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INVESTIGATING THE EFFECTIVENESS OF CHANNELS OF MONETARY TRANSMISSION MECHANISM IN PAKISTAN: AN APPLICATION OF VAR MODEL, IMPULSE RESPONSE FUNCTION AND VARIANCE DECOMPOSITION

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ABSTRACT

The study analyzes the various channels of the monetary transmission mechanism in Pakistan. The purpose of the study is to find out the effective channel of the monetary transmission mechanism in Pakistan by using the VAR model, impulse response function and variance decomposition. The study has used annual data from 1972 to 2019. The findings of the study exhibit that the lending channel and exchange rate channel are effective whereas the asset price channel is ineffective in Pakistan. The exchange rate has a strong impact on the determination of output through the exchange rate channel in Pakistan. So, to attain the optimal level of the output, controlling the volatility of the exchange rate may be focused. In the bank lending channel, the lending rate plays a vital role in determining the output level in Pakistan. That's why banks play an important role in the economy of Pakistan and the banking system may be promoted effectively.

Keywords: Monetary policy, VAR model, impulse response function, variance decomposition
JEL Codes: O23, C20

I. INTRODUCTION

The monetary policy transmission mechanisms exhibit the several channels in which money balances and interest rate affects the macroeconomic variables like output, employment and prices (Akani, 2017). The monetary transmission mechanism is the process in which monetary policy instruments are transmitted to the output and prices. Furthermore, generally, the monetary transmission mechanism has two categories, the first category is the financial transmission mechanism which involves the prices and returns on assets, for example, exchange rate, interest rate and assets prices. The second category is the credit transmission mechanism which shows the changes in the banks' lending and financial intermediaries (Taylor, 1995). So, the monetary policy transmission mechanism explicates how the monetary variables such as money supply and interest rate affect the real variables like output and employment (Ireland, 2005). Monetary policy may affect the variables through different channels that differ from country to country according to the different characteristics of the banks, economic conditions and capital markets like scope, attention and power (Baig, 2011). The purpose of the monetary transmission mechanism is identified firstly, that how and to what extent monetary policy affects the economy of any country, considering the time lag in which monetary policy is completely implemented. Secondly, what policy instruments a policymaker can use for the effective monetary policy to stabilize the economy. So, to impose correct monetary policy, it is necessary to know about the complete mechanism in which real variables are affected by the monetary variables (Boivin et al., 2010). For public welfare, the government have lots of policies like monetary policy and fiscal policy. Monetary policy enhances welfare by stabilization of output and prices (Ali and Naeem, 2017; Ali, 2011; Ali, 2015; Ali, 2018; Ali and Bibi, 2017; Ali and Ahmad, 2014; Ali and Audi, 2016; Ali and Audi, 2018; Ali and Rehman, 2015; Ali and Senturk, 2019; Ali and Zulfiqar, 2018; Ali et al., 2016; Ali et al., 2021; Ali et al., 2021; Ali et al., 2015; Arshad and Ali, 2016; Ashraf and Ali, 2018; Audi et al., 2022; Blanchard and Gali, 2010; Ippolito et al., 2018).

Moreover, still, economists are unable to conclude what measure is good and reliable among all measures from a single variable to a composite index of variables. Very few pieces of literature have been found on these measures in Pakistan, using the monetary condition index (which is a weighted average of the deviation of interest rate from the base period level) (like Qayyum, 2002; Hayder and Khan, 2006; Khan and Qayyum, 2007; Audi and Ali, 2017; Audi and Ali, 2017;

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Audi et al., 2021; Audi and Ali, 2016; Audi et al., 2021; Audi et al., 2021; Audi et al., 2021; Haider and Ali, 2015; Kaseem et al., 2019; Roussel et al., 2021; Senturk and Ali, 2021; Mehmood et al., 2022). To achieve the economic goals, monetary policy is used by the central bank. Monetary policy use tools to maintain the monetary variables like money supply, interest rate, exchange rate and bank credit, to achieve economic goals such as full employment, sustain economic growth and inflation targeting and exchange rate targeting. The central bank set the intermediate goals that are transmitted the monetary variable into ultimate economic goals. The paper proceeds as Section 2 shows the review of studies based on the monetary transmission mechanism. model specification, data and methodology are given in section 3. Results and discussions are presented in section 4 while section 5 offers the concluding remarks.

II. REVIEW OF LITERATURE

A literature review of previous studies of all channels of monetary transmission mechanism has been described in this section. Hanisch and Kempa (2017) investigated the international transmission channels of US supply and demand shocks by using the non-stationary dynamic factor model in G7 countries and concluded that Italy and Japan had negative transmission effects whereas the response of exchange rate was less prominent in Italy, France and Germanys as compared to other G7 economies. Uuskula (2016) endeavoured to find the relationship between monetary transmission mechanism and firm turnover and found that expansionary monetary policy shocks increase the number of firms after expansion. Razmi et al. (2016) explained the monetary transmission, in which oil price shocks had transmitted into the prices of four ASEAN countries and inferred that in pre-crisis except in Indonesia in other countries oil prices had a direct effect on domestic prices whereas during post-crisis oil prices had a strong but indirect impact on household prices. Barakchian (2015) considered the role of the transmission of US monetary policy in the Canadian economy and concluded that US monetary policy shocks transmitted into the Canadian economy due to interest rate pass-through is the major mechanism. Georgiadis (2015) pointed out the imbalance in the transmission mechanism of monetary policy in the euro area. The study pointed out that there were many inequalities across euro areas economies with the same monetary policy due to different structural characteristics. Bagzibagagli (2014) studied the monetary transmission mechanism in the EA Euro area by using the factor-augmented Vector autoregressive (FAVAR and pointed out that the Bayesian technique gave statistically significant results. Hespeler (2013) examined the monetary transmission mechanism in Uzbekistan using the VECM model and concluded that the interest rate channel of the monetary policy transmission mechanism in Uzbekistan was weaker as compared to the exchange rate channel of monetary transmission. Neuenkirch (2013) investigated the monetary transmission mechanism in Germany. The findings of the study suggested that monetary policy had a weaker and shorter impact on output and inflation during the crisis period. Kazi et al. (2013) verified the US monetary policy transmission mechanism shocks in 14 OECD countries. The study concluded that policy shocks had a negative impact on output in the US, Canada, Japan and Sweden whereas other countries had benefitted. Carpenter and Demiralp (2012) tested the association between transmission of monetary policy, money and reserves and investigated whether the money multiplier worked or not in Turkey. The study concluded that reserve requirements created the relation between money and reserves. The central bank could control the money supply by controlling the number of reserves through the open market operation.

Lewis (2012) described the monetary transmission mechanism with firms' markups and entry into the US. The study also concluded that markup changes depend on price stickiness. Andrade and Pires (2011) gave the implications of public debt for transmission techniques. The study concluded that a rise in interest rate wealth effect had a negative effect on consumption. Aleem (2010) examined the monetary policy transmission mechanism in India. The study inferred that asset price and exchange rate channels were weak and less important for transmitting the monetary policy to the real sector in India. Koop et al. (2009) concluded that transmission mechanisms and exogenous shocks all were changed and change was gradual. Jayaraman and Choong (2009) indicated the monetary policy transmission mechanism in Fiji and concluded that output was largely affected by the money channel as compared to the interest rate channel. Ciccaralli and Rebucci (2006) provided a piece of evidence on the question that the European Monetary policy transmission mechanism had changed or not and determined that in all countries of EMU at the same time European monetary policy transmission mechanism changed over time.

Fielding and Shields (2006) noted the regional unevenness of the monetary transmission mechanism of South Africa. The study stated that the impact of contractionary and expansionary monetary policy had different in the different regions due to dissimilarities among regions. Leroy and Lucotte (2005) presented the role of bank competition in the monetary transmission mechanism. This paper focused on the interest rate channel of the monetary transmission mechanism in the Euro area. The study concluded that the monetary transmission mechanism through the interest rate channel would increase the effectiveness by increasing bank competition. Dedola and Lippi (2005) asserted the monetary transmission mechanism of OECD countries. The study concluded that the impact of monetary policy shocks on output, depends on

financing requirements, and the size of the firm to borrow. Haug (2005) considered the role of the monetary policy transmission mechanism among Currency unions. The analysis concluded that GDP and CPI monetary shocks of transmission mechanism were similar in Australia and New Zealand. The study concluded that New Zealand had different exchange rates and different monetary policy shocks. Karasoy et al. (2005) worked on the monetary policy transmission mechanism in Turkey. The study concluded that inflation is affected by three channels exchange rate channel and default channel, default channel and aggregate demand channel.

Juselius and Toro (2005) indicated the monetary transmission in Spain and concluded the macroeconomic effects of joining the EMS. Integration within UE had changed the dynamics of the transmission mechanism. Disyatat and Vongsinsirikul (2003) investigated the monetary policy transmission mechanism in Thailand and inferred that investment was very sensitive to changes in monetary shocks and banks played an important role to link monetary policy to real activities. Disyatat and Vongsinsirikul (2003) elaborated on the monetary policy transmission in Thailand. The study concluded that investment was very sensitive to changes in monetary policy shocks in the transmission mechanism. Smets and Wouters (1999) verified the role of the exchange rate in the monetary transmission mechanism in Germany. In this study, tight monetary policy was used, the tight monetary policy led to the real appreciation of the exchange rate and this appreciation led to strong impacts of policy on prices that had a significant effect on net export. Gerlach and Smets (1995) examined the monetary transmission mechanism of G7 countries. The study concluded that the effects of monetary policy action were very similar among these countries. After reviewing the studies, we may infer that different channels of the monetary transmission mechanism have mixed results.

III. MODEL SPECIFICATION, DATA AND METHODOLOGY

This section investigates the model, data and methodology. Firstly, we discuss the baseline model that explores the overall impact of monetary policy on the GDP per capita growth and consumer goods prices. After that, we have examined the four channels of the transmission mechanism. Table 1 explains the details of variables used in the baseline model and different channels of the monetary transmission mechanism.

Table 1: Variables used in Channels of Monetary Transmission

Channels of Monetary Transmission	Variables
Baseline Model	GDPCG INF LR
Bank Lending or Credit Channel	GDPCG INF CRED LR
Exchange Rate Channel	GDPCG INF ER LR
Asset Price Channel	GDPCG INF MCG LR
Direct Interest Rate Channel	GDPCG INF LR CRED MCG ER

Where:
GDPCG= Gross Domestic Product per capita growth (annual %)
INF= Inflation, consumer prices (annual %)
ER= Official exchange rate
LR= Lending interest rate (%)
CRED= Domestic credit to the private sector by banks (% of GDP)
MCG= Market capitalization of listed companies' growth (current RS)
Time series data are used in the estimation of all models from 1972-to 2019. Annual data on GDPCG, INF, CRED, MCG, LR and ER are collected from World Development Indicators whereas data on LR are gathered from the handbook of statistics on Pakistan's Economy. VAR Model, Impulse Response Function, and Variance decomposition have been used to explicate the monetary transmission mechanism.

IV. RESULTS AND DISCUSSIONS

IV.I. BASELINE MODEL: OVERALL IMPACT OF MONETARY POLICY ON OUTPUT AND PRICES

The baseline model estimates the overall impact of monetary policy on output and prices. The purpose of this model is not only to analyze the overall impact of monetary policy on output and prices and then to compare it with the other channels of the transmission mechanism. The first step is the optimal lag length selection, according to the criteria[4] which are indicated in Table 2. The second step is to calculate the impulse responses according to the Cholesky, generalized and accumulated one S.D innovations.

[4] Including Akaike, Schwarz, and Hannan-Quinn.

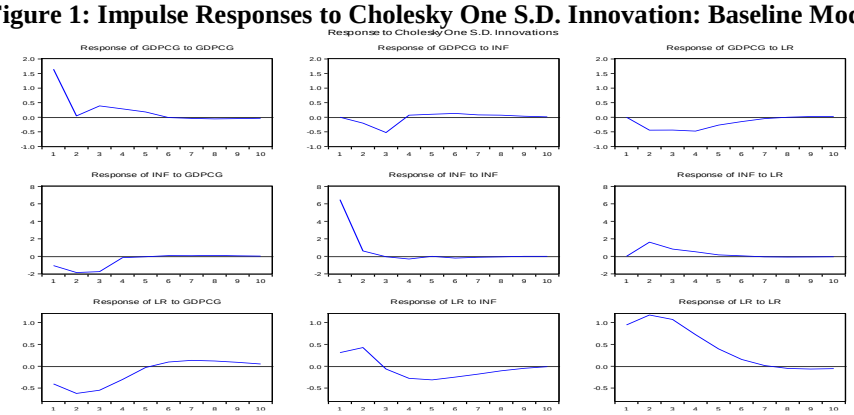
Table 2: VAR Lag Order Selection: Endogenous Variables: GDPCG INF LR

Lag	Log L	LR	FPE	AIC	SC	HQ
0	-310.3742	NA	308.1776	14.24428	14.36593	14.28940
1	-283.2099	49.38969	135.1670	13.41863	13.90523*	13.59909
2	-269.8049	22.54481*	111.3803*	13.21840*	14.06995	13.53420*
3	-262.9620	10.57542	124.8429	13.31645	14.53295	13.76759
4	-255.4351	10.60608	137.5856	13.38341	14.96485	13.96989

Table 2 describes the optimal lag length of the VAR model which is determined by the minimum values according to these criteria like FPE, AIC, SC, and HQ. In Table 2 the optimal lag length is 2 because the minimum values of FPE, AIC and HQ lie in the range of lag length 2. So, the optimal lag length of the baseline model is 2 which is supported by the minimum value criteria according to FPE, AIC and HQ. A positive one S.D. shock based on Cholesky is put into the error term, then is examined how the responding variable is reacting in the next period with how much magnitude and in what direction and in what manner. Figure 1 shows the impulse responses of each variable separately. Ordering of pattern of variable is important in case of impulse responses based on Cholesky one S.D innovation which discusses the own and cross effects of one positive S.D shocks responses of one variable to its own variable and other variables.

In Figure 1, impulse responses are taken from the baseline model based on Cholesky's one standard deviation innovation. By putting the one S.D. shock to GDPCG, the response of GDPCG is positive and initially larger in magnitude till period 6 after this it is negligible throughout. Response of one S.D shock to GDPCG provides initially negative and larger changes till period 4 after reaching a peak in period 2, it is negligible and positive around zero after period 4. For LR, one S.D shock to GDPCG exhibits a negative peak point in period 2, remains constant till period 4 then shows negligible variations.

Figure 1: Impulse Responses to Cholesky One S.D. Innovation: Baseline Model



One S.D shock to GDPCG is given to INF, it brings negative large changes initially till period 4 after this small variation in GDPCG, positive and larger in magnitude changes in INF till period 3 after this small in magnitude till reaching period 10 and for LR it is positive till period 6 after this negligible whereas one S.D innovation to LR brings negative initially fluctuation in GDPCG till period 5 with larger magnitude then becomes positive and negligible till period 10. It is positive for INF till period 3 after this period provides negative and reaches with smaller magnitude. For own shock, one S.D innovation brings a larger and positive magnitude of changes till period 7 after this smaller and negative response till period 10. Generalized one S.D innovation impulse responses are not based on ordering but exhibit direction, manner, and magnitude of responding variable, if these are the same as compared to impulse responses based on Cholesky one S.D, it means ordering taking in impulse responses of Cholesky one S.D innovation is in the right direction.

Figure 2 shows that generalized one S.D innovation for the baseline model is the same in magnitude and direction as the impulse responses for all variables including own and cross effects based on Cholesky Decomposition for the same baseline model.

In Figure 3, accumulated impulse responses to Cholesky on S.D shock to own GDPCG is positive and greater than 2 but negative in cross-case, it is about -1 and -2 for INF and LR. INF accumulated impulse responses show negative behaviour of GDPCG that is about -4 and greater than -4, positive for INF greater than 4 and also exhibits positive for LR but less than 4 to reach period 10. accumulated responses of LR to GDPCG show larger in magnitude and negative approximately

equal to -2, for the case of INF positive and negative trend with small magnitude showing little importance of accumulated responses of LR on INF but it is continuously increasing for LR till period 10. IRF traces influences of a shock to the single endogenous variable onto other variables in the VAR system whereas variance decomposition exhibits separate fluctuations in each of the endogenous variables that occur due to each random shock. Table 3 shows the results of the variance decomposition of GDPCG, INF, and LR with their own shock and cross shocks. 10 years are taken as the overall forecast period. Variance decomposition shows a percentage share in the overall fluctuation of a given variable, caused by different shocks. This time period is divided into the short run and in long run. In all models of Table 3, the row-wise sum becomes 100 and exhibits 100 per cent variation in the given variable due to different shocks.

Figure 2: Impulse Responses to Generalized One S.D. Innovation: Baseline Model

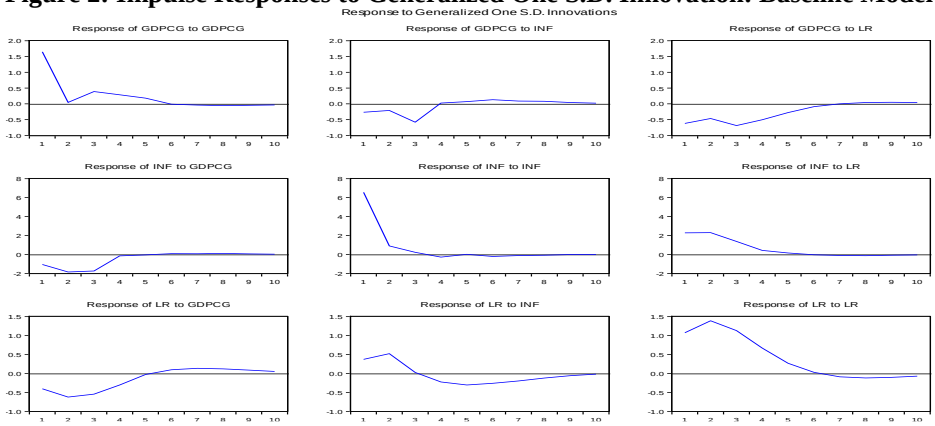
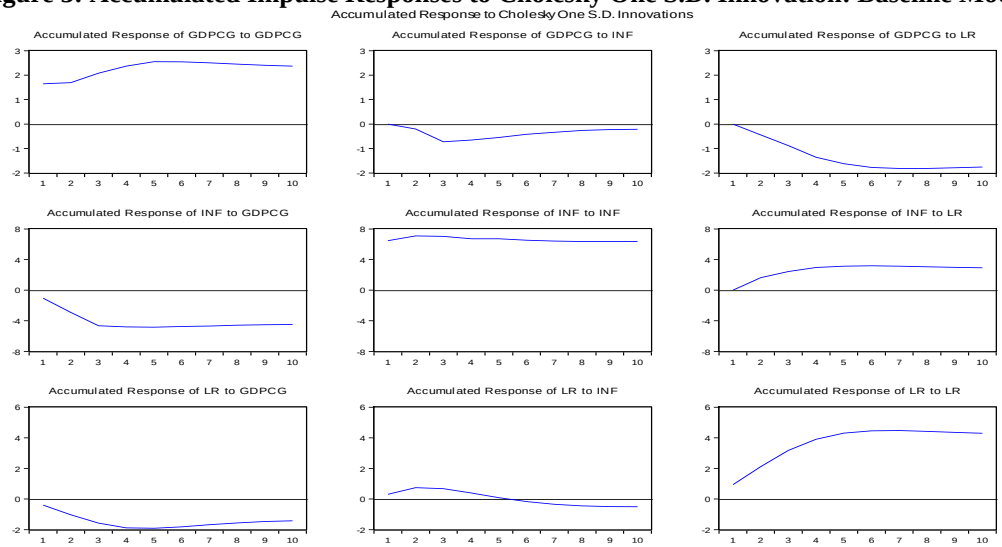


Figure 3: Accumulated Impulse Responses to Cholesky One S.D. Innovation: Baseline Model



In the first model, the shock to GDPCG brings its own shock and shocks to INF and LR represent cross shocks variations in GDPCG. In the short run that is period 4, 75.96 per cent contribution is delivered into the GDPCG by its own shock factor. After 4 periods, own shock contribution declines and in the long run, in year 10, it becomes 73.60 per cent of the overall variations in the GDPCG. In period 2, 1.38 per cent contribution is brought by the INF shock into the variations of GDPCG. This contribution increases after 2 years up to 8.83 per cent and remains approximately constant throughout. Shock to LR brings 6.59%, 10.86% and 15.77% increasing contribution into GDPCG while after period 4 it remains near about 17.12 per cent throughout the remaining period. Short-run analysis shows the second period brings a 9.16 per cent contribution to the total variations of INF because of the shock to GDPCG. While shocks to INF and LR provide 85.49 per cent and 5.34 per cent respectively, they important contribute to the fluctuations of INF. Long run estimation shows the contribution of GDPCG shock into INF increases and remains constant. While own shock contribution declines and remains constant while cross shock contribution of LR into the variations of INF increases up to 6.78 per cent. The third model of table 3 shows the shocks effects of GDPCG, INF and LR on LR. In period 4, the shock to GDPCG accounts for 18.04 per cent importance in the variations of LR. After this, it falls and remains constant throughout. Own shock contribution is 75.06 per cent in the short-run that is period 4, after this, it is constancy falling and in the long run with

period 10 this contribution reaches 72.50 per cent. Shock to INF contributes 6.89 per cent into LR in a short period, minor increase then constant throughout the period.

Table 3: Variance Decomposition of GDPCG, INF and LR

GDPCG				
Period	S.E.	GDPCG	INF	LR
1	1.647099	100.0000	0.000000	0.000000
2	1.717691	92.02103	1.383105	6.595869
3	1.889655	80.30385	8.834048	10.86210
4	1.970630	75.96984	8.260194	15.76996
5	2.000002	74.59049	8.284137	17.12537
6	2.009842	73.86432	8.640923	17.49476
7	2.012374	73.71314	8.787385	17.49947
8	2.014464	73.63926	8.897501	17.46324
9	2.015483	73.61586	8.920482	17.46366
10	2.016058	73.60442	8.921776	17.47381
INF				
Period	S.E.	GDPCG	INF	LR
1	6.556532	2.592938	97.40706	0.000000
2	7.029746	9.166656	85.49459	5.338754
3	7.289955	14.25867	79.50503	6.236300
4	7.316695	14.19499	79.10530	6.699715
5	7.318612	14.19118	79.06386	6.744957
6	7.322173	14.19159	79.06300	6.745409
7	7.323502	14.19611	79.05422	6.749673
8	7.324919	14.21128	79.03094	6.757777
9	7.325508	14.21509	79.01824	6.766670
10	7.325725	14.21600	79.01364	6.770364
LR				
Period	S.E.	GDPCG	INF	LR
1	1.073672	14.19896	8.409784	77.39126
2	1.759450	17.81853	9.039721	73.14174
3	2.131487	18.75260	6.248481	74.99892
4	2.287741	18.04198	6.893725	75.06430
5	2.342934	17.21689	8.352186	74.43093
6	2.363023	17.08834	9.314700	73.59696
7	2.373617	17.25234	9.802054	72.94560
8	2.379429	17.42020	9.945075	72.63473
9	2.382414	17.51287	9.959418	72.52771
10	2.383637	17.54231	9.951182	72.50650

IV.II. OTHER CHANNELS OF MONETARY TRANSMISSION

After estimating the baseline model and exploring the overall impact of monetary policy on output and prices. Now we explain the estimates of the four channels of the monetary transmission mechanism including the lending channel, exchange rate channel, asset price channel and interest rate channel.

IV.II.I. BANK LENDING OR CREDIT CHANNEL

The bank lending channel includes bank credit to the private sector and lending rate as the policy variables that explain the impact of these variables on the GDP. The bank lending channel operates through the supply of loanable funds that investors use for financing and affects the aggregate output. Table 4 describes the optimal lag length of the VAR model in the bank lending channel. Table 4 concludes the optimal lag length is 1 in the bank lending channel.

Impulse responses of GDPCG based on Cholesky one S.D innovation presents positive direction for GDPCG, initially, magnitude is about 2 in period 1 than little afterwards till period 10. It has a negative peak in period 3 and less than -1 but

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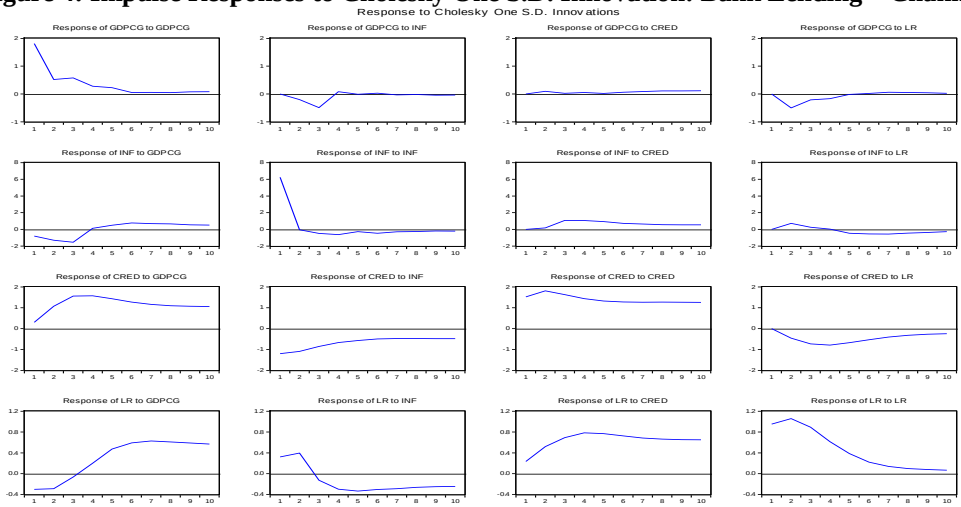
little in magnitude about zero after this, for INF. Magnitude is little and direction is not clear of the responding pattern in case of CRED but initially, it is negative greater than -1 in period 3 and after this smaller magnitude is showing for LR.

Table 4: VAR Lag Order Selection: Endogenous Variables: GDPCG INF CRED LR

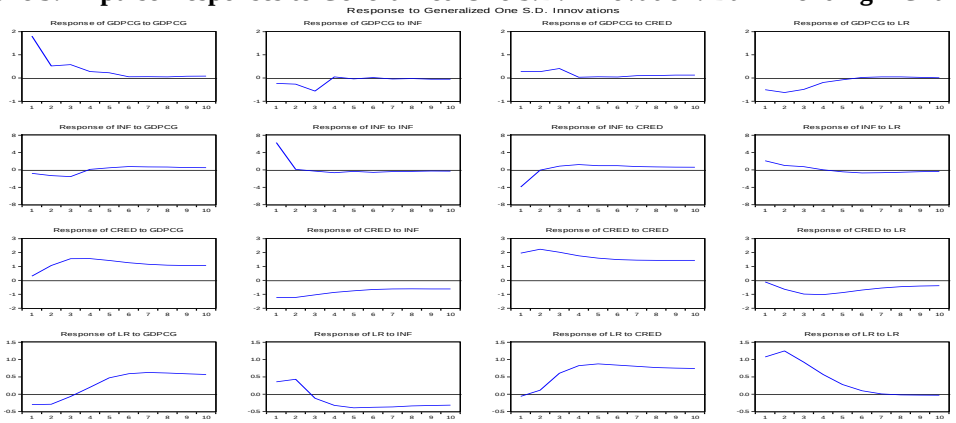
Lag	Log L	LR	FPE	AIC	SC	HQ
1	-363.4939	NA	365.1207*	17.24972*	17.89852*	17.49033*
2	-349.7305	22.52197	410.0301	17.35139	18.64898	17.83259
3	-334.7656	21.76716	447.4527	17.39843	19.34482	18.12025
4	-324.9718	12.46482	644.5135	17.68053	20.27572	18.64295

Figure 4: Impulse Responses to Cholesky One S.D. Innovation: Bank Lending Channel



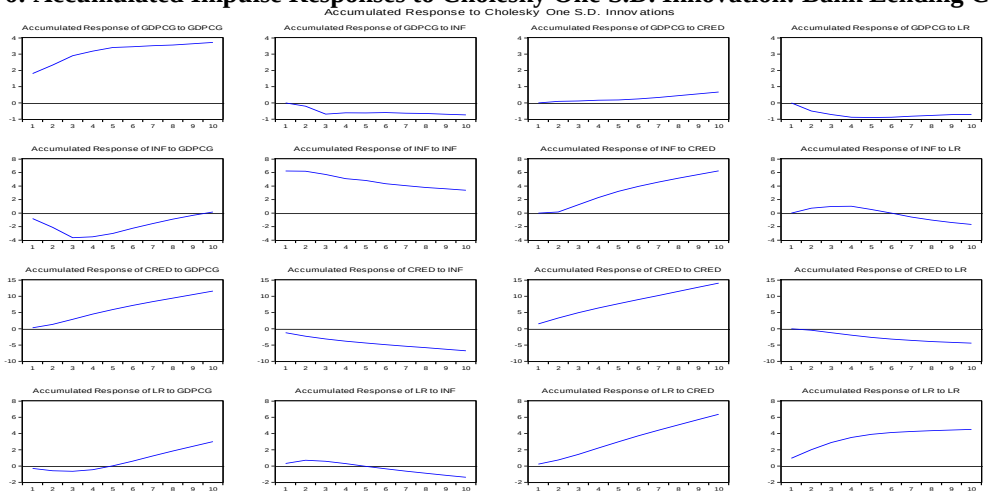
Impulse responses of INF based on Cholesky one S.D innovation presents negative direction for GDPCG, initially, magnitude is about -2 in period 3 then reaches at zero after this positive with little magnitude. It has a positive falling peak of about 6 in period 2 but little in magnitude about zero after this, for INF. Magnitude is little and direction is positive of the responding pattern in case of CRED but initially, it is positive in period 2, reaches zero then negative and constant till period 10 for LR. Responses of CRED on GDPCG are positive and about 2 in magnitude, negative and greater than -1 for INF, positive and between 1 and 2 in magnitude overall for CRED and negative with a magnitude greater than -1 for the case of LR. Impulse responses of LR with one S.D innovation are responding negatively with magnitude greater than -.04 reaches zero than positive in period 4 for the case of GDPCG, initially positive with the peak at 0.4 in period 2 than falling reaches zero than negative with magnitude about -0.4 till period 10 for INF, positive overall with a high peak at 0.8 in period 4 for CRED, and it is overall positive and falling magnitude for LR from 0.8 in period 3 to about zero after period 6. Impulse responses based on generalized one S.D innovation are the same in pattern, magnitude and direction for bank lending channel as in the case of impulse responses based on Cholesky one S.D innovation for the bank lending channel. The same results show correction of ordering in the case of impulse responses of Cholesky one SD innovation.

Figure 5: Impulse Responses to Generalized One S.D. Innovation: Bank Lending Channel



In Figure 6, accumulated impulse response based on Cholesky one S.D innovation for GDPCG own effect is positive and greater than 2 till period 10, for INF it is negative and greater than -1, till the period 10. Accumulated response to Cholesky One S.D. Innovations of GDPG on credit are positive and less than 1in magnitude throughout the period. Whereas response of GDPG on LR is negative and -1 or less in magnitude till the period 10. Accumulated response to one S.D.

Figure 6: Accumulated Impulse Responses to Cholesky One S.D. Innovation: Bank Lending Channel



Response of Innovations of INF to the GDPCG is negative at becoming declining in the start and reaches the -4 till the period between 2 to 3, and then rising. Accumulated own response of INF is positive and 6 in magnitude at the start and then declines till period 10, whereas the response of INF to CRED is positive and rises till 6 in magnitude in period 10, the response of INF to LR is positive from period 1 to 6 and starts decline and become negative. Accumulated response of CRED to GDPCG is positive and 10 in magnitude throughout the period and shows the high impact of CRED on the output level, and the response of CRED to INF is negative and declining less than -5 till period 10, Own response of CRED is positive and increases to 15 in magnitude till period 10 and The accumulated response of CRED to LR is negative and declining continuously reaching -5 till the period 10. The accumulated response of LR to GDPG is negative till period 5 and become positive and less than 4 in magnitude from period 5 to 10. The accumulated response of LR to the INF is positive and approximately1 in magnitude, becomes zero in period five, after period 5 it becomes negative and starts declining till the period 10. Response of LR to the CRED is positive and rises till period 10 and reaches the magnitude of 6. Own response of LR is positive and 4 in magnitude till period 10.

Variance decompositions show different shocks shared with the fluctuations in the given variable. In Table 5, the variables are GDPCG. INF, CRED and LR. By taking GDPCG as fluctuating given variable, Period 2 shows 92.19 per cent own shock contribution in GDPCG. With 86.14 per cent declining and approximately constant own shock contribution up to period 7 period is observed. Long run own shock contribution in period 10 is 85.34 per cent. Overall own shock contribution is more powerful than cross shock contribution, but its share is declining. Innovation to LR contributes more as compared to the share of the innovation of INF and CRED into the fluctuation of GDPCG. Shock to CRED shows negligible share in the variations of GDPCG such as it is up to 0.76 per cent in the short run and 1.29 per cent in the long run. Shock to LR however larger in magnitude as compared to the shock of CRED. Share of Innovation to INF in GDPCG variations is approximately constant throughout the period. LR innovation also contributes constantly most of the time period. Now, the given variable is INF. Cross shock to GDPCG depicts mix contribution with increasing and decreasing percentages values e.g. in the short run, that is period 5, it contributes 10.18 per cent into the variations of INF while in the long run at period 10 this increasing contribution is 12.99 per cent to the overall fluctuation in INF. Own shock contribution is powerful and increases in the short run such as, in period 5, it is 81. 60 per cent after this it is declining and in the long run, in period 10, own shock contributes 74.27 per cent to the fluctuation in the given variable.

The shock to CREDIT gives a minor increasing contribution to the overall fluctuation such as in the short run, say period 5, it is 6.53 per cent and in the long run with period 10 it is 9.29 per cent. Shock to LR contributes to the fluctuations in INF with little increase in each year, e.g. according to short-run analysis, it is increasing from 1.24 per cent in the second period up to 1.67 per cent in period five. But in the long-run period of 10 years, it is contributing 3.44 per cent. CRED is the given variable. Cross shocks include shocks to GDPCG, INF and LR while the own shock depicts the shock contribution of CRED in the total variations in CRED. Own shock depicts declining contribution throughout the period.

Shock to GDPCG shows increasing contribution into variations of CRED with short-run 12.80 per cent in the second period and 34.40 per cent contribution in overall fluctuation with period 10.

Table 5: Variance Decomposition of GDPCG INF CRED LR

GDPCG					
Period	S.E.	GDPCG	INF	CREDIT	LR
1	1.811764	100.0000	0.000000	0.000000	0.000000
2	1.962523	92.19926	1.045766	0.227778	6.527194
3	2.115359	86.82114	6.344364	0.209210	6.625287
4	2.142440	86.31614	6.333719	0.258080	7.092056
5	2.154453	86.45439	6.265638	0.261265	7.018709
6	2.156241	86.36552	6.270331	0.349279	7.014874
7	2.160002	86.13859	6.277200	0.507848	7.076358
8	2.163932	85.87342	6.263505	0.759499	7.103574
9	2.168984	85.59315	6.278395	1.022184	7.106270
10	2.173999	85.33753	6.285937	1.291782	7.084756
INF					
Period	S.E.	GDPCG	INF	CREDIT	LR
1	6.297856	1.646120	98.35388	0.000000	0.000000
2	6.473140	5.579156	93.10362	0.068315	1.248907
3	6.760324	10.27273	85.86241	2.573002	1.291858
4	6.873546	9.972162	83.89412	4.882088	1.251634
5	6.975959	10.18970	81.60214	6.532858	1.675305
6	7.093856	11.05032	79.35550	7.369480	2.224702
7	7.183938	11.69281	77.54063	7.977633	2.788924
8	7.255435	12.29569	76.14925	8.430131	3.124934
9	7.308826	12.68488	75.11294	8.869379	3.332795
10	7.354339	12.99860	74.26654	9.298531	3.436329
CRED					
Period	S.E.	GDPCG	INF	CREDIT	LR
1	1.963346	2.402353	37.33872	60.25892	0.000000
2	3.110774	12.80942	27.25063	57.78292	2.157030
3	4.004852	22.93024	20.96180	51.45734	4.650620
4	4.651696	28.38605	17.60795	47.68895	6.317054
5	5.120562	31.25248	15.78639	46.00778	6.953356
6	5.476693	32.70788	14.62045	45.65376	7.017915
7	5.773608	33.47605	13.82924	45.88747	6.807241
8	6.039036	33.89184	13.25096	46.35148	6.505712
9	6.286850	34.17243	12.80735	46.83236	6.187856
10	6.521528	34.40890	12.44637	47.25759	5.887143
LR					
Period	S.E.	GDPCG	INF	CREDIT	LR
1	1.074599	7.779975	8.993402	4.753241	78.47338
2	1.667390	6.210400	9.394287	11.64609	72.74922
3	2.018808	4.340514	6.795618	19.69018	69.17369
4	2.279972	4.170181	7.050698	27.28480	61.49432
5	2.505278	7.025501	7.611619	32.05357	53.30931
6	2.700723	10.83732	7.804313	34.81511	46.54326
7	2.873588	14.32556	7.895423	36.43690	41.34211
8	3.024645	17.00748	7.877673	37.69479	37.42006
9	3.160905	19.04387	7.841327	38.78638	34.32842
10	3.286766	20.59854	7.806041	39.80341	31.79201

Innovation to INF shows increasing contribution in the short run-up to period 4 and depicts declining contribution after period 4 up to 12.44 per cent contribution in period 10. Shock to LR represents a mix of increasing and decreasing but little in magnitude contribution to the fluctuation of CRED. Now, overall fluctuations occur in the given variable LR.

Cross shock to GDPCG depicts an increasing contribution to fluctuating LR throughout the period. Period 5 with short-run contribution is observed with 7.03 per cent and period 10 shows the long-run contribution of 20.56 per cent of the shock to GDPCG into Overall variations of LR. Shock to INF contribution is also increasing with 6.79 per cent and 7.80 per cent short-run and long-run contributions, respectively in fluctuating LR. Cross shock contribution is however larger in the case of CRED as compared to the contribution of the shock to GDPCG and INF. In period 4, the contribution of the shock to CRED into variations of LR is 27.28 per cent and in period 10 it is 39. 80 per cent. Own shock contribution is declining throughout the period. It is 61.49 per cent in the short run with period 4 and 31.79 per cent in the long run of period 10.

IV.II.II. EXCHANGE RATE CHANNEL

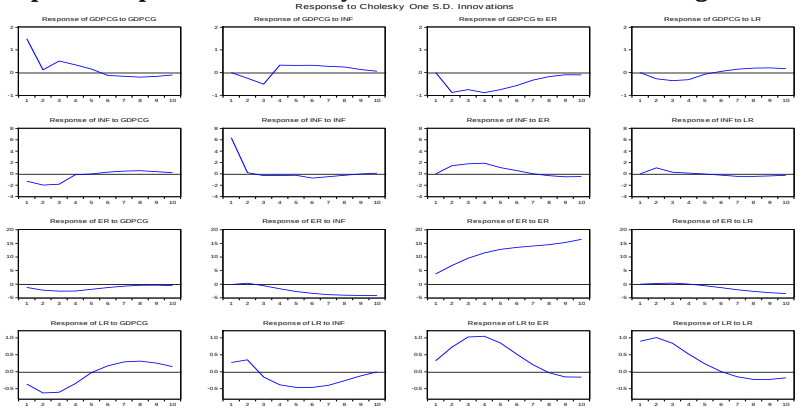
The importance of the exchange rate channel depends on the effects of the exchange rate on the monetary policy shocks and responsiveness to trade. In a small open economy like Pakistan, net exports increases due to the depreciation in the domestic currency or due to the easy monetary policy. The exchange rate channel estimates the policy shocks due to changes in the exchange rate. The exchange rate channels include variables like GDP per capita growth, inflation, official exchange rate and lending rate.

Table 6: VAR Lag Order Selection: Endogenous Variables: GDPCG INF ER LR

Lag	Log L	LR	FPE	AIC	SC	HQ
0	-528.2453	NA	377562.0	24.19297	24.35517	24.25312
1	-399.0141	229.0916	2205.105	19.04609	19.85709*	19.34685
2	-375.6463	37.17608*	1608.564*	18.71119*	20.17099	19.25255*
3	-362.4559	18.58636	1919.881	18.83891	20.94749	19.62087
4	-350.7809	14.32850	2574.022	19.03549	21.79288	20.05807

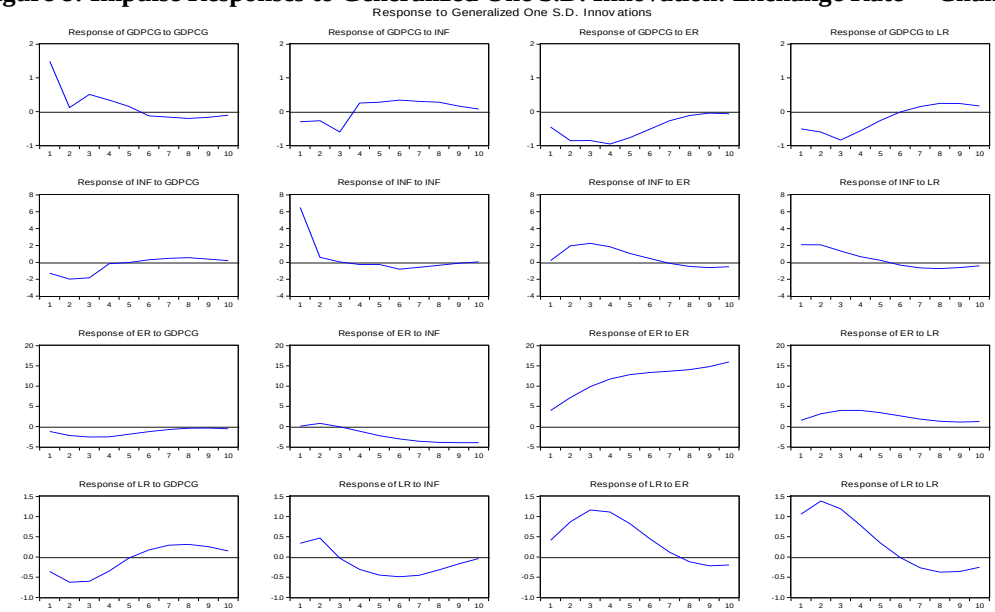
In Table 6, the optimal lag length is 2 because the minimum values of FPE, AIC and HQ lie in the range of lag length 2. In Figure 7, the response of GDPCG when one positive S.D. shock put to the error term to its own variable GDPCG is initially positive and greater than 1in magnitude but declining and become zero in period 6 and after that become negative till the period 10 and less than -1 in magnitude. Response of GDPCG to INF is initially negative and declining reaching -0.5 in magnitude and then rising even become zero in period 3 and after that is positive but less than 1 in magnitude. Response of GDPCG to the ER was initially negative and declined till period 4 and then rose throughout the period. Response of GDPG to LR is initially negative and becomes zero in period 5 and then positive and rising but less than 1 till the period 10. Response of INF to GDPG is negative and -2 in magnitude and starts rising become zero in period 6 and after that response is positive and less than 2 in magnitude till the period 10. Own Response of Cholesky one S.D. innovation of INF is positive in the start and 6 in magnitude and sharp declining become zero in period 3 and then negative and less than -2 in magnitude till the period 10. The impulse response of INF to ER is positive at the start and 2 in magnitude and after period 8 it becomes negative till period 10. Response of INF to the LR is positive initially, 1 in magnitude and then becomes zero in period 6 and after that, it is still negative and less than -2 in magnitude till period 10. Cholesky one S.D. innovation response of ER to GDPG is still negative throughout the period and less than -5 in magnitude. Response of ER to INF is still zero-till period 2 and after that, it is negative till the period 10 and -5 in magnitude. Own effect of ER is still positive and 15 % in magnitude till period 10. Response of ER to LR is still zero up to period 4 and then becomes negative till period 10 and less than -5 % in magnitude.

Figure 7: Impulse Responses to Cholesky One S.D. Innovation: Exchange Rate Channel



Response of LR to GDPG, when one positive S.D. shock put to the error term under Cholesky, is negative in the start and more than -0.5 in magnitude and start rising, after the period it becomes positive and less than 0.5 in magnitude till the period 10. Response of LR to the INF is positive but less than 0.5 in magnitude and becomes zero in period 2 and become negative after the till the period 10. Response of LR to the ER is positive initially and 1 in magnitude, becomes zero in period 8 and after that, it becomes negative till the period 10. The own response of LR is positive initially reaches the 1 in magnitude and after the period 6, it becomes negative till the period 10 and less than -0.5 in magnitude.

Figure 8: Impulse Responses to Generalized One S.D. Innovation: Exchange Rate Channel



In Figure 8 impulse responses to generalized one S.D. innovation under exchange rate channel is still the same as under Cholesky one S.D innovation for exchange rate channel except for the impulse response of ER to LR is positive throughout the time period and its impulse response to the LR is negative under Cholesky one S.D. innovations.

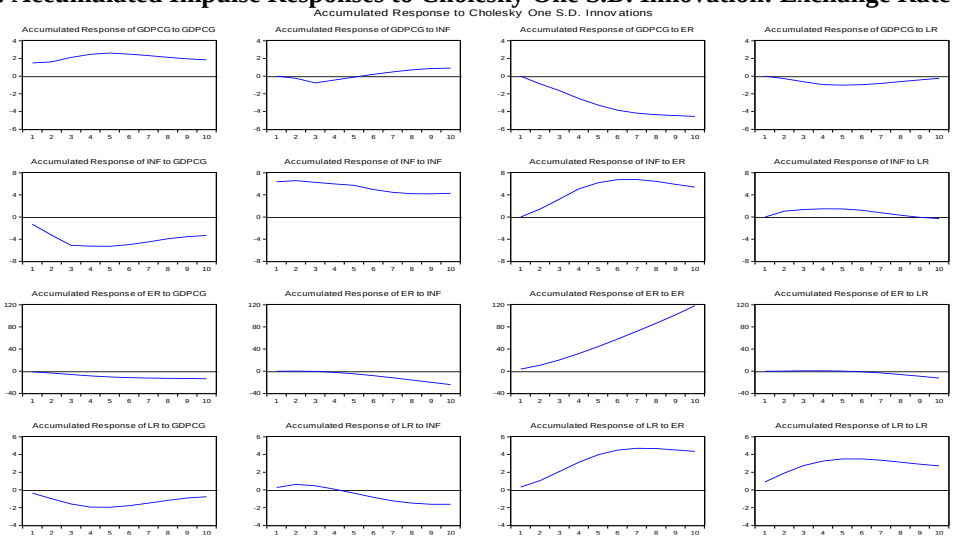
Figure 9 presents the accumulated impulse responses to Cholesky one S.D. innovation under the exchange rate channel. The first figure shows the own response of GDPG under the accumulated impulse response to the Cholesky one S.D. innovation, when one positive S.D. shock put to the error term is still positive throughout the period and 2 in magnitude. Response of GDPG to the INF is negative initially and after period five it becomes positive and 1 in magnitude. The accumulated response of GDPG to ER is still negative and declining till the period 10 and -4 in magnitude. Impulse response GGDPG to the LR is still negative throughout the period and -1 in magnitude.

The accumulated response of INF to the GDPG is still negative throughout the period and more than -4 in magnitude. Accumulated own impulse response of INF is still positive throughout the period and between the range of 4 to 8 in magnitude. The impulse response of INF to the ER is still positive till periods 10 and 6 in magnitude. The impulse response of INF to LR is positive throughout the period less than 4 in magnitude and becomes zero after period 8. Accumulated impulse responses to Cholesky one S.D. innovation of ER to GDPG is still negative and less than -40 throughout the period. Response of ER to the INF is zero till period 4 and after that, it becomes negative till period 10 and less than -40 in magnitude. Own Impulse response of ER is still rising and positive and 120 in magnitude till the period 10. Response of ER to the LR is zero till period 6 and after that, it becomes negative and less than -20 in magnitude, which shows the little impact of exchange rate on policy variable. The accumulated response of LR to the GDPG is still negative and -2 in magnitude in period 4 then rising till period 10. Response of LR to INF is positive initially and 1 in magnitude and becomes negative after period 4 and -2 in magnitude till period 10. The impulse response of the LR to ER is still positive and 4 in magnitude till period 10. The own impulse response of LR is still positive throughout the period and 4 in magnitude. The next step is the variance decomposition of GDPG, INF, ER and LR presented in Table 7.

Table 7 indicates the results of variance decomposition in the variables of GDPCG, INF, ER, and LR by taking shocks separately to each variable. Now examining the fluctuations in the GDPCG due to the contribution of our own shock and cross shocks. Own shock factor shows a falling contribution throughout the short-run and long-run periods. Shock to INF

shows increasing contribution with 7.92 per cent in short-run period 4 and 11.05 per cent contribution in the long run of period 10. Innovation to ER depicts however larger contribution in fluctuating GDPCG with increasing contribution up to period 8 and after this, it is declining up to period 10 with 44.31 per cent contribution in the overall fluctuation of GDPCG. Shock to LR exhibits negligible but increasing contribution to the total fluctuations of GDPCG.

Figure 9: Accumulated Impulse Responses to Cholesky One S.D. Innovation: Exchange Rate Channel



Now examining the variations in the INF due to the innovation contribution of GDPCG, INF, ER and LR. Innovation in GDPCG contributes to the variation in the INF, with slightly increasing values for each period. Own shock contribution is playing a major role in the fluctuation of INF, but this contribution is declining from short run to long run with 96.03 per cent contribution in the first period to 64.97 per cent contribution in period 10. Shock to ER contributes 14.58 per cent in the short run, that is period 4 and contributes approximately constant till period 10 in the variation of INF. Innovation to LR however contributes less to the total fluctuation of INF as compared to other shocks, this contribution remains approximately constant throughout the period with little negligible fall and rise. Now examine the fluctuations in ER due to shocks or innovations to GDPCG, INF, ER and LR. Own shock contribution is increasing in the short run, say period 7 up to 92. 39 per cent but in long run, say period 10 contribution is declining up to 91.21 per cent in fluctuating ER. Shock to GDPCG has constant contribution in the variations of ER in the first two periods, after the second period it is declining up to period 10 with a 1.52 per cent contribution. Innovation to INF contributes negligibly in the short run-up to period 3 but its contribution is increasing after period three up to period 10 with a 5.19 per cent contribution in the total variations of the given variable ER. Shock to LR however participates very negligible up to period 7 with 0.71 per cent participation in the total variations after this contribution little increases in the long run-up to 2.1 per cent contribution in the fluctuation of ER in period 10. Now the percentage of participation of the shocks to GDPCG, INF, ER and LR are examined on the given variable LR. Own shock participation percentages are declining continuously throughout the period from 72.22 per cent to 32.66 per cent contribution in fluctuating LR. Innovation to ER, however, participating larger as compared to other cross shocks, in the short run, up to period 6 it is increasing i.e. 44.64 per cent but in long run, this participation declines, say in period 10 it is 41.94 per cent.

IV.II.III. ASSET PRICE CHANNEL

In the asset price channel, the prices of the assets change due to monetary shocks. Due to the easy monetary policy, asset prices increase and have multiple effects on the monetary policy shocks, for example, higher assets prices increase the value of firms. Secondly higher assets prices increase the wealth of the asset holder and wealth holder then further increase the consumption. So, the stock of assets from the firms and the household creates wealth effects as well. This analysis use market capitalization growth to examine the prices of the assets.

By applying these criteria for the determination of optimal lag length, Table 8 concludes the optimal lag length is 2 in the bank lending channel.

Figure 10 displays the impulse responses to Cholesky one S.D. innovation on the asset price channel. Own response of GDPG when one S.D. shock put to the error term is initially positive and less than 2 in magnitude. Response of GDPG to the INF is negative at the start and less than -1 in magnitude and becomes positive after period 4 and less than 1 in

magnitude. Response of GDPG to MCG is negative in the start from period 1 to 2 and period 2 to 3 is positive and the magnitude is less than 1 in both conditions.

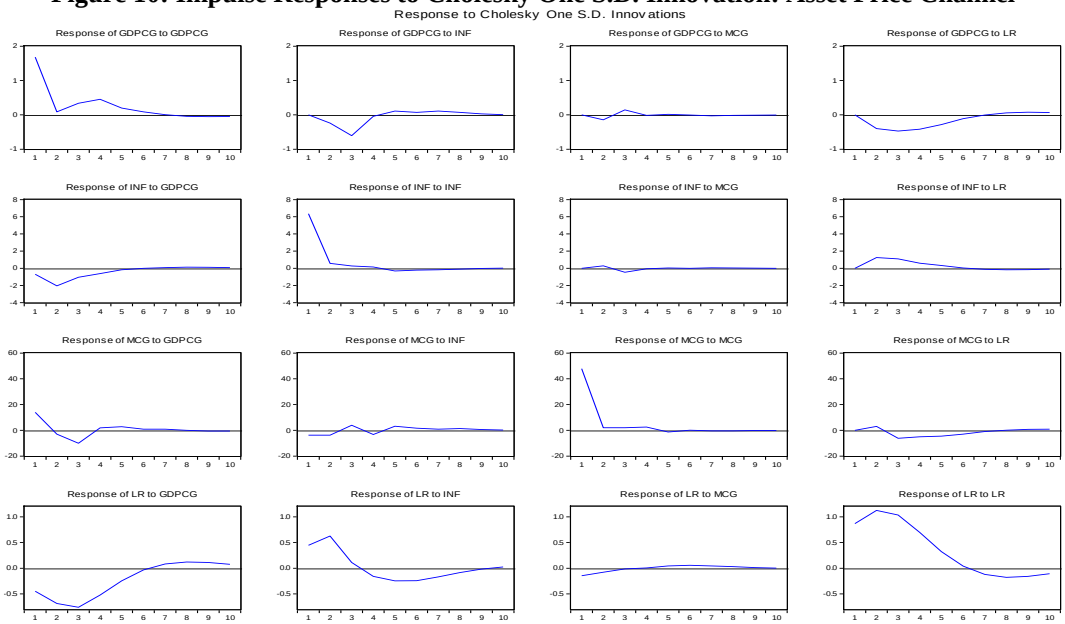
Table 7: Variance Decomposition of GDPCG INF ER LR

GDPCG					
Period	S.E.	GDPCG	INF	ER	LR
1	1.492406	100.0000	0.000000	0.000000	0.000000
2	1.773964	71.23041	1.990175	24.40559	2.373824
3	2.089170	57.28079	7.464074	30.58675	4.668390
4	2.339893	47.80623	7.917411	38.77653	5.499828
5	2.483763	42.80508	8.633648	43.59802	4.963249
6	2.573583	40.10293	9.618514	45.61804	4.660522
7	2.618646	39.13614	10.38803	45.66049	4.815346
8	2.651279	38.75138	10.99185	45.00852	5.248248
9	2.669842	38.61447	11.09177	44.51400	5.779761
10	2.680182	38.47623	11.05251	44.31039	6.160873
INF					
Period	S.E.	GDPCG	INF	ER	LR
1	6.511828	3.967855	96.03215	0.000000	0.000000
2	7.039910	11.32344	82.25018	4.154526	2.271851
3	7.498764	15.95267	72.66156	9.234246	2.151528
4	7.739118	15.01412	68.35231	14.58156	2.052013
5	7.821955	14.69843	67.02483	16.26603	2.010701
6	7.888799	14.60241	66.82603	16.50686	2.064703
7	7.931911	14.82030	66.50224	16.32851	2.348951
8	7.974921	15.14336	65.88589	16.33217	2.638581
9	8.009945	15.23687	65.31228	16.61671	2.834141
10	8.031893	15.21642	64.97297	16.89409	2.916521
ER					
Period	S.E.	GDPCG	INF	ER	LR
1	3.968071	9.355721	0.084095	90.56018	0.000000
2	8.237927	9.449360	0.224656	90.24556	0.080426
3	12.88707	7.850320	0.294947	91.72882	0.125916
4	17.52777	6.307092	1.080522	92.54331	0.069080
5	21.96174	4.769710	2.182241	92.93933	0.108721
6	26.08074	3.616119	3.212292	92.84447	0.327122
7	29.94096	2.801632	4.091761	92.39761	0.709002
8	33.64104	2.234151	4.708071	91.86869	1.189083
9	37.32781	1.823287	5.058509	91.44520	1.673006
10	41.16721	1.515171	5.189375	91.21202	2.083433
LR					
Period	S.E.	GDPCG	INF	ER	LR
1	1.057944	11.63798	6.638544	9.505287	72.21819
2	1.782195	16.35755	6.232564	19.98261	57.42728
3	2.305769	16.57045	4.169424	31.71231	47.54782
4	2.635959	14.41557	5.291862	40.03812	40.25445
5	2.816537	12.63369	7.296072	44.12264	35.94759
6	2.906228	12.23579	9.356050	44.64469	33.76347
7	2.959055	12.77394	10.84700	43.55460	32.82445
8	2.995851	13.55721	11.35233	42.50087	32.58959
9	3.021548	14.05544	11.31732	42.03107	32.59616
10	3.034800	14.18732	11.21905	41.93685	32.65678

Table 8: VAR Lag Order Selection: Endogenous Variables: GDPCG INF MCG LR

Lag	Log L	LR	FPE	AIC	SC	HQ
0	-531.1600	NA	758946.9	24.89116	25.05499*	24.95158
1	-503.2713	49.29167	438413.2	24.33820	25.15736	24.64028
2	-481.8543	33.86874*	347962.8*	24.08625*	25.56074	24.62999*
3	-469.8936	16.68936	442689.4	24.27412	26.40394	25.05953
4	-455.9577	16.85271	540806.7	24.37012	27.15528	25.39720

Figure 10: Impulse Responses to Cholesky One S.D. Innovation: Asset Price Channel



Response of INF to GDPG is negative initially till period 5 and the magnitude is -2. The impulse response of own INF is positive initially till the period 5 and the magnitude at the start is 6. Response of INF to the MCG is very minute from period 1 to 2 response is positive and less than 1 in magnitude and from period 2 to 3 is negative and less than -1 in magnitude. Response of INF to the LR is positive till period 6 and the magnitude is less than 2. The impulse response of MCG to the GDPG is positive but declining, during the period 2 till period 4 is negative and in both positive and negative time period the magnitude is less than 20 after that it becomes positive till the period 8. Response of MCG to INF is negative till the period 2, from period 2 to 3 it becomes positive but in less than 10 in magnitude, from period 3 to 4 it is again negative after the period 5 it is positive throughout. The impulse response of own MCG is still positive and 50 in magnitude and declining till the period 4. Response of MCG to LR is positive initially till the period 2, from period 2 to 7 it becomes negative and less than -10 in magnitude.

Responses of LR to the GDPG are negative and more than -0.5 in magnitude, after period 6 it becomes positive till period 10. Response pf LR to INF is positive and more than 0.5 in magnitude till the period 3, after that it becomes negative till the period 9. Response of LR to MCG is negative till period 3 and becomes positive from period 5 to 8. The impulse response of own LR is positive and more than 1 in magnitude and declining till the period 6 and after that, it becomes negative till the period 10 and less than -0.5 in magnitude.

In Figure 11 impulse responses to generalized one S.D. innovation under Asset price channel is still the same in direction, strength and magnitude as under Cholesky one S.D. innovation under asset price channel.

Figure 12 explains the accumulated impulse response to Cholesky one S.D. innovations under assets price channel when one positive S.D. shock putt to the error term. The impulse response of own GDPG is positive and the magnitude is 3 till the period 10. Response of GDPG to the INF is negative and -1 in magnitude till period 10. Response of GDPG to MCG is very minute negative from period 1 to 2 and the magnitude is approximately near zero. The impulse response of GDPG to LR is negative and -2 in magnitude till period 10.

Figure 11: Impulse Responses to Generalized One S.D. Innovation: Asset Price Channel

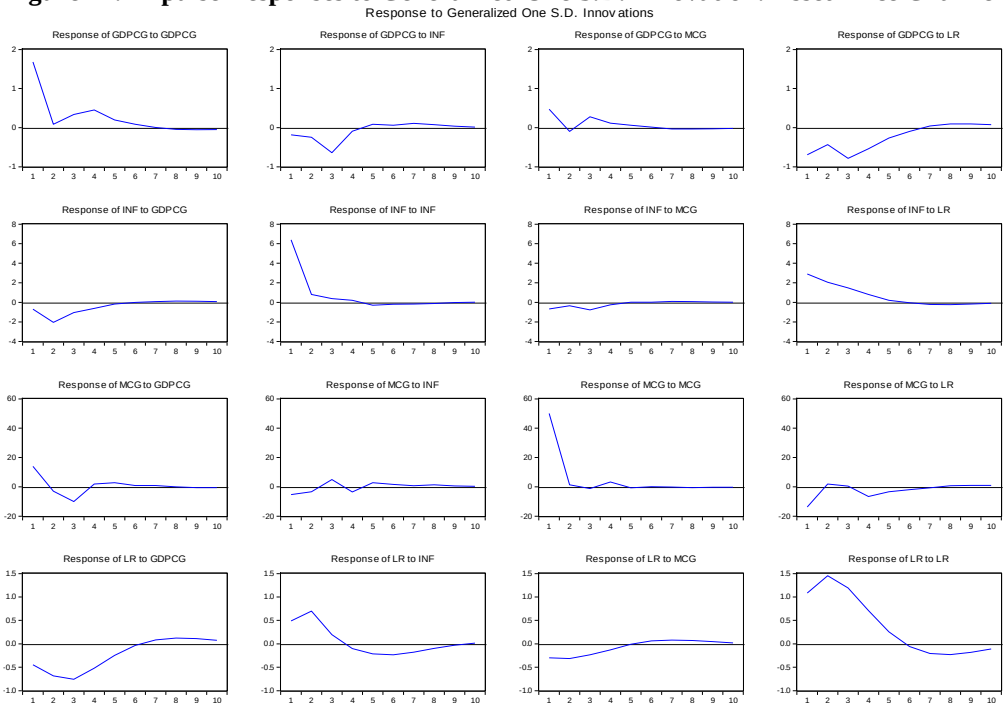
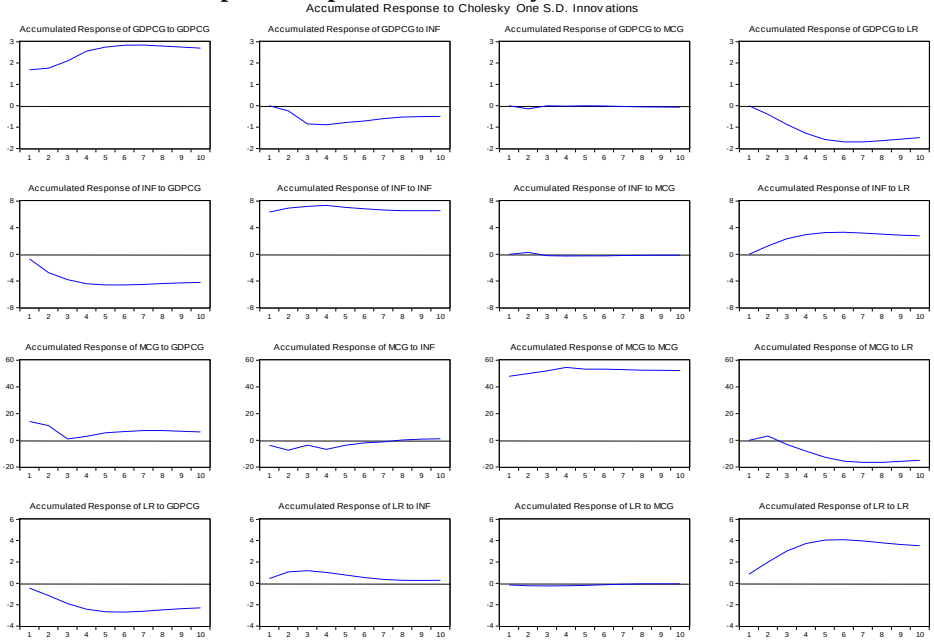


Figure 12: Accumulated Impulse Responses to Cholesky One S.D. Innovation: Asset Price Channel



The accumulated impulse response of INF to GDPG is still negative -4 in magnitude till period 10. Response of own INF is positive and 8 in the magnitude till the period 10. The impulse response of INF to the MCG is zero throughout the time period. The impulse response of INF to the LR is still positive and 4 in magnitude throughout the period.

The impulse response of MCG to GDPG when one S.D. shock put to the error term is positive and less than 20 in magnitude till the period 10, the impulse response of MCG to INF is negative till the period 7 and magnitude is less than 20. Accumulated response of own MCG is positive and 55 in magnitude. Response of MCG to LR is positive from 1 period to 2, after that, it becomes negative and -20 in magnitude.

The accumulated impulse response of LR to GDPCG is negative till period 10 and the magnitude is greater than -2. Response of LR to INF is positive till the period 10 and magnitude is less than 2. The impulse response of LR to MCG is approximately zero. The impulse response of own LR is still positive and 4 in magnitude throughout the period. This means market capitalization has a minute impact on gross domestic product per capita growth.

Table 9: Variance Decomposition of GDPCG INF MCG LR

GDPCG					
Period	S.E.	GDPCG	INF	MCG	LR
1	1.679714	100.0000	0.000000	0.000000	0.000000
2	1.751252	92.23895	1.876762	0.678967	5.205322
3	1.948361	77.49219	11.30501	1.093702	10.10910
4	2.044693	75.27107	10.31250	0.998732	13.41769
5	2.076813	73.84528	10.27602	0.972722	14.90597
6	2.082855	73.59388	10.33455	0.967431	15.10413
7	2.085957	73.37570	10.58103	0.983692	15.05958
8	2.088469	73.24650	10.66784	0.986333	15.09932
9	2.090826	73.14597	10.66438	0.987230	15.20242
10	2.092393	73.08650	10.64932	0.986464	15.27772
INF					
Period	S.E.	GDPCG	INF	MCG	LR
1	6.391438	1.191630	98.80837	0.000000	0.000000
2	6.859131	10.00175	86.49804	0.162657	3.337559
3	7.044391	11.69052	82.15304	0.606402	5.550036
4	7.098474	12.25593	80.95143	0.606055	6.186580
5	7.115582	12.26539	80.75647	0.605928	6.372211
6	7.118680	12.25494	80.76995	0.605405	6.369704
7	7.122593	12.25484	80.74333	0.609858	6.391971
8	7.126613	12.27695	80.67180	0.610701	6.440551
9	7.129182	12.29204	80.61400	0.610504	6.483455
10	7.130342	12.29848	80.58853	0.610328	6.502665
MCG					
Period	S.E.	GDPCG	INF	MCG	LR
1	50.04601	7.843400	0.572563	91.58404	0.000000
2	50.41349	8.089216	1.121124	90.41237	0.377287
3	51.97243	11.36063	1.632424	85.22735	1.779602
4	52.42303	11.30287	2.000859	84.01377	2.682494
5	52.80303	11.41282	2.329380	82.86854	3.389262
6	52.91744	11.38694	2.421797	82.51073	3.680525
7	52.94215	11.40301	2.448148	82.43889	3.709948
8	52.96281	11.39422	2.516527	82.38213	3.707119
9	52.97342	11.39858	2.528732	82.34991	3.722784
10	52.98384	11.40416	2.530207	82.31837	3.747264
LR					
Period	S.E.	GDPCG	INF	MCG	LR
1	1.082979	17.09654	16.84690	1.815343	64.24121
2	1.818615	20.29486	17.82950	0.822460	61.05319
3	2.228638	25.09323	12.13038	0.550891	62.22550
4	2.398052	26.40480	10.91493	0.476191	62.20408
5	2.444713	26.40954	11.50067	0.489666	61.60013
6	2.457797	26.14737	12.34205	0.535267	60.97531
7	2.468393	26.03810	12.70461	0.563942	60.69335
8	2.479424	26.05216	12.71239	0.573725	60.66172
9	2.487140	26.09194	12.63891	0.573069	60.69608
10	2.490732	26.10765	12.61193	0.571427	60.70899

Table 9 exhibits the results of variance decomposition by taking each variable separately. First of all, GDPCG is taken as a given variable and its variations are caused by the shocks to GDPCG, INF, MCG and LR. Own shock contribution is increasing in the short run, up to period 4 with 75.27 per cent contribution in the total fluctuation of GDPCG, after this, it declines and remains constant in the remaining time period. Innovation to INF brings increasing contribution up to period 3 with 11.30 per cent after this period it is falling and remains approximately constant throughout the period. Shock to MCG contributes very little throughout the time period. Innovation to LR in the short run, that is period 5 is contributing 14.90 per cent in the variations of GDPCG, and remains approximately constant throughout the long run time period, it is 15.27 per cent participating in the total variations.

Now inspecting the reaction contribution of a shock to different variables on the variations of INF, the given variable. Short-run own shock contribution is 82.15 per cent in period 3, after this period contribution is approximately constant throughout e.g. 80 .56 per cent in period 10. Up to period 3, the shock to GDPCG contributes 11.69 per cent in the variation of INF and after this contribution is the same for all remaining periods e.g. it is12.29 per cent in time period 10. Innovation in MCG contributes negligibly to the variations of INF. Shock to LR in the short run has increased participation by 5.55 per cent in period 3 but its participation is approximately the same throughout, say 6.50 per cent contribution in the total fluctuation in time period 10.

Own shock contribution in the fluctuation of MCG is declining throughout the period and remains constant after period 4. Shock to GDPCG has increasing and constant contribution in fluctuating the MCG, after period 2, this shock contributes same throughout e.g. 11.36 per cent. Shock to INF contributes 1.63 per cent to the total fluctuation of MCG in period 2 and after this, it also contributes approximately constant throughout the remaining periods. Shock to LR participates with 2.63 per cent in period 4 in the fluctuation of MCG but after this period contribution is slightly increasing and approximately constant throughout the period.

The last LR is taken as fluctuating variable for which different shocks are contributed. Own shock has declining participation in the overall variations of LR, own shock contribution is 61.60 per cent in period 5 and after this period it remains constant for the remaining periods. Innovation or shock to GDPCG provides 25.09 per cent importance in the short run to fluctuate the considering variable and remains approximately constant throughout the period after this. Shock to INF exhibits increasing participation until period 2 after this participation fluctuates LR is declining as it reaches 12.61 per cent in the long run, say in period 10. Shock to MCG provides a negligible contribution in the variations of LR, and it is approximately constant throughout the period.

IV.II.IV. DIRECT INTEREST RATE CHANNEL

The interest rate channel is also called the traditional interest rate channel due to its primary mechanism. (Ahmed et al., 2005). Due to tight monetary policy, the money supply decreases and interest rate increases which lead to a decrease in investment and consumption ultimately output decreases. To estimate the traditional or direct interest rate channel, the variables used are GDP per capita growth, inflation, lending rate, credit to the private sector by the bank, market capitalization growth and exchange rate.

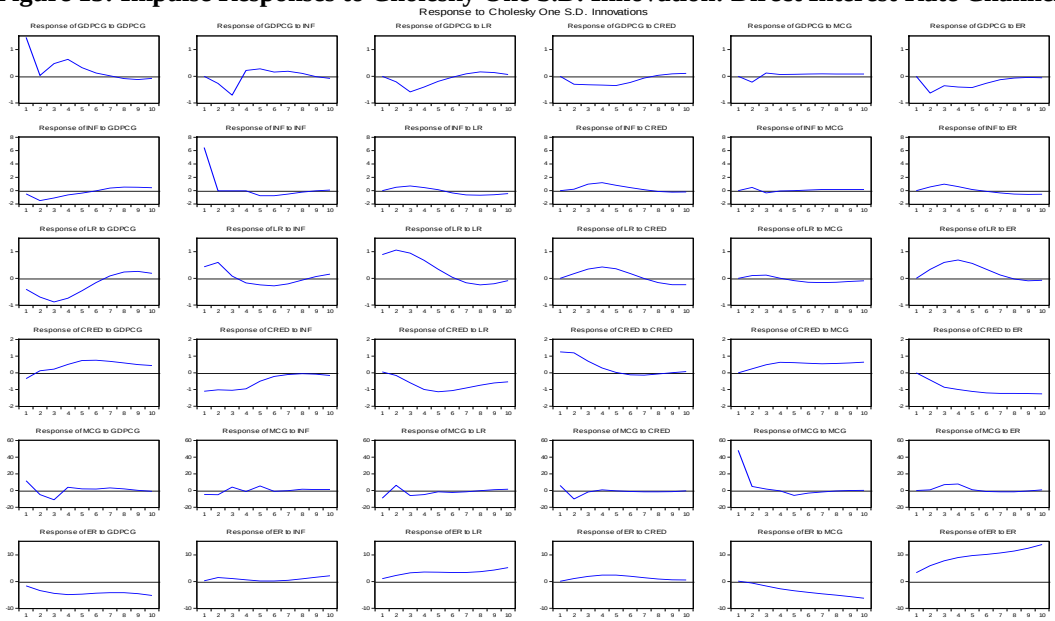
Table 10: VAR Lag Order Selection: **Endogenous Variables: GDPCG INF LR CRED MCG ER**

Lag	Log L	LR	FPE	AIC	SC	HQ
0	-831.1232	NA	8.27e+09	39.86301	40.11125	39.95400
1	-659.5277	285.9925	13225439	33.40608	35.14375*	34.04301
2	-620.6587	53.67632	12840772	33.26946	36.49656	34.45232
3	-587.4964	36.32062	19796830	33.40459	38.12112	35.13338
4	-552.7715	28.11058	40794849	33.46531	39.67127	35.74004
5	-452.1825	52.68947*	7730038.*	30.38964*	38.08504	33.21031*

Table 10 describes the optimal lag length of the VAR model as 5 in the bank lending channel. Figure 13 investigates the impulse responses to Cholesky one S.D. innovation under the direct interest rate channel when one S.D. shocks put to the error term. The impulse response of own GDPG is positive till the period 6 initially the magnitude is greater than 1. The impulse response of GDPG to INF is negative till period 3 and the magnitude is less than -1, after that it becomes positive till period 8 and the magnitude is less than 1. And start declining till the period 10. Response of GDPG to LR is negative initially till period 6 and magnitude is less than -1, and after that, it becomes positive till period 10. Response of GDPG to CRED is negative from period 1 to period 7 and magnitude is less than -1, and after that become positive till period 10. The impulse response of GDPG to MCG is negative initially till period 2 and the magnitude is less than -1, after that it

becomes positive till period 10. Responses of GDPG to ER are still negative throughout the time period with less than -1magnitude. The impulse response of INF to GDPG is negative and the magnitude is less than -2 till period 6. Response of INF to INF is, that is own response, is positive and 6 in magnitude, before the end of the period 2 till for response is zero after it is negative till the period 8 and the magnitude is less than -2. The impulse response of INF to LR is positive till period 5 and the magnitude is less than 2, after that response becomes negative till period 10. Response of INF to CRED is positive initially till period 7 with less than 2 magnitudes and become negative after that till period 10. The impulse of INF to MCG is positive from the start of period 1 to 2 And becomes negative from period 2 to 3, the response of INF to MCG is minute. Response of INF to the ER is positive till period 5 with less than 2 magnitudes and becomes negative after period 5 till period10.

Figure 13: Impulse Responses to Cholesky One S.D. Innovation: Direct Interest Rate Channel



Response of LR to the GDPG is negative till the period 6 and the magnitude is -1, after That it becomes positive till the period 10. Response of LR to the INF is positive till the period 3 with the less than 1 in magnitude and becomes negative from the period 3 to 8, and the magnitude is less than -1, after the period 8 it becomes positive till the period 10. Response of own LR is positive and the magnitude is 1 till the period 6 and after that become negative till the period 10 with the magnitude less than -1. Responses of LR to CRED are positive till period 6 with a magnitude less than 1 and after that, it becomes negative till period 10 with less than -1 in magnitude. The impulse response of LR to MCG is positive initially till period 3, after that it becomes negative till period 10. Responses of LR to the ER are positive till period 7 with less than 1in magnitude, after period 7 it becomes negative till period 10.

Response of CRED to GDPCG is negative till the end of period 1 after that it becomes positive till period 10 with a magnitude less than 1. Response of CRED to INF is negative till period 8 with the magnitude being -1. Responses of CRED to LR are still negative throughout the period with a magnitude of -1. Response of CRED to its own variable CRED is positive till the period 5 with a magnitude greater than 1 and becomes negative till 9. Response of CRED to MCG is still positive throughout the time period with a magnitude less than 1. Response of CRED to ER is negative till period 10 with a magnitude less than -1.

The impulse response of MCG to GDPCG is positive from the start till the period 1, from the period 1 to 3 is negative with a magnitude less than -20, after that, it becomes positive till the period 10. Response of MCG to INF is negative till the period 2, becomes positive from the period 2 to 3 and 3 to 4 and becomes zero after that. Response of MCG to LR is negative in period 1, become positive till period 2 and becomes negative till period 8. Response of MCG to CRED is positive initially from period 1 to 3 with a magnitude less than -20. Response of MCG to MCG is positive initially till period 3 with the magnitude of 50 and become negative from 3 to period 10. Response of MCG to ER is positive till period 5 with magnitude 10.

The impulse response of ER to the GDPCG is still negative till period 10 with a magnitude of 5. Response of ER to INF is positive with 1 magnitude throughout the period. Response of ER to LR is positive with the magnitude of 5 till period

10. Response of ER to CRED is positive till period 10 with a maximum magnitude of approximately 3. Response of ER to the MCG is negative and declining with the magnitude of 5 till the period 10. Response of ER to ER is positive and greater than 10 in magnitude till the period 10.

Impulse responses based on generalized one S.D innovation for the direct interest rate channel are the same in pattern, magnitude and. direction as in the case of impulse responses based on Cholesky one S.D innovation for the direct interest rate channel. The same results show correction of ordering in the case of impulse responses of Cholesky one SD innovation. So, the explanation of this figure is the same as above.

Figure 14: Impulse Responses to Generalized One S.D. Innovation: Direct Interest Rate Channel

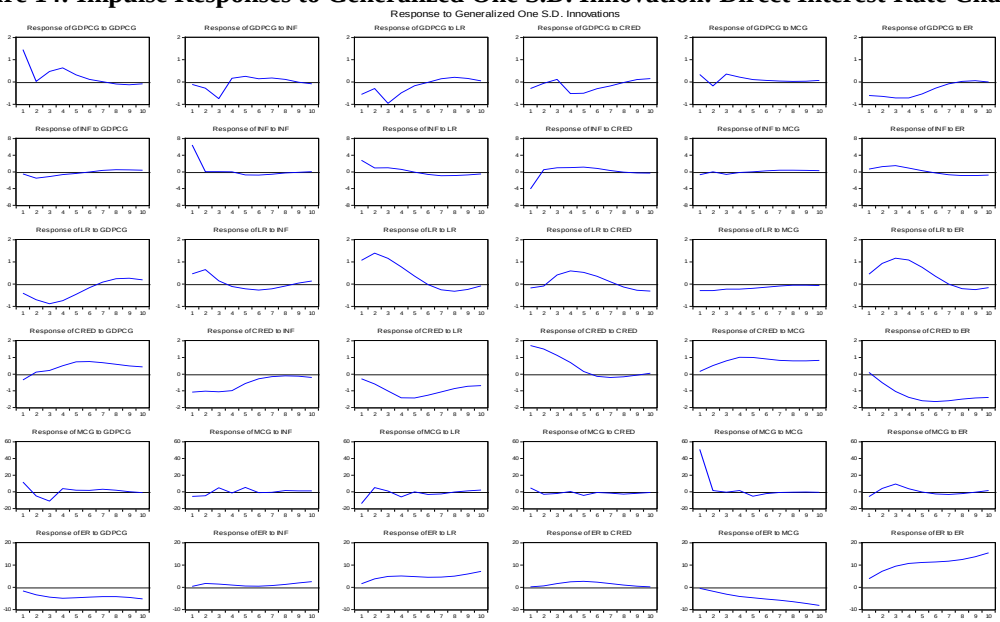
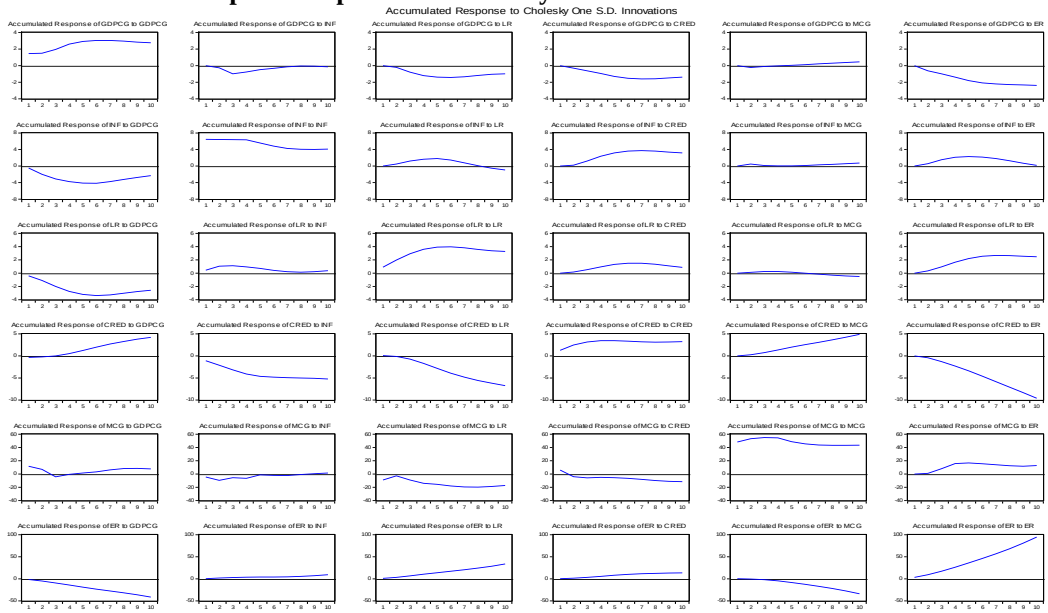


Figure 15: Accumulated Impulse Responses to Cholesky One S.D. Innovation: Direct Interest Rate Channel



In Figure15 accumulated impulse responses to Cholesky one S.D. innovation of the direct interest rate channel When one S.D. shock is put to the error term. The accumulated response of GDPCG to GDPCG is positive and 3 in magnitude till the period 10. The impulse response of GDPCG to INF is negative with -1 magnitude from period 1 to 7. Response of GDPCG to LR is negative with -2 magnitude throughout the period. Response of GDPCG to CRED is also negative with the -2 magnitude till the period 10. The accumulated response of GDPCG to MCG is positive but parallel to zero. Response of GDPCG to LR is negative and -3 in magnitude.

The accumulated response of INF to GDPCG is negative with -4 in magnitude throughout the period. Response of own INF effect is positive and the magnitude is more than 4. Response of INF to LR is positive initially till the period 8 with the magnitude of 2 after the period 8 it becomes negative till the period 10. The impulse response of INF to CRED is positive and increases throughout the period with 4 in magnitude. Response of INF to MCG is the same as the impact of GDPCG on MCG less responsive to approximately zero. The impact of INF on ER is positive throughout the period with 2 in magnitude.

The accumulated response of LR to GDPCG is negative throughout the time period with -4 in magnitude. Response of LR to INF is positive throughout the period and with 1 in magnitude. Response of LR to LR is positive till period 10 with 4 magnitude. Response of LR in CRED is positive throughout the period with 2 magnitudes. The response of LR to MCG becomes positive and negative but in minute changes that are near about the zero line. Response of LR to the ER is positive and 2 in magnitude.

The accumulated response of CRED to GDPCG is positive with a magnitude of 5 throughout the time period. Response of CRED to INF is negative and -5 in magnitude throughout the period. Response of CRED to LR is negative and greater than -5 in magnitude. The response of CRED to CRED means its own shocks effect is positive and the magnitude is 4. Response of CRED to MCG is positive and the magnitude is 5 throughout the period. The response of CRED to ER is negative till period 10 with -10 in magnitude in period 10.

The accumulated response of MCG to GDPC is initially positive till period 2 remains negative from period 2 to 3 after that it becomes positive with a magnitude of 10. The response of MCG to INF is negative till period 8 with -10 in magnitude at the start. Responses of MCG to LR are negative with a magnitude of -20 throughout the period. Responses of MCG to CRED are negative till the period 10 with a magnitude of -10. Response of MCG to MCG is positive and 50 in magnitude. Response of MCG is ER is positive and 20 in magnitude.

The accumulated response of ER to GDPCG is negative throughout the period with -50 in magnitude. Response of ER to INF is positive and approximately 10 in magnitude in the last. Response of ER to LR is positive with less than 50 in magnitude throughout the period. Response of ER to CRED is positive around 10 in magnitude throughout the period. Response of ER to MCG is negative throughout the period with -40 in magnitude. Response of ER to ER is positive and 100 in magnitude throughout the period.

Table 11: Variance Decomposition of GDPCG INF LR CRED MCG ER

GDPCG							
Period	S.E.	GDPCG	INF	LR	CRED	MCG	ER
1	1.451499	100.0000	0.000000	0.000000	0.000000	0.000000	0.000000
2	1.662175	76.28880	2.722705	1.562702	3.316922	1.812398	14.29647
3	2.020585	57.14919	14.25227	9.504004	4.736501	1.584994	12.77305
4	2.230324	54.98957	12.61795	11.10605	6.089841	1.381939	13.81465
5	2.344871	51.57955	12.80738	10.71368	7.769385	1.340460	15.78954
6	2.381123	50.25947	12.85654	10.41957	8.503623	1.420038	16.54076
7	2.396498	49.61985	13.29035	10.42271	8.487624	1.540198	16.63927
8	2.408610	49.25467	13.35268	10.75847	8.420110	1.650247	16.56383
9	2.419460	49.08199	13.23693	10.98954	8.487109	1.753632	16.45080
10	2.427691	48.85738	13.27038	10.98122	8.625261	1.865228	16.40054
INF							
Period	S.E.	GDPCG	INF	LR	CRED	MCG	ER
1	6.469245	0.591279	99.40872	0.000000	0.000000	0.000000	0.000000
2	6.701823	5.568165	92.63314	0.549297	0.104982	0.483257	0.661162
3	6.975515	7.723786	85.50899	1.498502	2.027972	0.702782	2.537967
4	7.144252	8.170916	81.52130	1.838776	4.658459	0.678346	3.132207
5	7.241795	8.234497	80.44656	1.826272	5.735305	0.660993	3.096375
6	7.307061	8.089419	80.13479	2.035944	6.011940	0.659489	3.068416
7	7.376017	8.216479	79.15347	2.769211	5.930670	0.696259	3.233916
8	7.452215	8.542948	77.63392	3.586025	5.838194	0.722002	3.676914
9	7.523021	8.834932	76.18266	4.195959	5.824026	0.752256	4.210165

10	7.573103	9.021803	75.19124	4.488714	5.828777	0.792812	4.676658
LR							
Period	S.E.	GDPCG	INF	LR	CRED	MCG	ER
1	1.072120	14.70612	16.41478	68.87909	0.000000	0.000000	0.000000
2	1.813673	20.21174	16.63123	58.44865	0.927167	0.312264	3.468952
3	2.342101	26.55750	10.09877	51.48422	2.748250	0.468889	8.642371
4	2.681262	28.01807	8.102976	45.68486	4.637885	0.357877	13.19833
5	2.835262	27.72919	8.001975	42.32413	5.784690	0.418494	15.74152
6	2.884095	27.10911	8.690677	40.92451	6.002939	0.660387	16.61237
7	2.904926	26.82003	9.067472	40.66599	5.917887	0.962350	16.56628
8	2.933851	26.96757	8.944944	40.55229	6.095849	1.190563	16.24878
9	2.966531	27.16311	8.797220	40.12222	6.603733	1.325735	15.98798
10	2.989508	27.14657	8.934139	39.59371	7.127795	1.396746	15.80104
CRED							
Period	S.E.	GDPCG	INF	LR	CRED	MCG	ER
1	1.712048	4.138027	41.80543	0.084398	53.97215	0.000000	0.000000
2	2.381523	2.391572	39.76880	0.519007	53.02362	0.966650	3.330344
3	2.940616	2.108115	38.80613	4.566765	40.44668	3.357334	10.71498
4	3.508508	3.561320	34.71550	11.38526	29.06668	5.562256	15.70898
5	4.001524	6.101944	28.26756	16.78985	22.34797	6.633291	19.85939
6	4.423935	7.932266	23.36983	19.56085	18.36074	7.071319	23.70499
7	4.767992	8.910945	20.16272	20.52267	15.89206	7.383668	27.12794
8	5.048231	9.335779	17.99807	20.47812	14.19956	7.803060	30.18541
9	5.291088	9.378837	16.40923	19.96087	12.92609	8.359905	32.96507
10	5.524495	9.214684	15.14020	19.28777	11.87586	9.011778	35.46971
MCG							
Period	S.E.	GDPCG	INF	LR	CRED	MCG	ER
1	51.01854	5.235077	0.811336	3.269168	1.374495	89.30992	0.000000
2	53.07812	5.688411	1.651985	4.405129	4.876572	83.35646	0.021448
3	55.23831	9.358862	2.074882	5.277546	4.610941	77.06441	1.613355
4	56.14635	9.518789	2.046453	5.890594	4.480257	74.59610	3.467810
5	56.77556	9.422161	2.900840	5.845610	4.386017	74.02191	3.423458
6	56.97100	9.454196	2.907816	5.978953	4.399412	73.82251	3.437109
7	57.14467	9.703698	2.892140	6.014975	4.439744	73.46368	3.485763
8	57.25077	9.787000	2.962267	5.993939	4.502453	73.20193	3.552407
9	57.28755	9.776198	2.998650	6.010103	4.548901	73.10819	3.557962
10	57.33750	9.786491	3.032091	6.080999	4.547379	72.98158	3.571461
ER							
Period	S.E.	GDPCG	INF	LR	CRED	MCG	ER
1	3.890002	17.62519	0.557806	7.467867	0.046351	0.154943	74.14784
2	8.409133	19.69547	3.291150	9.091325	1.836956	0.525258	65.55984
3	13.01276	19.71056	2.139282	10.08367	2.973577	1.937648	63.15526
4	17.32628	19.06777	1.341904	9.981393	3.581430	3.592778	62.43472
5	21.12988	17.78210	0.912313	9.478284	3.685313	5.108619	63.03337
6	24.51296	16.38939	0.684144	8.942083	3.398433	6.569576	64.01637
7	27.69290	15.08417	0.565713	8.491132	2.933988	7.909811	65.01519
8	30.92468	13.91438	0.555803	8.216950	2.447716	9.071239	65.79391
9	34.44539	12.94411	0.663284	8.183410	2.008160	10.00321	66.19783
10	38.44286	12.22179	0.844059	8.402327	1.633470	10.67562	66.22274

Table 11 depicts own shocks and cross shocks contribution in the fluctuations of variables GDPCG, INF, LR, CRED, MCG and ER in percentages. Row wise sum of all shocks is 100 indicating the contribution of shocks in percentages. First of all, interpreting the variations in GDPCG due to own and cross shocks. Own shock indicates declining contribution throughout the period in varying GDPCG, as in the short run its contribution is 50.26 per cent in period 6 while in the

long run own shock contribution is 48.86 per cent in period 10 to fluctuate GDPCG. Contribution of the innovation to INF brings 14.25 per cent variations in GDPCG in period 3 after this period contribution is declining and becomes constant. On the other hand, in the short run, that is period 4 participation of the innovation to LR brings 11.11 per cent fluctuations in GDPCG. In the long run shock to LR brings a constant contribution to the variations of GDPCG. Shock to CRED brings 7.78 per cent fluctuations in GDPCG in period 5 after this contribution remains constant throughout. Shock to MCG provides negligible contribution throughout the period in fluctuating GDPCG. In the short run, that is period 5, innovation to ER brings 15.79 per cent participation and after this contribution is approximately fixed up to period 10 with 16.40 per cent.

Now expressing variations in INF with the help of own and cross shocks effects. Innovation to INF provides a strong and larger but falling contribution in fluctuating INF while a shock to MCG brings negligible changes in INF. Shock to GDPCG brings 7.72 per cent changes in INF in period 2 after this it remains constant up to period 9 and reaches 9.02 per cent in period 10. In the short run at period 5, the shock to LR brings 1.83 per cent contribution in total fluctuation and provides 4.49 per cent contributing changes in INF. Shock to CRED enhances INF fluctuation with 6.01 per cent contribution in period 6 after this period contribution declines and remains constant. Innovation to ER provides an increasing but minor contribution to variations of INF.

Now presenting 100 per cent cross and own shocks shares in the variations of LR. Own shock contribution is declining overall and it is 51.48 per cent in period 3, say in the short run. After period 3, own shock contribution remains almost constant in the long run. Minor contribution is stated by the innovation to MCG into the fluctuation of LR, for the last periods, in the long run, a negligible rise in its share is observed. Shock to GDPCG provides a mix of increasing and decreasing share overall to fluctuate LR. The declining contribution of a shock to INF is 10.09 per cent in the short run that is period 3, after this period it is about constant throughout. Participation of shock to CRED into LR fluctuation is rising with little magnitude overall but a little fall is observed in period 7 showing a 5.92 per cent share. Share of innovation to ER into LR is 16.25 per cent in period 8 then falling up to 15.80 per cent in the long run, say in period 10.

Own shock contribution of CRED to the fluctuation of CRED is falling overall, it is 53.97 per cent in the first period and remains 11.88 per cent at the end of the period. Share of a shock to GDPCG into total fluctuation is rising overall up to period 7 with 8.91 per cent share and remains constant after this with 9.21 per cent share in period 10. Participation of the innovation to INF into the variations of CRED is falling but powerful. The contribution of the shocks to LR, MCG, and ER into changing variations of CRED is rising overall but the shock to ER contribution is more powerful. Weaker contribution is observed in the case of a shock to MCG.

Own shock share of MCG into the fluctuations of MCG is falling overall but it is powerful and larger in size as compared to the cross-shock effects. Cross shocks contribution is about constant after the period, GDPCG has a strong cross shock effect While INF has a weaker cross shock effect on MCG variations. Short-run (period 2) contributions of cross shocks, are 5.69 per cent, 1.66 per cent, 4.40 per cent, 4.88 per cent and 1.61 per cent in the case of GDPCG, INF, LR, CRED and ER respectively, while long-run (period 10) contribution of cross shocks are 9.78 per cent, 3.03 per cent, 6.08 per cent, 4.55 per cent, and 3.57 per cent in period 10 for the case of GDPCG, INF, LR, CRED and ER respectively.
Own shock participation in the case of ER is falling continuously overall but is powerful as compared to cross shocks contribution. Cross shocks shares of GDPCG, INF, LR, and CRED are falling continuously but increasing for the case of MCG. Innovation to GDPCG contribution is strong in overall cross shocks effects and shock to INF contribution shows weaker cross shock effect.

V. CONCLUDING REMARKS

This study investigates the effectiveness of five channels of the monetary transmission mechanism in Pakistan by applying the VAR model, impulse response function and variance decomposition. The study has used time-series data from 1972 to 2019. The study has pointed out that the exchange rate channel has been very effective in Pakistan. Moreover, the bank lending channel has also thrashed out to be the effective channel of the monetary transmission mechanism in Pakistan. It is pertinent to mention that the asset price channel has been ineffective in Pakistan. So based on these findings, we may recommend that the policymakers may focus on the exchange rate and lending rate while forming the monetary policy.

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