to fully implement this policy and gets it after-effects on the economy. Second, What effective policy tools can help the policymakers to control the economy through their policies. To make accurate assessment of monetary policy effect and shocks one should need to know the complete mechanism through which monetary policy impacts real economic activity and inflation (Boivin et al., 2010). The literature identifies a number of channels through which the monetary policy can affect the prices and output of the economy. However, Taylor (1995) classified various theories or channels of the monetary transmission mechanism into two broad categories: The financial market price view, also known as the "money" view, which primarily consists of the interest rate and exchange rate channels; and the "credit" view which also consists of two channels, namely; balance sheet channel and bank lending channel. Examining the effectiveness of these channels helps in examining whether predictions of different theories regarding monetary policy are consistent with empirical evidence (Mazhar, 2013). It also allows policy makers a better choice of instrument to achieve targets.

In Pakistan, many researchers have discussed the monetary transmission mechanism. Agha et al., (2005) argued that banks play a vital role in monetary transmission mechanism. In contrast, Khan and Khan (2012) suggested that banks loans and deposits have not performed a signficant role in the monetary transmission mechansisim of Pakistan. Other studies like Hussain (2009) argued that only exchange rate channel perform a significant role in monetary transmission mechanism of Pakistan and Safia (2012) supported the existence of net worth channel. In contrast, Baig (2011) concluded that all channels including credit channel, interet rate channel, exchange rate channel and assest price channel are signficantly ineffective to transmit monetary shocks into output and prices in Paksitan's case. All these studies have produced mixed results on the role of various channels but important question arise whether the role of different transmission channels changed over time. Several academic researchers have also argued that time to time changes in financial, banking and other regulation, and regime shifts may have affected the way monetary shocks are transmitted into the real economy over time. Many researchers documented for different countries that there is significant change in the impact of monetary policy on output and prices over time (see Kim, 1999; Canova and Nicolo, 2002; Stock and Watson, 2003; Boivin and Giannoni, 2006). In the case of Pakistan no single study, to the best of our knowledge, captured whether the relative importance of different channels changed over time or not. In the past all studies only focused on assessing whether the different channels operates or not. The present study utilizes the VAR approach, which is most accepted method of analyzing such problems, by dividing sample period into two subsample periods in order to estimate the relative importance of credit channel and interest rate channel in the monetary transmission mechanism of Pakistan.

1.1 Problem Statement

The main concern of this paper is to test specific relationships of interest rate and credit

channels with macroeconomic variables under study, namely: output and price. The question to be addressed is:

- To examine the effectiveness of the monetary policy with the credit channel compared to interest rate channel of monetary transmission mechanism.

2. Literature Review

From the academic literature it is recognized that monetary policy affects the price and output through different channels of monetary transmission mechanism. The literature identified three schools of thought regarding monetary transmission mechanism. The first school of thought focusing on the role of financial market prices "the money view", the second school of thought emphasizing on the role of credit "the credit view/the bank lending view" and the third school of thought emphasized credit rationing which is another mechanism. The first school of thought argued that monetary aggregate affected the output through interest rate and cost of capital, these types of arguments mostly discussed by the Keynesian economists. On the other hand, the credit view proposed that quantity of credit plays an important role in aggregate spending level so it affects the aggregate demand which is directly related to the business communities. Friedman and Schwartz (1963) provide statistical evidence based on the monetary history of United States that changes in monetary aggregates translate into a change in real economic activity. It shows that growth in money supply has positive correlation with output. Sims (1972) was the first to use causality test. He concludes that money Granger causes nominal GNP in a bivariate system that is past behavior of money predicated future GNP while uni-directional causality from income to money was rejected. Sims (1992) utilizes VAR model between money and output disjointedly in five countries namely, France, Germany, Japan, United Kingdom and United States. The study finds that in all five countries monetary shocks significantly impact output and following a hump-shaped pattern. In case of a contractionary shock, output patterns form a peak after several months and then eventually die out. Moreover, results also indicate that in all five countries a positive interest rate shocks led to an increase in price level. Bernanke and Blinder (1992) argued that the federal funds rate play significant role in predicating the real variables as compare to money, t-bill and bond rate. Atesoglu (2005) utilzed the co-integration and VECM tecniques on monthly data for the period of 1987:02 to 2004:04 and found a cointegrating relationship between fereral funds rate and long-term interest rate. Dabla-Norris and Floerkemeier (2006) argued that the interest rate channel seems to be the main appliance in industrially developed countries with having advanced economic and financial market.

Barran et al. (1996) carried out VAR model on quarterly data from 1976:Q1 to 1994:Q4 to examine the effectiveness of the monetary policy in European states. Their findings demonstrate that credit channel has played significant role in monetary transmission in European countries. Sichei (2005) argued that there is a significant relationship between bank loans and economic activities in South Africa. In the case of US economy Bernanke and Gertler (1995) utilized VAR approach and conclude that credit channels have performed a vital role in transmitting the monetary shocks into real output and prices. In contrast, Ramey (1993) finds that the credit channels play an insignificant role in transmitting the policy shocks into real output and prices.

Sun (2004) argued that money channel plays prominent role as compared to credit channel

which is witnessed in China's monetary policy transmission. On the other hand, Jiang et al. (2005) were in opposite direction. They conclude that credit aggregate has much greater impact on GDP and inflation as compare to money aggregate and explore the credit channel is more effective in china's monetary policy transmission. Boivin and Giannoni (2006) estimated VAR model for US economy over the pre- and post-1980 periods. They conclude that monetary policy has stabilized the economy more effectively in the post-1980 period. Other studies like Canova and Nicolo (2002) also conclude for G-7 countries that monetary shocks has reasonable properties; which they significantly contribute to output and inflation cycles but their impact is time varying.

In terms of literature available on monetary policy channels in developing economy, Ozdogan (2009) for Turkey and Kassim and Majid (2009) for Malaysia were in support of the money supply endogeneity theory. Their findings indicate that loans and deposits of banks have a significant function in the monetary transmission mechanism of these countries. Shams (2012) analyzed the causal links between prices, income, and money in Bangladesh. Results based on co-integration test indicate a long-term relationship among the concerned variables. Moreover, the study provides evidence in the favor of bi-directional causality between money and income and unidirectional causal link from money to prices. This implies that money supply is an effective variable to control inflation.

With respect to the literature available on credit channel and interest rate channel in Pakistan, Agha et al. (2005) carried out the VAR model on monthly data for the period 1996:M7 to 2004:M3 to assess the monetary transmission mechanism in Pakistan. The study finds that contraction in monetary policy leads to shrink the domestic demand by the companies and its impact on the financing by the banks which follow gradually to reduce the price pressures and finally decrease the overall price level with significant lag. The study concludes that banks play a significant role in monetary transmission mechanism of Pakistan. Qayyum (2006) studied the past behavior of the monetary policy and its impact on inflation. He examined the validity of the monetarist stance that inflation in Pakistan is a monetary phenomenon. He concludes that there is a positive correlation between inflation and money growth. Furthermore, his findings also indicate that due to an excessive money supply GDP grow a lot but in the second phase inflation also increased in Pakistan. Another attempt made by Hussain (2009) he utilized the VAR approach on monthly data for the period 1964: M1 and 2007: M12 to examine the effectiveness of monetary transmission channels in Pakistan. The findings indicate that the money market interest rate is not significant tool to act as monetary policy instrument in Pakistan's case. Moreover, the results also demonstrate that in both cases M1 and M2 are used as monetary policy transmission channel (credit channel) do not have a significant role in monetary transmission mechanism of Pakistan. Lastly, he concludes exchange rate channel perform a significant role in monetary transmission mechanism of Pakistan. Khan and Khan (2012) analyzed the impact of banks loans and deposits in the monetary transmission mechanism of Pakistan. The study concludes that the banks loans and deposits are not key link to transmit the change in monetary policy variables into real economic activities and prices in Pakistan. Baig (2011) examined the effectiveness of market-based monetary transmission mechanism in Paksitan. He carried out VAR model on monthly data for the period 1993: M1 to 2009: M4. The study finds that all channels "credit channel, interest rate channel, exchnage rate channel and assest price channel" are sigificantly ineffective in case of Paksitan. Mohsin (2011) carried out the panel data techniques on the bank-type monthly data from 2001:M9 to 2011 M3 to analyze the impact of policy rate on the lending

and deposited rate in Pakistan. The empirical evidences indicate a cointegrating relationship between policy rate and lending rate whereas deposit rate has no long-term relationship with policy rate. Safia (2012) examined the balance sheet channel in monetary transmission of Pakistan for the period of 1999-2010. She employed the linear panel model on the micro level of data from 160 non-financial companies. She argued that monetary tightening has significant impact on the balance sheets, income statement and cash flows accounts of the firm due to an increase in the interest rates. Generally, it enhance the financial expenses (financial charges) of the firms and that eventually overcome company profit as well as weakened the financial position of the firms. Finally, the study supports the existence of net worth channel. In short, in the context of Pakistan, all these studies produced mixed results regarding importance and effectiveness of various channels in monetary transmission mechanism.

3. Research Methodology

This study utilizes VAR approach based on variance decomposition analysis and impulse response function to examine the effect of credit channel and interest rate channel on key economic variables i.e. output and inflation. The inspiration to employ a VAR model came from the existence of a large empirical literature i.e. Bernanke and Blinder (1992), Jiang et al. (2005), Agha et al. (2005), Hussain (2009) and Baig (2011) applied the VAR model to examine the impact of monetary policy on real income and prices.

Basic Model:

$$\begin{bmatrix} Y_t \\ P_t \\ M_t \end{bmatrix} = A(L)\begin{bmatrix} Y_{t-1} \\ P_{t-1} \\ M_{t-1} \end{bmatrix} + \begin{bmatrix} \varepsilon_{Yt} \\ \varepsilon_{Pt} \\ \varepsilon_{Mt} \end{bmatrix}$$

The basic VAR model in a matrix form or trivariate system can be written as followingIn the above equation, Y_t represents the output, P_t is used for the prices level and M_t is used for policy instruments i.e. credit to private sector or interest rate. *A(L)* is a 3*3 matrix polynomial in the lag operator L. where ε_{it} is a white noise disturbance term. The model assumes that ε_{it} is a time t serially uncorrelated shocks to the ith variables. These shocks can either be independently distributed innovations to Y_t, P_t and M_t. The procedure to run the VAR model is to take only one policy instrument at a time and tried all the possible orders of the variables.

3.1 Impulse Response Function

The dynamic relationship among the variables in the vector autoregressive model can be investigated through impulse response function. Impulse response function indicates the dynamic responses of the dependent variables in the VAR system to one unit shock in each of the variables. The impulse response can be explained in the subsequent way.

The VAR model in the standard form is:

$$Y_t = A_1 Y_{t-1} + A_2 Y_{t-2} + \ldots\ldots\ldots A_n Y_{t-k} + \varepsilon_t \ldots\ldots\ldots 1$$

Where

Y_t is an (n x 1) vector having n variables. If Y_t is covariance stationary the above model can be written in a vector moving average representation, characterized as,

$$Y_{t} = \mu + \sum_{i=0}^{\infty} \varpi_i \, \varepsilon_{t-i} \ldots\ldots\ldots\ldots 2$$

The moving average representation is a particularly useful way to observe the interaction between the variables included in the vector autoregressive model. Provided that the system is stable, the shock should gradually die away. Now consider there are two variables Y_t and P_t. The coefficients of ϖi can be used to produce the effects of εyt and εP_t unit shock on the total time paths of Y_t and P_t sequence. The accumulated effects of unit shock of εy_t and εP_t can be obtained by the suitable summary of the coefficients of the impulse response function.

3.2 Variance Decompositions

To get an idea of the proportion of the fluctuations of a given variable that are caused by different shocks in the VAR system can be investigated through Variance decomposition. It shows the fraction of forecast variance error of the variables that are due to its "own" shocks, versus shocks to the other variables. To illustrate how variance decomposition operates, take a vector autoregressive model in the standard form i.e.

$$Y_t = A_1 Y_{t-1} + A_2 Y_{t-2} + \ldots\ldots\ldots A_k Y_{t-k} + \varepsilon_t \ldots\ldots\ldots\ldots\ldots\ldots 1$$

Identify the coefficients of A_1, $A_2 \ldots A_k$ and then bring up to date the above-mentioned equation for one era and taking the provisional anticipation of Y_{t+1}. The above-mentioned model transforms in the following:

$$E_t Y_{t+1} = A_1 Y_t + A_2 Y_{t-1} + \ldots\ldots\ldots A_k Y_{t-k} + 1 \ldots\ldots\ldots\ldots\ldots\ldots 2$$

One step-ahead forecast error is:

$$Y_{t+1} - E_t Y_{t+1} = \varepsilon t+1 \ldots\ldots\ldots\ldots\ldots\ldots 3$$

Moreover, the n-step-ahead forecast error is:

$$\varepsilon_{t+n}=A_1 \varepsilon_{t+n-1}+A_1^2 \varepsilon_{t+n-2}+\ldots\ldots\ldots A_1^{n-1} \varepsilon_t +1\ldots\ldots\ldots\ldots\ldots\ldots\ldots 4$$

Equation 4 determines the n-step-ahead forecast error variance of a given variable which is explained by shocks to each independent variable.

3. 3 Data and Variables

This study is based on the time series data. Quarterly data was used for the period 1991-Q3 to 2012-Q2. To find out the relative importance of different transmission channels i.e. interest rate channel and credit channel in different time periods the sample period is divided into two subsample periods; 1991-Q3 to 2000-Q4, and 2001-Q1 to 2012-Q2. Data regarding credit to private sector was obtained from the State Bank of Pakistan's monetary survey. Data for variables like exchange rate, inflation (CPI), and money market interest rate were collected from IMF (International Financial Statistics). Data for real GDP obtained from "Quarterisation of National Accounts of Pakistan" by (Hanif, Iqbal, & Malik, 2013). All variables are converted into quarterly growth rate with corresponding quarter except money market interest rate. CPI (consumer price index) is used to measure the price level and it's considered as inflation while real GDP growth rate is used to measure the real economic activity. Money market interest rate is used as indicator of monetary policy stance or to measure the interest rate channel whereas credit to private sector is used to measure the credit channel.

4. Results and Discussion

For any time series analysis the primary task is to check the order of integration of the variables of interest. For this purpose the Augmented Dickey Fuller test (1979-1981) has been employed. Only constant term included when ADF test performed to these variables. The test statistic values of ADF test for each variable reported in table 2 appendix A indicates that all variables are stationary in their level form at 5% and 10% level of significance. In the second step, we have employed Akaike information criteria (AIC) and other diagnostic tests to select appropriate lag length and the accurate specification of VAR model The results of "Akaike Information Criterion (AIC)" for both equations reported in table 3 appendix A demonstrate that the most favorable lag length is 5 quarters for combine sample period while for the subsample periods the optimal lag length is 2 and 4 quarters for money market interest rate and credit to private sector equations respectively.

4.1 Impulse responses Analysis

In VAR model two different equations estimated to analyze relative importance of credit and interest rate channels in monetary transmission mechanism of Pakistan. The equations comprise of (money market interest rate, credit to private sector), real GDP, exchange rate and inflation in the given order. Different orders of the variables are tried but the results are almost similar.

Interest Rate Channel

Results of impulse response of real GDP and inflation to shocks in money market interest rate for the period 1991-Q1 to 2012-Q2 presented in figure 2 Appendix B. Shocks on real GDP and inflation are investigated up to 12 quarters in impulse response function. It demonstrates that one standard deviation shocks in money market interest rate shows positive and although weaker impact on real GDP for first four quarters however after one year the impact is relative high till the end of forecast horizon of 12 quarters. Impulse response of inflation to money market interest rate innovations; inflation is slightly increasing in the year after the shocks, to be reached the peak (0.69 %) after 12 quarters. The impacts of innovations in money market interest rate on price level are ineffective, explaining less than 1 % variations in price level in one quarter throughout the forecast horizon of 12 quarters.

Results of impulse response of real GDP and inflation to innovations in money market interest rate for the subsample period 1991-Q3 to 2000-Q4 reported in figure 3 Appendix B. it reveals that there is sharply declines in real GDP for the first four quarters after initial shocks in money market interest rate. After 4 quarters a very weaker positive impact of money market interest rate shocks on real GDP observed throughout the forecast period of 12 quarters. Inflation has positively responded to the innovations in money market interest rate. Inflation is slowly increasing in the year after the shocks in money market interest rate, to be reached the peak (0.60%) in fourth quarter. Hence, one can be concluded that innovation in money market interest rate are ineffective, explaining less than 1% fluctuations in real GDP and inflation throughout the forecast horizon of 12 quarters.

Shocks of money market interest rate on real GDP and inflation for the subsample period 2001-Q1 to 2012-Q2 presented in figure 4 appendix B. Shocks on these variables are investigated up to 12 quarters in impulse response function. The results show that shocks in money market interest rate have significant impact on real GDP and price level during this period. Inflation is positively responded to shocks in the money market interest rate. It responses immediately to innovations in money market interest rate and there is sharp increase in inflation, to be reached the peak (1.08 %) in first three quarters after initial shocks in money market interest rate. While real GDP initially is negatively responded to shocks in money market interest rate in first four quarters and after one year it is highly positive responded to shocks in money market interest rate till the end of forecast horizon. Hence, one can be concluded that innovations in money market interest rate are highly effective because money market interest rate shocks explain more than 1% variation in price level within third quarter.

Credit Channel

Credit to private sector is used as a measurement of credit channel. Results of impulse response function for the period 1991-Q1 to 2012-Q2 presented in figure 2 appendix B. It indicates that real GDP is slightly increasing for whole forecast horizon and touch the high level (0.40%) in nine quarter after shocks in credit to private sector. Impulse response of inflation to innovations in credit to private sector; inflation is slightly increasing for first five quarters, to be reached the peak (.22%) in third quarter. It then gradually decreases to the end of twelfth quarter. Hence, one can be concluded that innovations in credit to private sector are ineffective, explaining less than 1% fluctuations in real GDP and price level in one quarter throughout forecast horizon of 12 quarters.

Results of impulse response of real GDP and inflation to shocks in credit to private sector for the subsample period 1991-Q3 to 2000-Q4 reported in figure 3 Appendix B. It determines that real GDP highly positive responded to innovation in credit to private sector throughout the forecast horizon of 12 quarters, to be reached the peak (1.35%) in 12 quarter. The shocks in credit to private sector are highly significant impact on price level. After the shocks in credit to private sector the inflation begins to increase immediately and reaching the peak (1.67%) after eleven quarters. Hence, one can be concluded, innovation in credit to private sector is highly significant, explaining more than 1.20% fluctuations in real GDP and price level during these period.

Result of impulse response of real GDP and inflation to innovation in credit to private sector during 2001-Q1 to 2012-Q2 presented in figure 4 Appendix B. It shows that shocks in credit to private sector have no significant impact on real GDP and price level. It explains less than 1% variations in real GDP and price level throughout the forecast horizon of 12 quarters. After shocks in credit to private sector real GDP gradually declines in the first four quarters and then coming to the baseline after 12. Inflation has also positively responded to shocks in credit to private sector. Inflation moved upward immediately after initial shocks in credit to private sector and to be reached the peak (0.77) within 2 quarters. The important result draw here is that inflation relative higher positively responded during 1991-Q3 to 2000-Q4 as compared to subsample period of 2001-Q1 to 2012-Q2.

4.2 Variance Decomposition Analysis

The results of both equations of variance decomposition for inflation and real GDP for the period 1991-Q3 to 2012-Q2 at forecast horizons of 12 quarters summarized in table 4 Appendix C. The columns present the percentage of the variance due to each shock with each row adding up to 100%. It shows that money market interest rate and credit to private sector shocks account for 11.30% and 12.54% variations respectively in real GDP after 12 quarters. Moreover, the results also demonstrate that after passing through 12 quarters shocks in money market interest and credit to private sector account for only 2.62% and 2.98% fluctuations in price level. This implies that shocks in money market interest rate and credit to private sector have no significant impact on price level during the period of 1991-Q3 to 2012-Q2.

Table 5 Appendix C presents the results of Variance decomposition test for the period of 1991-Q3 to 2000-Q4. It reveals that after passing through three years money market shocks account for 0.73% and 5.93% of the fluctuations in price level and real GDP while the most of the rest are explained by its own shocks. Furthermore, the results also indicate that after 8 quarters credit to private sector shocks account for 12.35% and 24% fluctuations in price level and real GDP respectively, relatively high as compared to interest rate channel which is only 0.82% and 6% for price level and real GDP after 8 quarters respectively. This states that credit to private sector has significance impact on price level and real GDP during this period.

Table 6 Appendix C reports the results of variance decomposition test for inflation and real GDP of both equations for the period 2001-Q1 to 2012-Q2. The results uncover that after passing through three years the share of real GDP variance accounted for credit to private sector is 15.5 % while credit to private sector explain only 7.29% variation in price level.

Furthermore, the findings suggest that after passing through three years money market interest rate shocks account for 41.21% and 20.55% fluctuations in real GDP and price level respectively, relatively much higher as compared to credit to private sector (credit channel) that account for 15.5 % and 7.29 % fluctuations in real GDP and price level after 12 quarters during this period. This implies that the money market interest rate is significantly affected the real GDP and inflation during this period.

5. Conclusion

This study attempted to estimate the relative importance of credit cannel and interest rate channel in the monetary transmission mechanism of Pakistan by covering the period from 1991:Q3 to 2010:Q2. The VAR model was employed in order to achieve the objective of the study. The empirical results based on impulse response function and variance decomposition analysis demonstrate that for the combine sample period covering from 1991-Q3 to 2012-Q2 both credit and interest rate channels seem ineffective and to distinguish which channel is more important during this period in Pakistan's case was difficult. The results are generally consistent with the findings of previous researchers, using similar methodology; for example Hussain (2009) and Baig (2011) documented that credit and interest rate channels are ineffective in Pakistan's case. For the subsample periods, the evidences based on variance decomposition analysis indicate that credit to private sector shocks are found to be significant in explaining the movements in inflation and real GDP for the first period of 1991:Q3 2012-Q2, while money market interest rate shocks are found to be more important in explaining the variation in prices and real GDP for the second period of 2000-Q1 to 2012-Q2. An analysis of graphs produced by impulse response functions reveals that inflationary pressures are much higher in case of credit to private sector shocks as compared to money market interest rate shocks in the first sample covering 1991-Q3 to 2000-Q4, while in the second sample period 2000-Q1 to 2012-Q4 the inflationary pressures are higher in the case of money market interest rate shocks as compared to credit to private shocks.

The results also confirm the presence of both channels in two subsample periods. However, credit channel is dominant in the first sample covering 1991-Q3 to 2000-Q4, while interest rate channel plays a greater role in transmitting policy shocks into output and prices in the second sample period 2001-Q1 to 2012-Q2. This implies that the role of both transmission channels changed during the last two decades in Pakistan. The role of credit channel in transmitting the policy shocks into output and prices has been diminished greatly since the early 2000s, whereas interest rate channel is become more important during this period. The results have important implications for policy design, supporting a greater emphasize on financial prices than the quantity of credit in order to accomplish the targets of monetary policy in Pakistan.

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Appendix A

Table 1

Detail of Abbreviation and Data Source for each Variable

Variables	Abbreviation	Data Source
RGDP	Real Gross Domestic Product (Constant price= 1999-2000)	Quarterisation of National Accounts of Pakistan by (Hanif, Iqbal, & Malik, 2013).
MMR	Money Market Interest Rate	IMF (International Financial Statistics)
CPI	Consumer Price Index	IMF (International Financial Statistics)
ER	Exchange Rate	IMF (International Financial Statistics)
CRPS	Credit to Private Sector	State Bank of Pakistan's monetary survey
MTM	Monetary Transmission Mechanism	-

Table 2

ADF Unit Root Test

		Level	
Variables	**t-statistic**	**Probability**	**Lag length**
CRPS	-3.004547	0.0387	3
MMR	-3.433994	0.0124	0
RGDP	-2.965745	0.0424	1
CPI	-3.411998	0.0133	1
ER	-4.727253	0.0002	1

Critical value at 5% and 10% level of significance is: -2.896779 and -2.585626 respectively

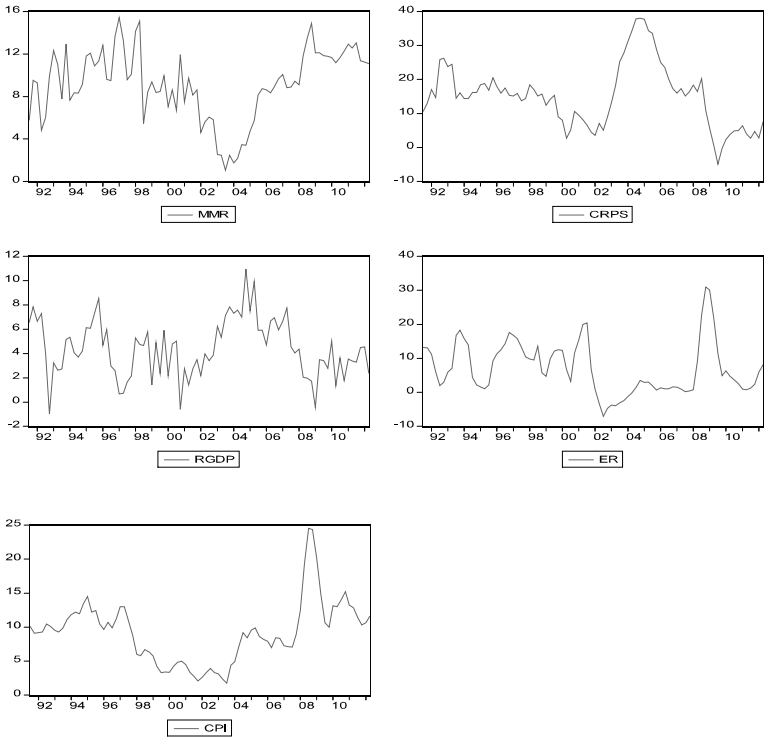
Table 3

Optimal Lag length

Sample: 1991Q3- 2012Q2			**1991Q3-2000Q4**		**2001Q1-2012Q2**	
Lag	**AIC-MMR**	**AIC-CRPS**	**AIC-MMR**	**AIC-CPRS**	**AIC-MMR**	**AIC-CPRS**
0	23.82	21.56	20.44	21.57	20.71	23.30
1	18.28	17.84	18.13	18.71	15.66	17.40
2	17.78	17.07	18.09*	18.65	14.57*	16.44
3	17.83	17.13	18.31	18.35	14.68	16.36
4	17.68	17.00	18.10	17.74*	14.78	16.26*
5	17.43*	16.83*	-	-	-	-
6	17.59	16.94	-	-	-	-
7	17.68	17.04	-	-	-	-

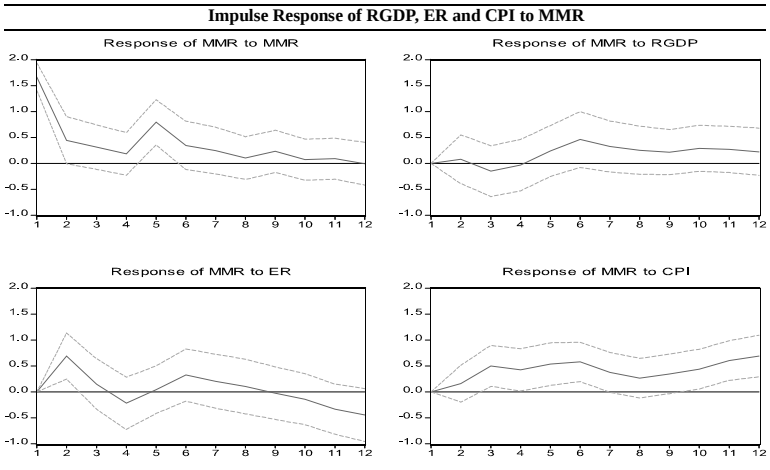
* indicates optimal lag length for specific equation: Akaike information criterion

Figure: 1 Graphical Illustration of Data



Appendix B

Figure: 2 Impulse Response Analysis for the period of 1991-Q3-2012-Q2



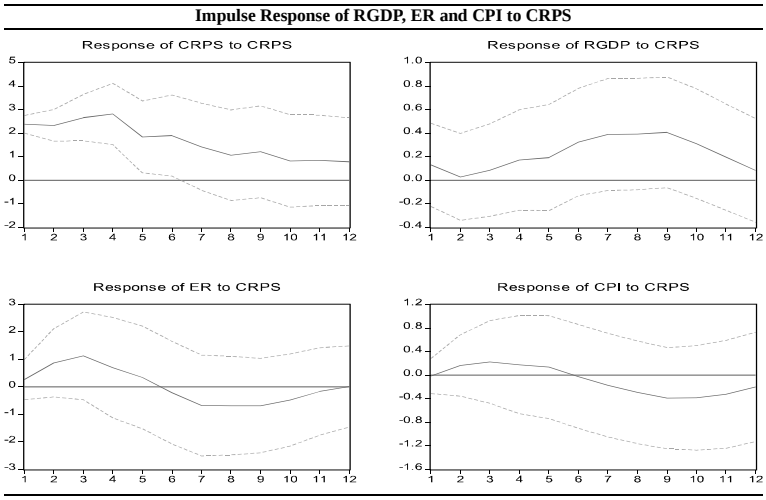
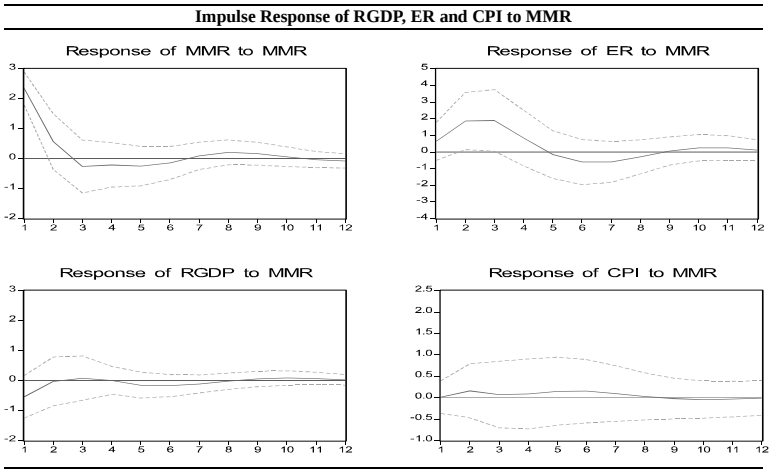


Figure: 3 Impulse Response Analysis for the period of 1991-Q3 - 2000-Q4



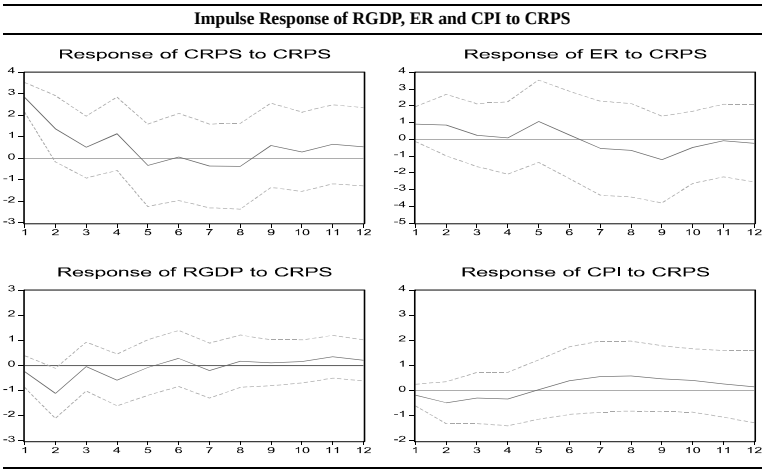
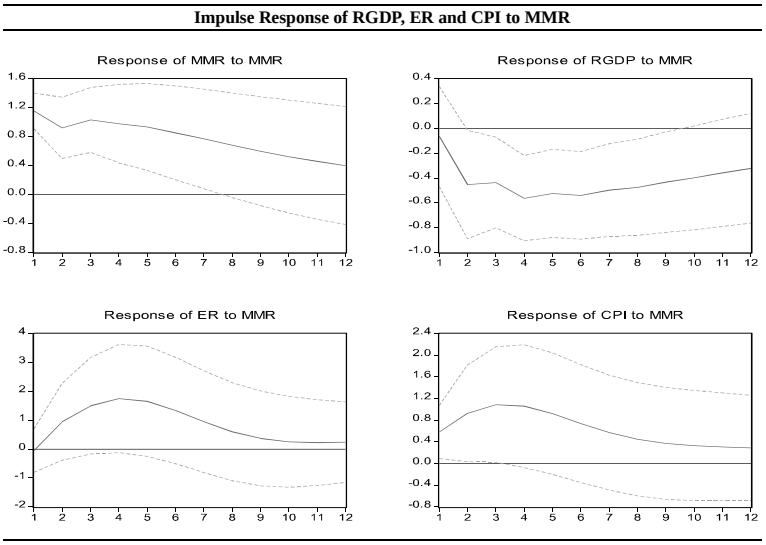
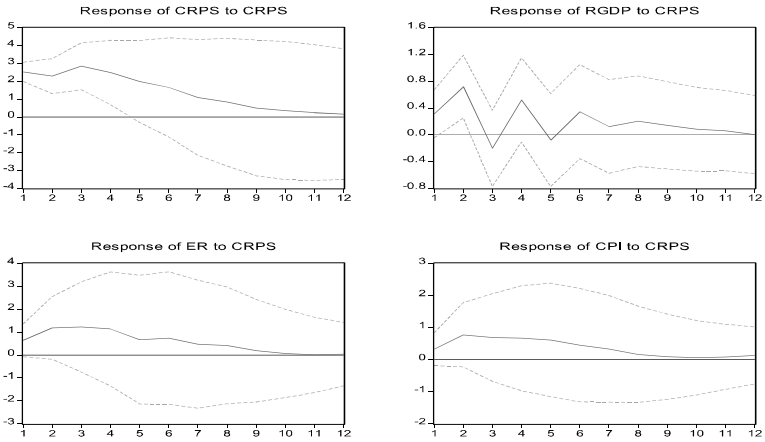


Figure: 4 Impulse Response Analysis for the period of 2001-Q1 - 2012-Q



Impulse Response of RGDP, ER and CPI to CRPS



Appendix C

Table 4
Variance Decomposition of CPI and RGDP (1991Q3-2012Q2)

	Variance Decomposition of CPI					**Variance Decomposition of CPI**			
Period	MMR	RGDP	ER	CPI	Period	CRPS	GDP	ER	CPI
1	5.33	0.002	7.57	87.08	1	0.01	0.03	8.01	91.93
2	3.46	0.016	3.98	92.52	2	0.50	0.14	4.16	95.18
4	1.77	0.678	1.90	95.64	4	0.87	0.13	2.29	96.68
6	3.08	3.13	4.35	89.42	6	0.90	0.24	5.11	93.72
8	3.39	3.22	9.54	83.83	8	1.62	1.50	8.66	88.21
10	2.92	3.39	17.42	76.25	10	2.98	6.96	13.11	76.92
12	2.62	2.89	22.57	71.90	12	2.98	9.44	18.15	69.41
	Variance Decomposition of RGDP					**Variance Decomposition of RGDP**			
1	0.43	99.56	0.00	0.00	1	0.68	99.31	0.00	0.00
2	1.24	96.92	0.62	1.20	2	0.68	94.85	2.82	1.63
4	3.61	87.56	3.20	5.61	4	1.38	77.11	14.48	7.02
6	6.85	77.46	10.52	5.15	6	3.93	62.28	28.01	5.76
8	8.53	70.88	13.20	7.37	8	8.79	54.74	30.75	5.69
10	10.93	69.82	12.27	6.96	10	12.62	51.79	29.25	6.32
12	11.3	67.70	11.26	9.70	12	12.54	49.02	27.58	10.84
Cholesky Ordering: MMR RGDP ER CPI					Cholesky Ordering: CRPS RGDP ER CPI				

Table 5
Variance Decomposition of CPI and RGDP (1991Q3-2000Q4)

	Variance Decomposition of CPI					**Variance Decomposition of CPI**			
Period	MMR	RGDP	ER	CPI	Period	CRPS	GDP	ER	CPI
1	0.009	0.015	0.21	99.76	1	1.88	0.79	2.15	95.16
2	0.74	0.33	1.83	97.08	2	6.30	0.82	1.08	91.78
4	0.52	0.53	7.68	91.25	4	6.43	3.40	0.63	89.52
6	0.84	2.00	9.93	87.21	6	7.52	8.89	0.77	82.81
8	0.82	3.62	9.55	85.99	8	12.35	14.83	0.74	72.06
10	0.77	5.04	8.84	85.34	10	11.70	21.02	0.90	66.36
12	0.73	5.94	8.49	84.82	12	8.63	24.36	0.66	66.32
	Variance Decomposition of RGDP					**Variance Decomposition of RGDP**			
1	6.33	93.66	0.00	0.00	1	1.60	98.39	0.00	0.00
2	5.86	91.34	0.47	2.30	2	27.06	71.52	1.30	0.10
4	5.38	90.66	1.65	2.29	4	27.28	64.98	4.71	3.02
6	5.98	86.78	3.24	3.98	6	25.08	59.19	5.34	10.37
8	5.97	83.83	3.35	6.84	8	23.93	54.22	5.61	16.22
10	5.94	81.65	4.13	8.26	10	23.78	52.92	7.17	16.11
12	5.93	80.74	4.23	9.07	12	24.86	50.98	7.65	16.48
Cholesky Ordering: MMR RGDP ER CPI					Cholesky Ordering: CRPS RGDP ER CPI				

Table 6
Variance Decomposition of CPI and RGDP (2001Q1-2012Q2)

	Variance Decomposition of CPI					**Variance Decomposition of CPI**			
Period	MMR	RGDP	ER	CPI	Period	CRPS	GDP	ER	CPI
1	12.08	0.46	29.17	58.27	1	3.59	14.34	21.22	60.83
2	12.87	0.26	23.11	63.74	2	6.58	14.64	15.12	63.64
4	15.89	0.27	15.54	68.28	4	6.38	12.92	11.80	68.87
6	18.43	1.21	13.10	67.25	6	7.30	11.23	11.67	69.78
8	19.64	2.34	12.68	65.33	8	7.52	11.81	11.82	68.83
10	20.20	3.00	12.48	64.30	10	7.47	11.76	11.90	68.86
12	20.55	3.31	12.36	63.76	12	7.29	11.87	11.82	69.01
	Variance Decomposition of RGDP					**Variance Decomposition of RGDP**			
1	0.23	99.76	0.00	0.00	1	6.81	93.18	0.00	0.00
2	9.17	79.29	3.061	8.47	2	25.77	58.57	1.59	14.06
4	21.43	61.42	4.95	12.19	4	21.41	40.64	9.34	28.59
6	31.38	50.71	5.34	12.54	6	19.46	33.30	11.27	35.96
8	37.26	45.07	5.14	12.51	8	18.31	30.23	11.70	39.74
10	40.11	42.04	4.81	13.02	10	16.91	27.99	11.93	43.16
12	41.21	40.37	4.51	13.89	12	15.50	26.20	12.13	46.15
Cholesky Ordering: MMR RGDP ER CPI					Cholesky Ordering: CRPS RGDP ER CPI				