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Monetary Transmission Mechanism and Macroeconomy in Pakistan

Rana Zafar Hayat[1], Muhammad Ramzan Sheikh[2] & Fozia Latif Gill[3]

Abstract

Monetary policy is considered a vital policy to manage aggregate demand. The main purpose of the analysis is to comprehend the accessibility of channels of the monetary transmission mechanism and to determine the basic monetary channel of the transmission mechanism for Pakistan. The study has applied vector autoregressions, impulse response function and variance decomposition and used time-series data from 1975 to 2015 to validate the interest rate channel, asset price channel, credit channel and exchange rate channel. The findings of the study show that all the channels are vital channels of the monetary transmission mechanism in Pakistan.

Key Words: Credit channel, Asset price channel, exchange rate channel, Interest rate channel
JEL Codes: E52, E63

1 Introduction

The public sector has to perform three important functions in the economy which include allocation, distribution and stabilization functions. All the functions have their significance, but the stabilization of the economy matters a lot for sustainable economic development. Monetary policy tools are vital factors for stabilization. In the monetary policy, the role of the central bank is pivotal along with commercial banks to control the money supply and interest rates. There are many objectives of monetary policy but nowadays every central bank is following the ultimate objectives of price stability and economic growth. Monetary

[1] Department of Economics, Government Civil Lines College, Multan, Pakistan. Email: itszafarhayat@gmail.com
[2] School of Economics, Bahauddin Zakariya University, Multan, Pakistan. Email: ramzansheikh@bzu.edu.pk
[3] Department of Economics, The Government Sadiq College for Women University, Pakistan. Email: fozialatifgill@gmail.com

policy may influence economic behaviour and prices through its transmission mechanisms. The monetary transmission mechanism demonstrates how the money supply is ultimately affecting GDP growth via various channels of monetary influence. It is pertinent to note that channels of monetary influence vary from country to country due to multiple reasons (Ahmed and Malik, 2011; Ahmed et al., 2012).

To comprehend the effectiveness of the various channels of monetary transmission, it is necessary to grasp the nature and strength of every channel of the monetary transmission mechanism. The policymakers must know the lags in monetary policy which affect the objectives ultimately, but the time of recognition of inside lag and outside lag is important when choosing the instruments of monetary policy. The empirical review illustrates that monetary transmission mechanisms play a crucial role to enhance investment spending, prices, and aggregate output. Although monetary transmission mechanism has become an imperative area of empirical studies, in the case of Pakistan, a few studies have been found in this area, so this issue is not properly explored in Pakistan. Few studies are available in Pakistan such as that (see Alam and Waheed (2006), Ahmed et al (2006), Hussain (2009), Haider and Khan (2009), Hussien et al (2011), Ahmed and Malik (2011), Shabbir (2012), Choudhri and Malik (2012), Ahmed et al (2012) and Hussain (2014). So, in the case of Pakistan, no single study is available to understand whether the comparative consequence of different channels changed overtime or not. In the past, all studies have only focused on evaluating whether the several channels operated or not. So, there are shortcomings in these studies, therefore we have chosen this analysis to delve into the overall monetary transmission mechanisms.

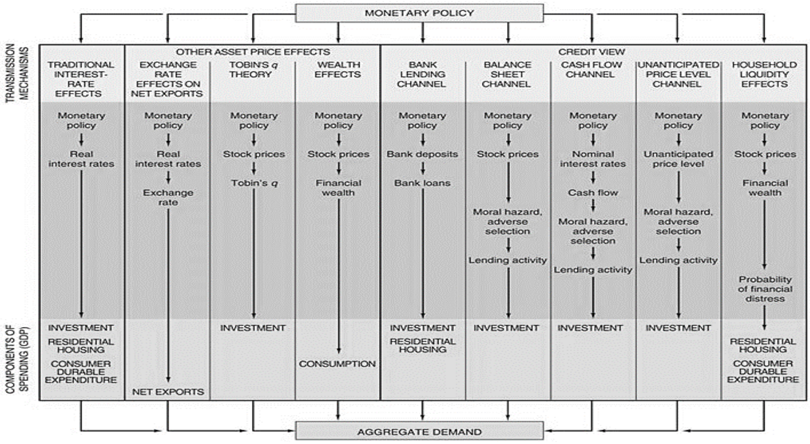
The paper is structured as follows: Section 2 represents the theoretical and conceptual framework of monetary transmissions mechanisms. Section 3 reviews the empirical literature. Section 4 discusses data, model, and methodology. Results and discussions are in section 5 and section 6 provides conclusions and policy implications.

2 Channels of Monetary Transmission Mechanism

The monetary transmission channels play a crucial role to influence economic activity. All the channels operate through different frameworks, and it would differently affect the economic activity and other macroeconomic variables. The interest rate channel shows that when the money supply increases, the real interest rate would fall, therefore lowering the cost of capital causing the rise of investment thus leading to an increase in aggregate demand as well as a rise in output. The exchange rate channel exhibits that when domestic real interest rates fall, it would cause own currency deposits to be less attractive relative to foreign currency deposits, therefore the value of domestic currency deposits relative to foreign currency deposits falls so the depreciation of domestic currency lowers the value of the domestic currency. It indicates that domestic goods are cheaper than foreign goods, so the result is an increase in net export as well as in aggregate output.

The credit channel explains two types of monetary transmission channels, consequently as a result of information problems in the credit markets: first, manage through effects on bank lending and consequently, that operates through effects on firms as well as household balance sheets. Bank lending channel shows that when expansionary monetary policy is taken; as consequence, it leads to increase bank reserves as well as bank deposits, as a result, an increase in the number of bank loans obtainable because many borrowers are generally relying on bank loans to finance their activities because their increase in loans will consequently raise investment as well as consumer spending. The second type of credit channel is the balance sheet channel introduced by Romer and Romer (1993) which indicates that when expansionary monetary policy is taken, it will raise the equity prices and net worth of firms and as a result investment spending and aggregate output will increase because of fall in adverse selection and moral hazard problems. The wealth channel which is represented by Franco Modigliani (1963) indicates that when money supply increases, stock price rises, therefore the value of financial wealth rises and as a result increases the lifetime resources of consumers as well as consumption and hence the output can be raised. Figure A shows the summary of various channels of influence of monetary policy.

Figure: A
Summary of Various Channels of Influence of Monetary Policy



Source: Mishkin, 1996

3 Review of Empirical Literature

There are many studies on monetary transmission mechanisms and all the studies indicate the different implications and dimensions. Many studies have shown positive or significant consequences and some studies have exhibited insignificant results. Some studies have conducted aggregated analysis while some studies have done disaggregated analysis.

Gertler and Gilchrist (1992) examined the monetary policy, business cycle and behaviour of the manufacturing firms in the USA. The study used time series data from 1958 to 1990 and applied the VAR approach. The study analyzed that monetary policy largely affects small firms and small firms are sensitive to changes in GNP, interest rate and technology and firms rely on bank financing. Wesche (2000) investigated the impact of monetary policy on firms' investment decisions in Austria using time series data from 1979 to 1980 and applied the two-stage non-linear approach which results that an insignificant interest rate, and significant debt ratio effect on investment. Guariglia and Mateut (2002) highlighted the credit channel, trade channel and inventory investment based in the UK, used time-series data from 1980 to 2000, applied the Generalized Method of Movement (GMM) approach and examined the positive and negative significant effects on inventory investment, trade credit channel had a stronger effect than credit channel and credit channel diminishes the effect of contradictory monetary policy. Agha et al. (2005), investigated the monetary transmission in Pakistan, applied time-series data from 1996 to 2004, adopted the VAR approach and analyzed that monetary tightness leads to a fall in investment, price level, and output level. The asset price channel was active with significance as compared to the exchange rate channel. Alam and Waheed (2006) discussed the sectoral effect of monetary policy in Pakistan, used the VAR approach on seven sectors, and suggested that potential sector effects of monetary shocks would be required to take into deliberation for future formulation of monetary stabilization policies in Pakistan. Black and Rosen (2007) discussed the differentiation between the bank lending channel and balance sheet channel in the USA, used time-series data from 1982 to 2006, applying the logit specification approach and analyzed that the coefficient of fund rate was negative and insignificant. Haider and Khan (2009) examined the small open economy dynamic stochastic equilibrium model based in Pakistan, used time-series data from (1984-2007), applying the Bayesian Estimation Approach and analyzed that high inflation would not significantly affect domestic consumption and due to high inflation, the central bank would raise the policy rate by 100 to 200 bps. Karim (2010) highlighted the monetary policy and firm's investment in Malaysia, used the data from 1990 to 2008, applied the Generalized Method of Moment (GMM) approach and analyzed that coefficient of the user cost of capital was negative and significant, the coefficient of cash flow capital ratio and coefficient of sale growth had a statistically significant effect on investment spending.

Hussien et al. (2011) described the financial accelerator; an emerging market story in Pakistan, using data from (2002-2008) adopted Vector Autoregressive (VAR) approach, the result indicated that the cyclicality of margins still after controlling the monetary policy, terms structural of interest rate and credit risk effects. Shabbir (2012) examined the monetary transmission and balanced sheet based in Pakistan, used data from (1999 to 2010), adopted the random effect approach and analyzed that monetary policy contraction would directly affect the balance sheet that would increase the financial expenses of the firms, reduced their profits and compressed their cash flows. Hussain (2014) described the monetary transmission mechanism based in Pakistan, used data from (1991-2012), Applied Vector Autoregressive Approach (VAR) and analyzed that both the credit and interest rate channels would appear too ineffective and it would be difficult to differentiate which channel was more essential during the period. Mukhtar and Younas (2019) analyzed the bank lending and asset price channels of the monetary transmission mechanism in Pakistan. The study pointed out that targeting the monetary aggregates was effective to influence the output level, The results show that the monetary aggregates targeting agenda are still operative in affecting the output and general price level.

4 Model Specification

Following models have been specified to explore the effectiveness of various channels of the monetary transmission mechanism in Pakistan.

Model 1: Basic VAR model

Output level =f (Monetary policy)

Price level =f (Monetary policy)

Model 2: Exchange rate channel

Output level=f (Credit, Exchange rate, interest rate)

Price level =f (Credit, Exchange rate, interest rate)

Model 3: Interest rate channel

Output=f (Credit, interest rate)

Price level =f (Credit, interest rate)

Model 4: Asset price channel

Output level=f (MCG, interest rate)

Price level =f (MCG, interest rate)

Model 5: Exchange rate channel

Output level=f (Exchange rate, interest rate)

Price level=f (Exchange rate, interest rate)

Where:

Credit channel: GDPPC, INFD, CREDIT, INT

Asset price channel: GDPPC, INFD, MCG, INT

Exchange rate channel: GDPPC, INFD, ER, INT

Interest rate channel: GDPPC, INFD, CREDIT, INT

GDPPC=GDP per-capita (Annual per centage)

INFD= GDP deflator (inflation rate, annual per centage)

CREDIT= Domestic Credit to the private sector (% of GDP)

MCG= Market Capitalization Growth Rate (Annual per centage)

INT= Bank lending rate (Annual per centage)

ER= Dollar-rupee exchange rate

5 Data and Methodology

To analyze monetary transmission mechanism channels, we have used time-series data from 1975-2015 collected from World Development Indicators, 2020 and Pakistan Economic Survey (various issues). To examine the impact of monetary transmission on the macroeconomy of Pakistan, we have applied the vector autoregressive (VAR) model with Cholesky decomposition.

5.1 Vector Autoregressive (VAR) Model

It is the approach in which the dependent variable is a function of lagged independent variables. So, the term autoregressive indicates the appearance of the lagged value of the variables. We assume that each equation may include k lag values of X and Y. We can estimate the following equation by applying the OLS estimation.

$$X_{1t} = \alpha + \sum_{j=1}^{k} \beta_j X_{t-j} + \sum_{j=1}^{k} \delta_j Y_{t-j} + \mu_{1t} \quad (1)$$

$$Y_{1t} = \alpha^{/} + \sum_{j=1}^{k} \theta_j X_{t-j} + \sum_{j=1}^{k} \delta_j Y_{t-j} + \mu_{2t} \quad (2)$$

In the above equations, µ1t and µ2t should be stochastic error terms, we can call them to impulse or innovations or shocks in the sense of VAR. In general, before estimating the above equations, we must have to find the maximum lag length k. There are many criteria to find the maximum lag length such as the Akaike or Schwarz information criterion, Final prediction error and Hannan-Quinn information criterion.

There are many advantages of the VAR which are given below.

1. First, this method is very simple because all the variables in VAR must be endogenous and not worry about determining which variable is exogenous and which is endogenous.
2. Second, in the VAR, estimation is very simple. A simple OLS method can be applied to every equation individually.
3. Third, in the VAR system, the forecast we get in this method is much superior in many cases rather than that we obtained from more complex simultaneous equation models.

Like the advantages, some critics point out the problems of VAR which are given below.

1. VAR model can be theoretic since it employs less previous information.
2. VAR model can be less appropriate for policy analysis because it largely focuses on forecasting.
3. The basic problem of the VAR model is to select the proper lag length.
4. VAR model, all the variables must be stationary. If that would not be the case, so we first transform the data properly by taking the first differencing.
5. In the estimated VAR model, it is difficult to interpret the individual coefficients, so the researcher must estimate the impulse response function (IRF).

5.2 Impulse Response Function

- It is a shock to a VAR system.
- It identifies the responsiveness of the dependent variable in the VAR when a shock is put to the error term such as U1 and U2 at the equations given below.

$$Y = \beta_1 + \beta_2 X_{t-i} + \beta_3 Y_{t-i} + U_1 \quad (3)$$
$$X = \beta_4 + \beta_5 Y_{t-i} + \beta_6 X_{t-i} + U_2 \quad (4)$$

- A unit shock is applied to each variable and examines its effects on the VAR system.

But for calculating it, the ordering of the variables is important. Many methods are given for ordering such as residual one unit, residual one standard deviation, Cholesky def adjustment and generalized impulse. We have chosen the Cholesky def adjustment method.

6 Result and Discussions

The results of VAR are not directly interpretable, so for this solution, the analysis split the interpretation into lag order selection, impulse response function and variance decomposition.

6.1 Basic Model

The purpose of the basic model is to check the lag structure. In the basic model, we have estimated the overall influence of monetary policy on prices and output.

Table:1

VAR Lag Order Selection Endogenous variables: GDPPC INFD INT

Lag	Log L	LR	FPE	AIC	SC	HQ
0	-270.72	NA	176.38	13.68	13.81	13.73
1	-239.56	56.09*	58.35*	12.57*	13.08*	12.76*
2	-231.60	13.13	62.02	12.63	13.51	12.95
3	-226.39	7.81	76.61	12.81	14.08	13.27
4	-220.55	7.88	93.45	12.97	14.62	13.57

Table 1 shows that the optimal lag length of the model is 1 because of the lower values of FPE, AIC SC HQ and higher value of LR.

Figure 1 indicates that INT is affecting GDPPC into the future. It affects GDPPC negatively throughout the given period if we give the positive shock to INT. If we give one Standard Deviation (SD) shock to INT, GDPPC is negatively influenced and it declines negatively at year 2 and after that, it is getting close to the baseline. Overall, the response of GDPPC to INT is negative. Figure 1 also indicates that if we give one SD positive shock to INT, INFD becomes stable through the given period, and it becomes parallel to the baseline. Moreover, if we give one positive SD shock to INT, INT is positively affected and declines at year 6 and after that, it becomes close to baseline. So, the overall response of INT to INT is positive.

Figure: 1

Impulse Response: Basic Model

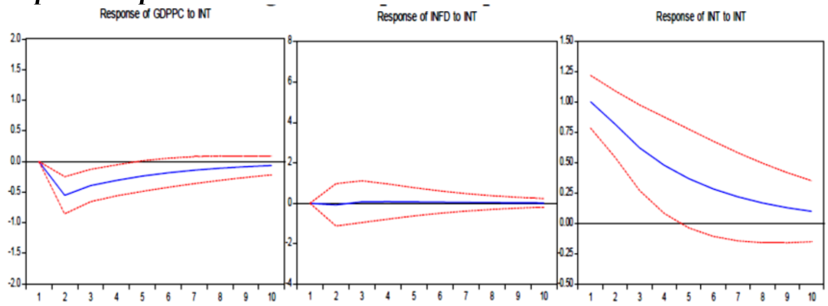


Table 2 indicates the variance decomposition of GDPPC, INFD and INT. The first part of the table exhibits the variance decomposition of GDPPC. In the short run, for year 2 shock to GDPPC accounts for 78.56 % variation of the fluctuation in GDPPC (own shock). Shock to INFD causes a 10.94 per cent fluctuation in GDPPC and shock to INT causes a 10.5 per cent fluctuation in GDPPC (cross shocks) but as a whole total fluctuation becomes 100%. In the long run, after year 2, variation of the fluctuation in GDPPC (own shock) declines for the given period but the fluctuation in GDPPC increases due to INFD and INT (cross shocks) after year 2 in the long run.

Table: 2

Variance Decomposition-Basic VAR Model

Period	S.E.	GDPPC	INFD	INT
Variance Decomposition of GDPPC				
1	1.50	100.00	0.00	0.00
2	1.70	78.56	10.94	10.48
3	1.77	72.18	13.29	14.51
4	1.81	68.89	14.37	16.72
5	1.84	67.10	14.93	17.96
6	1.85	66.08	15.24	18.66
7	1.86	65.49	15.42	19.07
8	1.86	65.14	15.53	19.31
9	1.87	64.94	15.59	19.45
10	1.87	64.82	15.63	19.54
Variance Decomposition of INFD				
Period	**S.E.**	**GDPPC**	**INFD**	**INT**
1	5.69	1.81	98.18	0.00
2	5.87	2.80	97.18	0.01
3	5.89	2.83	97.13	0.03
4	5.89	2.83	97.11	0.05
5	5.89	2.83	97.09	0.06
6	5.89	2.83	97.08	0.07
7	5.89	2.83	97.08	0.08
8	5.89	2.83	97.07	0.08
9	5.90	2.83	97.07	0.09
10	5.90	2.83	97.07	0.09
Variance Decomposition of INT				
Period	**S.E.**	**GDPPC**	**INFD**	**INT**
1	1.13	0.26	21.55	78.17
2	1.51	0.27	26.15	73.57
3	1.69	0.23	27.77	71.98
4	1.79	0.21	28.55	71.23
5	1.85	0.20	28.95	70.83
6	1.89	0.19	29.17	70.62
7	1.91	0.19	29.30	70.50
8	1.92	0.19	29.37	70.43
9	1.92	0.19	29.41	70.38
10	1.93	0.19	29.44	70.36

The middle part of Table 2 shows the variance decomposition of INFD. In the short run, for year 1 shock to INFD accounts for 98.18% variation of fluctuation in INFD (own shock) but the shock to GDPPC caused 1.81 per cent fluctuation in INFD, as well as shock to INT, has not caused fluctuation in INFD (cross shocks). So, the overall fluctuation is 100%. Therefore, in the long run, after year 1, fluctuation in INFD (own shock) declines but the fluctuation in INFD increases due to shock in GDPPC and INT (cross shocks) for the whole period.

The last part of Table 2 indicates the variance decomposition of INT. In the short run, the study shows that for year 1 shock to INT accounts for 78.17% variation of fluctuation in INT (own shock) as well as shock to GDPPC causes 0.27 per cent fluctuation in INT and shock to INFD has caused 21.55 per cent fluctuation in INT (cross shocks). So, we conclude that the overall fluctuation is 100% in year 1. Consequently, in the long run, after year 1 fluctuation in INT (own shock) declines however the fluctuation in INT increases due to shock in GDPPC and INFD (cross shocks) for the entire period.

6.2 Bank Lending Channel (Credit Channel)

In this section, we discuss the bank lending channel to probe the role of bank credit. How does bank credit affect the supply of loanable funds, consumption, output, investment decision and prices? If we undertake a monetary policy shock to the bank lending channel, it would result in a decrease in bank reserves, and a drop in the loanable funds supply and affect consumption, investment and aggregate demand as well. So, we have analyzed the bank lending channel to examine how much it would affect the consumption, investment, output, interest rate and prices.

Table:3

VAR Lag Order Selection Endogenous Variables: GDPPC INFD CREDIT INT

Lag	Log L	LR	FPE	AIC	SC	HQ
0	-374.07	NA	1905.22	18.90	19.07	18.96
1	-312.22	108.17*	193.79*	16.61*	17.45*	16.91*
2	-299.08	20.42	229.08	16.75	18.27	17.30
3	-281.80	23.32	229.65	16.69	18.88	17.48
4	-273.04	10.07	376.49	17.05	19.92	18.09

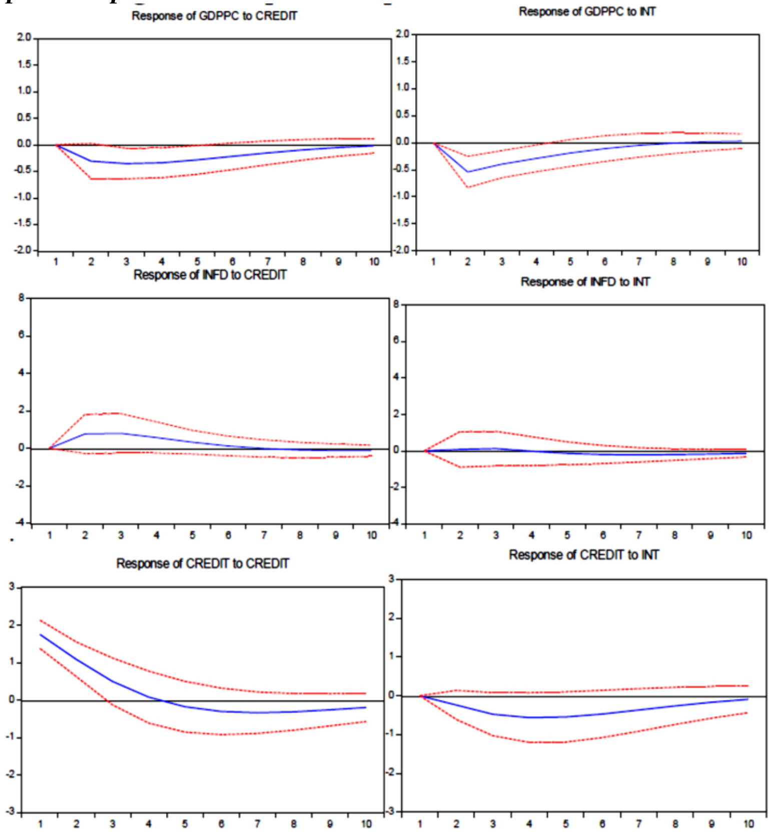
The value of SC, AIC, and HQ is lower at lag 1, so therefore we consider lag 1for estimation. Although for LR, we have decided on the uppermost value to choose the lag length. Thus in general the lag length should be 1 for the model.

Figure 2 displays the impulse response for the credit channel. CREDIT is affecting GDPPC in the future. We notice that it affects GDPPC negatively during the given period if we provide the positive shock to CREDIT. One Standard Deviation

(SD) shock to CREDIT influences GDPPC negatively and it declines negatively at the end of year 2 furthermore after that it is becoming stable. Therefore, it is getting closer to baseline at the end of the given period. Although in general the response of GDPPC to CREDIT is negative.

Figure :2

Impulse Response: Credit Channel



If we give one positive SD shock to INT, it initially affects the GDPPC negatively and at year 8 it touches the baseline. Therefore, after year 8, it is becoming positive. One positive SD shock to CREDIT initially affects INFD positively. In year 7, it closes the baseline. Consequently, after year 7, if one positive shock is given, it negatively affects the INFD. Figure 2 highlights that if we provide one positive SD shock to INT, in the beginning, it affects INFD positively as well as in years 3 to 4 it closes to baseline. Therefore, after year 4. the effect on INFD is negative. CREDIT is also affecting CREDIT in future. Initially, if we provide one positive SD shock to CREDIT, the effect on CREDIT is positive but after year 4 the effect on CREDIT is negative. Moreover, INT is affecting CREDIT in the future. We observe that the effect of INT on CREDIT is negative for the whole period.

Table 4 exhibits the variance decomposition of GDPPC, INFD, CREDIT and INT. The first part of Table 4 shows that in the short run, for year 1 shock to GDPPC account for 100 % variation of the fluctuation in GDPPC (own shock) but Shocks to INFD, CREDIT and INT (cross shocks) have not caused fluctuation in GDPPC within year 1. As a whole, total fluctuation becomes 100% during year 1. In the long run, we specify that after year 1 variation of the fluctuation in GDPPC (own shock) declines for the given period. However, the fluctuation in GDPPC increases due to INFD, CREDIT and INT (cross shocks) after year 1 for consider period.

Table: 4

Variance decomposition of Credit channel, Variance Decomposition of GDPPC

Period	**S.E.**	**GDPPC**	**INFD**	**CREDIT**	**INT**
Variance Decomposition of GDPPC					
1	1.50	100.00	0.00	0.00	0.00
2	1.70	78.30	8.44	3.21	10.04
3	1.79	70.60	8.75	6.74	13.89
4	1.85	66.51	8.31	9.65	15.52
5	1.88	64.32	8.08	11.59	16.00
6	1.90	63.16	8.13	12.67	16.02
7	1.91	62.57	8.32	13.16	15.93
8	1.91	62.27	8.53	13.34	15.85
9	1.91	62.11	8.68	13.37	15.82
10	1.92	62.03	8.77	13.36	15.82
Variance Decomposition of INFD					
Period	**S.E.**	**GDPPC**	**INFD**	**CREDIT**	**INT**
1	5.57	0.95	99.04	0.00	0.00
2	5.77	2.03	96.16	1.77	0.02
3	5.83	2.00	94.29	3.62	0.07
4	5.88	1.98	93.41	4.53	0.06
5	5.91	1.97	93.11	4.79	0.11
6	5.92	1.96	92.99	4.81	0.22
7	5.93	1.96	92.88	4.79	0.35
8	5.94	1.95	92.77	4.80	0.46
9	5.95	1.95	92.66	4.83	0.54
10	5.95	1.95	92.58	4.87	0.58
Variance Decomposition of CREDIT					
Period	**S.E.**	**GDPPC**	**INFD**	**CREDIT**	**INT**
1	2.11	0.97	30.51	68.50	0.00
2	2.71	1.10	40.47	57.64	0.77

3	3.03	1.06	46.80	49.02	3.10
4	3.20	0.99	49.20	43.92	5.87
5	3.30	0.93	49.28	41.52	8.25
6	3.37	0.90	48.43	40.76	9.89
7	3.41	0.89	47.49	40.77	10.83
8	3.43	0.89	46.82	41.01	11.25
9	3.45	0.90	46.45	41.24	11.40
10	3.46	0.90	46.29	41.37	11.42
Variance Decomposition of INT					
Period	**S.E.**	**GDPPC**	**INFD**	**CREDIT**	**INT**
1	1.09	0.00	17.87	8.21	73.91
2	1.50	0.37	19.05	13.40	67.15
3	1.72	0.44	16.82	18.80	63.92
4	1.85	0.52	14.82	23.20	61.44
5	1.92	0.59	13.78	26.19	59.42
6	1.96	0.64	13.54	27.89	57.90
7	1.98	0.68	13.72	28.68	56.90
8	1.99	0.69	14.03	28.95	56.31
9	2.00	0.70	14.29	28.97	56.02
10	2.00	0.70	14.46	28.92	55.90

The next part of Table 4 illustrates the variance decomposition of INFD. The results point out that in the short run, for year 1 shock to INFD accounts for 99.04% variation of fluctuation in INFD (own shock). However, the shock to GDPPC causes a 0.95 per cent fluctuation in INFD as well as shock to INT and CREDIT has not caused fluctuation in INFD (cross shocks). As a result, the overall fluctuation is 100% in year 1. Thus in the long run, after year 1 fluctuation in INFD (own shock) decreases, although the fluctuation in INFD increases due to shock in GDPPC, CREDIT and INT (cross shocks) for the entire period.

The next part of Table 4 explains the variance decomposition of CREDIT. Consequently, we examine that in the short run, for year 1 shock to CREDIT accounts for a 68.50% discrepancy of fluctuation in CREDIT. However shock to GDPPC causes 0.97 per cent fluctuation in CREDIT, the shock to INFD causes 30.51 per cent fluctuation in CREDIT but INT has not caused fluctuation in CREDIT.

Consequently, the overall fluctuation in year 1 is 100%. In the long run, fluctuation in CREDIT (own shock) declines but fluctuation in CREDIT increases due to shock in GDPPC, INFD and INT (cross shocks) after year 1. Finally, in the last part of Table 4, we have shown the variance decomposition of INT. In the short run, the study explains that shock to INT accounts for

73.91% variation of fluctuation in INT (own shock) as well as shock to GDPPC causes 1.72 per cent, the shock to INFD has caused 17.87 and shock to CREDIT causes 8.21 per cent fluctuations in INT (cross shocks) during year 1. So therefore the overall fluctuation must be 100% in year 1. Accordingly, in the long run, fluctuation in INT (own shock) declines but the fluctuation in INT increases due to shock in GDPPC, CREDIT and INFD (cross shocks) after year 1.

6.3 Exchange Rate Channel

In this section, we have discussed the exchange rate channel to observe how much the exchange rate responds due to monetary shocks. The strength of the exchange rate channel mostly depends on the responsiveness of the exchange rate to monetary shocks as well as the degree of openness of the economy and consequently the sensitivity of net exports to exchange rate variations.

Table 5 illustrates the lag order selection of the VAR model. The optimal lag length of the model is 3 because of the lower value of FPE, AIC; SC, HQ and generally the bigger value of LR identify the lag length of 3.

Table: 5

VAR Lag Order Selection. Endogenous Variables: GDPPC INFD ER INT

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-460.83	NA	145853.2	23.24	23.41	23.30
1	-346.21	200.58	1058.55	18.31	19.15*	18.61*
2	-333.53	19.66	1282.39	18.47	19.99	19.02
3	-312.34	28.60*	1057.44*	18.21*	20.41	19.01
4	-296.49	18.22	1216.39	18.22	21.09	19.26

Figure 3 displays the impulse response for the exchange rate channel. If we provide one SD shock to INT, then GDPPC is negatively affected at the beginning until year 7. Consequently, after year 7, it is positive until period 9. Therefore, after year 9, it becomes negative while in general, the response of GDPPC to CREDIT is negative and positive during the given period. If we provide one positive shock to ER, GDPPC affects negatively in the beginning at the end of year 3. So, after year 3, it is positive until year 6 and after year 6 it is negatively affecting GDPPC at year 8. Resultantly, after year 8, it becomes positive.

Figure: 3
Impulse Response: Exchange Rate Channel

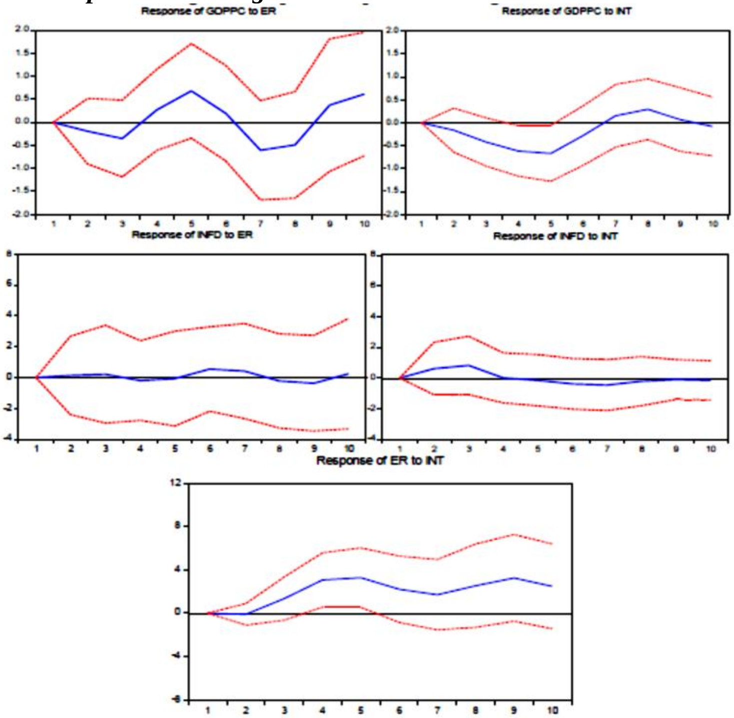


Figure 3 demonstrates that INT would affect the INFD in the future. So, if we give one positive SD shock to INT, initially it affects the INFD positively at the end of year 4 and touches the baseline. However, after year 4, it affects the INFD negatively.

ER is also influencing the INFD in the future. If we give one SD positive shock to ER, it affects INFD positively in the beginning until year 3. After year 3, it becomes negative for year 5. Although after year 5, it again affects INFD positively between years 7 and 8. However, after that, it affects negatively and, in the end, it influences positively. Figure 3 shows that INT is affecting ER in the future time period. We may observe that if we give one SD positive shock to INT, initially it is stable and on the baseline until year 2. However, after year 2, INT influences the ER positively during the period.

Table 6 demonstrates the variance decomposition of GDPPC, INFD, ER and INT. The first part of Table 6 indicates that in the short run, the shock to GDPPC accounts for a 100 % variation of the fluctuation in GDPPC (own shock). Although shocks to INFD, ER and INT (cross shocks) have not caused any fluctuation in GDPPC in year 1. However, the entire fluctuation becomes 100% through year 1. In the long run, we observe that variation of the fluctuation in GDPPC (own shock) declines after year 1 but the fluctuation in GDPPC rises due to shock in INFD, ER and INT (cross shocks) after year 1.

Table: 6

Variance Decomposition of Exchange rate channel. Variance Decomposition of GDPPC

Period	S.E.	GDPPC	INFD	ER	INT
Variance Decomposition of GDPPC					
1	1.57	100.00	0.00	0.00	0.00
2	1.66	90.78	6.90	1.35	0.95
3	1.95	67.08	23.44	4.17	5.28
4	2.08	59.55	21.60	5.39	13.43
5	2.29	48.99	18.20	13.29	19.50
6	2.33	48.18	17.79	13.62	20.39
7	2.41	45.04	16.62	18.96	19.36
8	2.48	42.62	15.91	21.78	19.67
9	2.51	41.58	15.74	23.42	19.24
10	2.60	39.48	14.78	27.57	18.15
Variance Decomposition of INFD					
Period	**S.E.**	**GDPPC**	**INFD**	**ER**	**INT**
1	5.63	2.02	97.97	0.00	0.00
2	5.82	5.12	93.70	0.05	1.10
3	5.90	5.19	91.61	0.18	3.00
4	6.02	8.53	88.29	0.28	2.88
5	6.03	8.73	88.02	0.29	2.93
6	6.08	8.68	86.91	1.11	3.28
7	6.12	8.66	85.96	1.56	3.80
8	6.13	8.64	85.76	1.68	3.90
9	6.14	8.60	85.43	2.03	3.91
10	6.15	8.59	85.23	2.19	3.96
Variance Decomposition of ER					
Period	**S.E.**	**GDPPC**	**INFD**	**ER**	**INT**
1	3.29	10.56	0.40	89.02	0.00
2	5.95	16.52	1.55	81.87	0.03
3	6.94	25.35	3.66	67.19	3.78
4	7.98	22.50	8.01	51.91	17.55
5	8.90	19.35	11.01	41.97	27.66
6	10.13	17.08	10.53	46.26	26.11
7	11.34	17.81	9.51	49.60	23.06
8	11.90	19.08	9.90	45.54	25.47
9	12.50	17.97	10.56	41.60	29.85
10	13.01	17.06	10.85	40.91	31.15
Variance Decomposition of INT					
Period	**S.E.**	**GDPPC**	**INFD**	**ER**	**INT**

1	1.04	8.17	34.70	0.66	56.45
2	1.66	4.68	34.98	2.58	57.73
3	2.12	3.38	25.47	6.98	64.15
4	2.34	3.13	23.37	7.21	66.26
5	2.38	3.09	22.83	7.40	66.66
6	2.39	3.22	22.64	8.28	65.84
7	2.40	3.27	22.79	8.33	65.59
8	2.42	3.55	22.83	9.00	64.60
9	2.45	3.70	22.79	9.04	64.45
10	2.52	3.54	21.87	11.65	62.92

The next part of Table 6 explains the variance decomposition of INFD. Generally, we have observed that in the short run, the shock to INFD accounts for a 97.97% variation of fluctuation in INFD (own shock). Although the shock to GDPPC causes 2.02 per cent however shock to INT and ER has not caused any fluctuation in INFD (cross shocks) in year 1. So in general, the total fluctuation is 100% during year 1. As a consequence, in the long run, fluctuation in INFD (own shock) falls but the fluctuation in INFD rises because of shock in GDPPC, ER and INT (cross shocks) after year 1. The findings show that in the short run, a shock to ER is 89.02% variation of fluctuation in ER (own shock), the shock to GDPPC causes 10.56 per cent and shock to INFD will cause 0.40 per cent but INT has not caused any fluctuations in ER (cross shock) in year 1. So we conclude that the entire fluctuation in year 1 is 100%.

In the long run, fluctuation in ER (own shock) declines however the fluctuations increases in ER as a shock in GDPPC, INFD and INT (cross shocks) after year 1. The last part of Table 6 exhibits the variance decomposition of INT. In the short run, we have examined that shock to INT accounts for 56.45% variation of fluctuation in INT (own shock) and shock to GDPPC causes 8.17 per cent, a shock to INFD has caused 34.70, as well as shock to ER, can cause 0.66 per cent fluctuations in INT (cross shocks) throughout year 1 so the entire fluctuation could be 100% during year 1. Consequently, in the long run, fluctuation in INT (own shock) declines however the fluctuation in INT rises because of shocks in GDPPC, ER and INFD (cross shocks) later than year 1.

6.4 Asset Price Channel

This section explains the asset price channel to examine how much asset price reacts or fluctuates due to monetary shocks. Table 7 explains the lag order choice of the VAR model. The optimal lag length of the model is 1.

Table: 7

VAR Lag Order Selection. Endogenous Variables: GDPPC INFD MCG INT

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-465.70	NA	339684.6	24.08	24.25	24.14
1	-434.76	53.94*	158790.5*	23.32*	24.17*	23.62*
2	-422.97	18.12	202752.7	23.53	25.07	24.08
3	-414.12	11.80	314322.7	23.90	26.12	24.69
4	-400.51	15.35	410324.8	24.02	26.92	25.06

Figure 4 displays the impulse response for the asset price channel. If we give one positive shock to INT, GDPPC affects negatively in the beginning at the end of year 8. However, after year 8, it becomes stable and touches the baseline. If we give one positive SD shock to MCG, initially it affects GDPPC negatively until year 3. After year 3, it behaves positively in year 5. However, after year 5, it influences the GDPPC negatively and closes to baseline. Similarly, if we provide one SD positive shock to INT, it influences INFD positively from the beginning until year 4. Although after year 4, it becomes stable as well as on the baseline for consider period.

Figure: 4

Impulse Response: Asset Price Channel

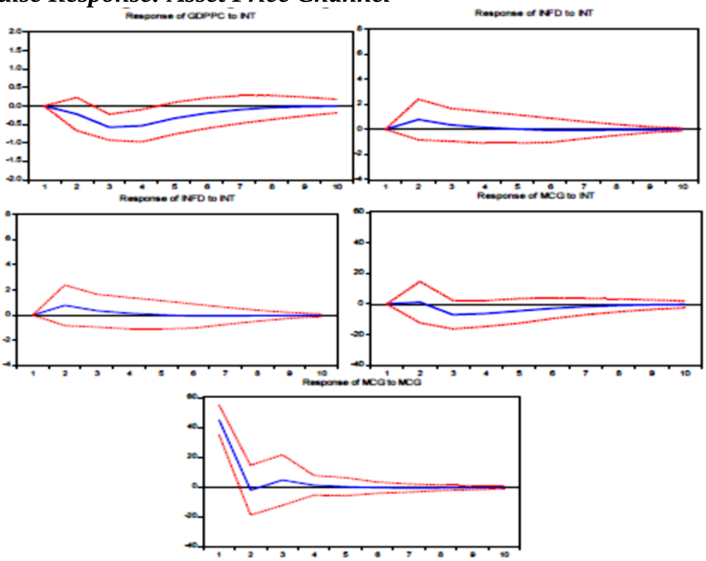


Figure 4 demonstrates that MCG can influence the INFD in future. So, if we give one positive SD shock to MCG, initially it behaves negatively with INFD at the end of year 4. Consequently, after year 4, it is becoming stable and on the baseline for the given period. If we give one positive SD shock to

INT, it influences the MCG positively and can be on the baseline for year 2. However, it is negative and comes close to baseline after year 2.

MCG can influence the MCG in future. If we give one SD positive shock to MCG, initially it affects MCG positively at the end of year 4. Consequently, it becomes stable and lies on the baseline for a particular period.

Table 8 reveals the variance decomposition of GDPPC, INFD, MCG and INT. The first part of Table 8 points out the variance decomposition of GDPPC. In the short run, the shock to GDPPC accounts for 100 % variation of the fluctuation in GDPPC (own shock) while shocks to INFD, MCG and INT (cross shocks) have not caused any fluctuation in GDPPC during year 1. Consequently, the whole fluctuation must be 100% within year 1. In the long run, the fluctuation in GDPPC (own shock) declines, however, the fluctuation in GDPPC rises as a shock in INFD, MCG and INT (cross shocks) after year 1.

The subsequent part of Table 8 explains the variance decomposition of INFD. In the short run, the shock to INFD accounts for a 98.69% variation of fluctuation in INFD (own shock). Even though the shock to GDPPC causes 1.30 per cent but the shock to INT and MCG has not caused any fluctuations in INFD (cross shocks) during year 1. The overall fluctuation in year 1 is 100%. So, fluctuation in INFD (own shock) falls however the fluctuation in INFD rises because of shock in GDPPC, MCG and INT (cross shocks) after year 1 in the long run.

The next part of Table 8 indicates the variance decomposition of MCG. In the short run, a shock to MCG is a 95.25% variation of fluctuation in MCG (own shock), a shock to GDPPC causes 4.73 per cent, a shock to INFD causes 0.01 per cent but INT has not caused any fluctuations in MCG (cross shocks) in year1. The fluctuations in MCG (own shock) decrease while fluctuations in MCG rise as a result of shock in GDPPC, INFD and INT (cross shocks) after 1 year in the long run.

Table: 8

Variance Decomposition of Asset price channel

Period	S.E.	GDPPC	INFD	MCG	INT
Variance Decomposition of GDPPC					
1	1.52	100.00	0.00	0.00	0.00
2	1.61	90.11	7.37	0.64	1.86
3	1.91	64.71	24.33	0.46	10.48

4	2.01	59.03	23.97	0.49	16.49
5	2.04	57.33	23.48	0.49	18.68
6	2.05	56.78	23.24	0.54	19.41
7	2.06	56.59	23.20	0.59	19.59
8	2.06	56.53	23.20	0.63	19.62
9	2.06	56.51	23.20	0.66	19.62
10	2.06	56.50	23.20	0.67	19.61
Variance Decomposition of INFD					
Period	**S.E.**	**GDPPC**	**INFD**	**MCG**	**INT**
1	5.47	1.30	98.69	0.00	0.00
2	5.72	4.18	93.79	0.17	1.84
3	5.83	4.36	91.15	2.33	2.13
4	5.83	4.36	91.09	2.34	2.19
5	5.84	4.35	91.05	2.38	2.19
6	5.84	4.36	91.03	2.38	2.21
7	5.84	4.36	91.02	2.38	2.22
8	5.84	4.36	91.01	2.38	2.22
9	5.84	4.36	91.01	2.38	2.23
10	5.84	4.36	91.01	2.38	2.23
Variance Decomposition of MCG					
Period	**S.E.**	**GDPPC**	**INFD**	**MCG**	**INT**
1	46.16	4.73	0.01	95.25	0.00
2	46.70	5.63	1.03	93.25	0.07
3	47.80	5.40	2.38	89.98	2.22
4	48.37	5.38	2.90	87.89	3.81
5	48.59	5.35	2.89	87.11	4.63
6	48.68	5.34	2.88	86.82	4.94
7	48.71	5.34	2.88	86.71	5.05
8	48.73	5.34	2.88	86.68	5.08
9	48.73	5.34	2.88	86.67	5.09
10	48.73	5.34	2.88	86.67	5.09
Variance Decomposition of INT					
Period	**S.E.**	**GDPPC**	**INFD**	**MCG**	**INT**
1	1.09	5.55	29.80	0.46	64.17
2	1.70	3.72	33.28	0.18	62.80
3	1.99	3.94	29.36	0.18	66.50
4	2.10	3.90	27.02	0.24	68.82
5	2.14	3.89	26.06	0.46	69.57
6	2.16	3.89	25.76	0.67	69.66
7	2.16	3.89	25.69	0.81	69.59
8	2.16	3.89	25.67	0.89	69.54
9	2.16	3.89	25.66	0.91	69.51
10	2.16	3.89	25.66	0.92	69.51

In the last part of Table 8, we have investigated the variance decomposition of INT. In the short run, the shock to INT is a 64.17% variation of fluctuation in INT (own shock), the shock to GDPPC causes 5.55 per cent, the shock to INFD has caused

29.80, as well as shock to MCG, causes 0.66 per cent fluctuations in INT (cross shocks) in year 1. Therefore, overall fluctuation in year 1 is 100%. As a result, fluctuation in INT (own shock) falls but the fluctuation in INT rises because of shocks in GDPPC, MCG and INFD (cross shocks) later than year 1 in the long run.

6.5 Direct Interest Rate Channel

Now, we discuss the traditional interest rate channel to analyze how interest rate behaves due to monetary shocks. Table 9 displays the lag order choice of the VAR model. The optimal lag length of the model is 4.

Table: 9

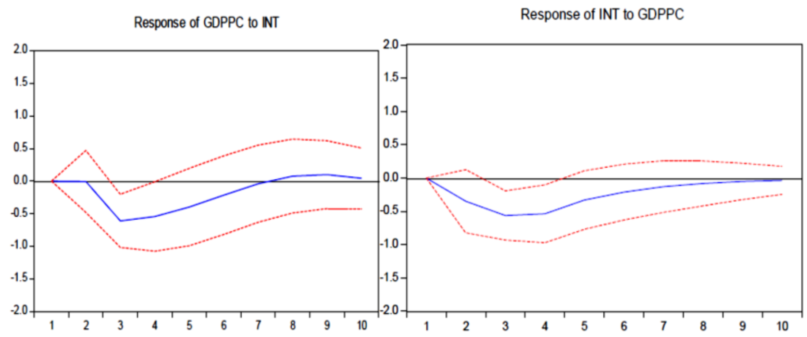
VAR Lag Order Selection. Endogenous Variables: GDPPC INFD INT CREDIT

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-748.35	NA	2.55e+09	38.68	38.94098	38.77
1	-596.00	250.01	6679096.	32.71	34.50*	33.36
2	-568.54	36.60	11850813	33.15	36.41	34.35
3	-511.65	58.34*	5955612.	32.08	36.92	33.82
4	-448.54	45.35	3591451.*	30.69*	37.09	32.94*

Figure 5 displays the impulse response for the traditional interest rate channel.

Figure: 5

Impulse Response: Direct Interest Rate Channel



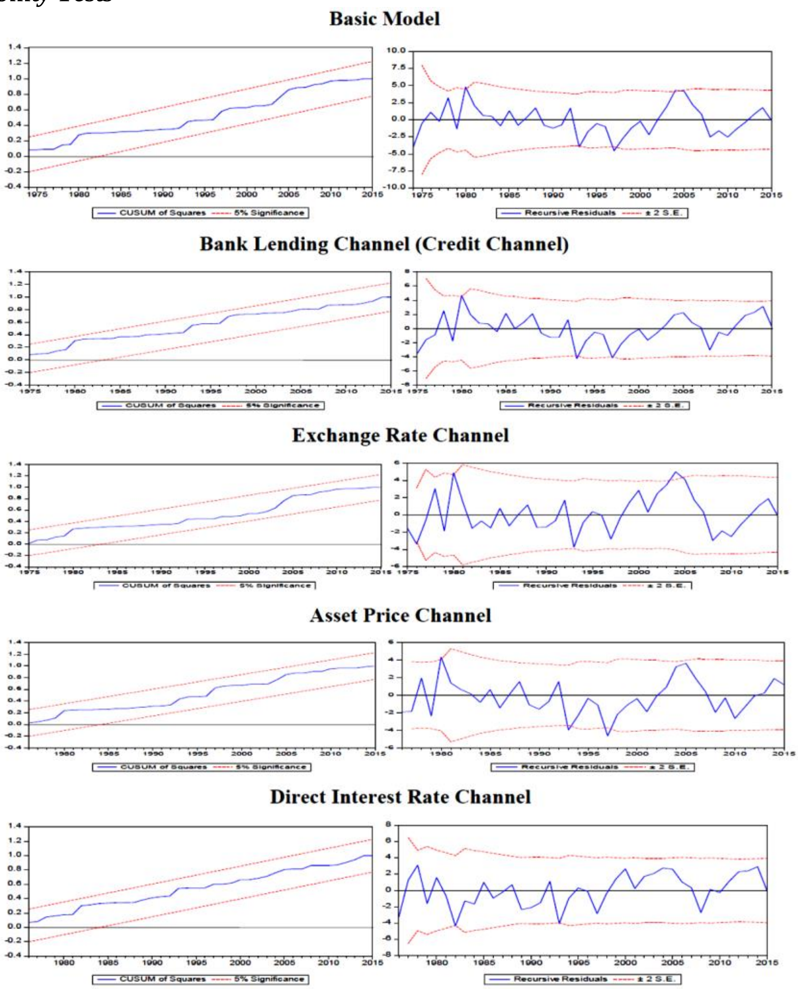
The study has observed that if we give one positive SD shock to INT, initially it affects the GDPPC stably and even on the baseline at the end of year 2. However, after year 2, it affects GDPPC negatively until year 7 and afterwards, it behaves with GDPPC positively.

Figure 5 also explains that INT affects the GDPPC in future. So, if we provide one SD positive shock to INT, it influences the GDPPC negatively throughout the given period.

6.6 Stability Tests

We have used the cumulative sum of squares (CUSUM) tests of stability in parameters. Table 6 displays stability tests of all models.

Figure: 6
Stability Tests



7 Conclusions

The study has been conducted to examine the monetary transmission mechanisms in Pakistan. We have applied the VAR approach to investigate the short run as well as the long-run relationship. The findings exhibit that all the channels affect the overall economy or performance of the country. Specifically, results show that due to monetary policy tightness, investment falls, the overall price level decreases and significant lags and output falls. The financial system of Pakistan is not well developed that's why the effects of monetary policy acquire comparatively shorter time to entirely disperse throughout the economy. The findings also point out the reality that the association of monetary policy with the real sector is direct through the bank lending channel. We have also observed that the asset price channel is active although the exchange rate channel is less significant as banks play a particularly significant role in lending to the private sector.

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