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Monetary Policy Effectiveness in Pakistan: A Reassessment of Four Transmission Channels

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Abstract
Monetary policy is an important financial tool to maintain the total demand in an economy. The main objective of this study is to understand the feasibility of monetary transmission mechanism channels and to investigate the fundamental monetary transmission mechanism channel for Pakistan. To evaluate the asset price, direct interest rate, exchange rate, and bank lending channels, the study used the time series data spanning from 1972 to 2023 and for the estimation of data employed the vector-autoregressive, impulse response function, and variance decomposition model. The results of the study indicate that the exchange rate channel is the more significant channel in Pakistan's economy.
Keywords: Asset price channel, Direct interest rate channel, Exchange rate channel, Bank lending Channel

1. Introduction

The public sector has three important functions: allocation, distribution, and stabilization. Allocation and distribution have their importance but stabilization is more significant for sustainable development of the economy. Monetary policy instruments are important for sustainability. An important function of the central monetary policy is connected with commercial banks to control the money supply and interest rate. Moreover, monetary policy has many objectives but the objectives of price stability and economic growth are observed today by every central bank. The money transmission mechanism is the process through which monetary policy affects economic behavior and prices. Monetary transmission reveals how the supply of money influences GDP growth through the different monetary channels. It is important to note these monetary transmission channels are changing from country to country due to many reasons (Ahmed et al., 2011). A monetary policy framework is prepared by the monetary authority to achieve the policy objectives, likely control the targeting of inflation, and achieve sustainable economic growth (Mohanty, 2012: Iqbal & Shahzad, 2020; Senturk & Ali, 2021).

The monetary transmission mechanism illustrates the various channels that influence macroeconomic variables like prices, employment, and output (Akani, 2017; Machove, 2022). The monetary policy tools are transferred to prices and output in the monetary transmission mechanism process. Moreover, the Monetary transmission mechanism is divided into two parts. The first one is the neoclassfical channels in which financial markets are perfect or financial transmission of prices and return on assets, for instance, asset price channel, interest rate channel, and exchange rate channel. The second part of the monetary transmission mechanism channels is the non-neoclassical in which the financial markets are imperfect or credit channels which reveal the changes in bank lending and financial channels (Taylor, 1995). Monetary policy may influence the macroeconomic variables through different monetary transmission channels and these channels are changed from country to country via different essential banks and economic conditions (Baig, 2009; Nwezeaku, 2018; Oulay, 2021). Variations in interest rates from the monetary authority of the central bank affect the asset price further causing the wealth impact. Moreover, higher interest rates affect the currency and, as a result, affect the net export, aggregate demand, and output. On the output side spending, saving, and investment attitudes of individuals and firms are affected in the economy by these changes (Mohanty, 2012; Kumar, 2018; Nasir, 2019). The objective of the monetary transmission mechanism is to recognize how and what dimensions of monetary policy impact the economy of the country and what tools are used by the monetary policy authority or policymakers to stabilize the economy of the country. Therefore, to apply the perfect monetary policy in which real variables are influenced by the monetary variables (Boivin et al., 2010; Ahmad, 2018).

The country's central bank used monetary policy to attain economic goals. Monetary policy uses various instruments for the sustainability of monetary variables like money supply, interest rate, bank credit, and exchange rate and uses the tools for economic goals, likely full employment, inflation targeting, exchange rate targeting, and stability of economic growth (Khan & Ahmad, 2018; Shahzadi & Ahmad, 2018; Sana, 2022). Monetary policy rules are connected with the monetary transmission mechanism that helps the central bank in decision-making (Taylor, 2002). Central banks influence the extent of lending and interest rates through the monetary policy in the economy (Hussain, 2014; Iqbal & Raza, 2018). The research evaluation describes that monetary transmission mechanisms (MTM) play an important role in increasing prices (P), investment spending, and aggregate output. Though monetary-transmission-mechanism (MTM) has become an important area of research, in the case of Pakistan, a smaller number of empirical studies have been found in this field, therefore this problem is not effectively studied in Pakistan. Several empirical studies are available in Pakistan for example (look at Asif et al (2005; Mahmood & Aslam, 2018), Irshad (2014), Saghir et al (2022), Ahmed et al (2011), and Tasneem and Muhammad (2006), Waliullah and Fazli (2011), Hussain (2014), and Alam and Waheed (2006). Therefore, in the Pakistan case study, not one empirical study is available to comprehend whether the corresponding outcomes of various monetary transmission channels (MTM) varied over time or not. In previous, all the empirical research has only targeted on analyzing whether the different channels worked or not. Therefore, there are weaknesses in these empirical studies, so we have chosen this examination to explore entirely monetary transmission mechanisms (MTM).

This study is organized into six sections consistently investigates the monetary policy effectiveness in Pakistan and analyses the four monetary transmission mechanism channels. Section 2 describes the various monetary transmission mechanism channels. Section 3 presents the literature review and section 4 shows model specification while section 5 explains data and methodology. Section 6 illustrates the results and interpretation of the results. Furthermore, section 7 uncovers the conclusion and policy recommendations.

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2. Monetary Transmission Mechanism (MTM) Channels

The monetary transmission mechanism describes how much changes in the supply of money and interest rate influence the real macroeconomic variables like output, prices, and employment level in the economy. Monetary transmission mechanism channels are split into three basic monetary transmission mechanism channels: credit channels, money channels, and other asset price channels.

Traditional Interest-Rate Channel

$$M \uparrow \Rightarrow i_r \downarrow \Rightarrow \Rightarrow I \uparrow \Rightarrow Y \uparrow \quad (1)$$

$$M \uparrow \Rightarrow P^{e\uparrow} \uparrow \Rightarrow \pi^e \uparrow \Rightarrow i_r \downarrow \Rightarrow Y \uparrow \quad (2)$$

Other Asset Price Channels

Exchange Rate (ER) Impacts on the (X-M) Net Exports

$$\mathrm{M} \uparrow \Rightarrow \mathrm{i_r} \downarrow \Rightarrow \mathrm{E} \uparrow \Rightarrow \mathrm{NX} \uparrow \Rightarrow \mathrm{Y} \uparrow \quad (3)$$

Tobin q Theory

$$\mathrm{M} \uparrow \Rightarrow \mathrm{P_s} \uparrow \Rightarrow \mathrm{q} \uparrow \Rightarrow \mathrm{I} \uparrow \Rightarrow \mathrm{Y} \uparrow \quad (4)$$

Wealth Effects

$$\mathrm{M} \uparrow \Rightarrow \mathrm{P_s} \uparrow \Rightarrow \text{wealth} \uparrow \Rightarrow \text{consumption} \uparrow \Rightarrow \mathrm{Y} \uparrow \quad (5)$$

Credit View

Bank lending Channel

$$M \uparrow \Rightarrow \text{bank deposits} \uparrow \Rightarrow \text{bank loans} \uparrow \Rightarrow \mathrm{I} \uparrow \Rightarrow \mathrm{Y} \uparrow \quad (6)$$

Balance Sheet Channel

$$\mathrm{M} \uparrow \Rightarrow \mathrm{P_s} \uparrow \Rightarrow \text{firm net worth} \uparrow \Rightarrow \text{adverse selection} \downarrow \Rightarrow \text{moral hazard} \downarrow \Rightarrow \text{lending} \uparrow \Rightarrow \mathrm{I} \uparrow \Rightarrow \mathrm{Y} \uparrow \quad (7)$$

Cash Flow Channel

$$M \uparrow \Rightarrow i \downarrow \Rightarrow firms\ cash\ flow \uparrow \Rightarrow adverse\ selection \downarrow \Rightarrow moral\ hazard \downarrow \Rightarrow lending \uparrow \Rightarrow I \uparrow \Rightarrow Y \uparrow \quad (8)$$

Unanticipated Price Level Channel

$$\mathrm{M} \uparrow \Rightarrow \text{unanticipated P} \uparrow \Rightarrow \text{firms real net worth} \uparrow \Rightarrow \text{adverse selection} \downarrow \Rightarrow \text{moral hazard} \downarrow \Rightarrow \text{lending} \uparrow \Rightarrow \mathrm{I} \uparrow \Rightarrow \mathrm{Y} \uparrow \quad (9)$$

Household Liquidity Effects

$$\mathrm{M} \uparrow \Rightarrow \mathrm{P_s} \uparrow \Rightarrow \text{value of household financial assets} \uparrow \Rightarrow \text{likelihood of financial distress} \downarrow \Rightarrow \text{consumer durable and housing expenditure} \uparrow \Rightarrow \mathrm{Y} \uparrow \quad (10)$$

3. Literature Review

There are many empirical studies on monetary transmission mechanisms (MTM), and all show the various effects and features. Many studies have revealed significant outcomes, and few studies have explored negative results. Some empirical studies have undertaken an aggregated review, while some have achieved a separate analysis.

Hayat et al. (2022) highlighted that monetary policy plays a crucial role in managing aggregate demand. This analysis aims to assess the effectiveness of various channels within the monetary transmission mechanism and identify the primary transmission channel in Pakistan. Utilizing vector autoregressions, impulse response functions, and variance decomposition, the study examines time-series data from 1975 to 2015 to evaluate the interest rate channel, asset price channel, credit channel, and exchange rate channel. The findings confirm that all four channels significantly contribute to the monetary transmission mechanism in Pakistan.

Emmanuel et al. (2022) analyzed the influence of mobile money on Ghana's monetary policy effectiveness. This study used the monthly data from 2012-2018 and used the SVAR model. The study used the output gap as a dependent and short-run interest rate, inflation rate, nominal exchange rate, and foreign and domestic price levels as exogenous variables. This study suggested that through the growth of mobile money, the monetary policy of Ghana became less effective. This study suggested that Ghana's monetary authority must add mobile money activity to manage the monetary policy in Ghana.

Dang and Dang (2021) analyzed the effect of bank diversification on monetary policy transmission by bank lending channels. The study used data from Vietnamese commercial banks from 2008-2018 and made 320 observations from 30 banks. The results show that the transmission of bank lending channels becomes weaker when banks interfere in non-traditional activities. Implications of different policies banks should move towards the non-traditional part of banking sectors.

Nicholas (2021) estimated that substantial evidence shows that the efficiency of monetary policy depends on the housing cycle because housing prices were the most important factor for banks to lend. The study used monthly data from February 2020 to October 2020 from 31 countries. Findings show that the COVID-19 recession created a challenge for expansionary monetary transmission.

Manuchehr (2020) suggested an asymmetric analysis of the impact of monetary policy on economic output fluctuations. The study collected data from nine countries from 1987 to 2019. It pointed out that contractionary monetary policy is more effective than expansionary policy and that expansionary policy has a lower effect on positive output growth.

Keyra (2018) used direct and indirect monetary policy tools in Barbados, Jamaica, Trinidad, and Tobago and checked their effectiveness in these countries. Because of higher financial liquidity, the result shows weak transmission changes in the policy interest rate. Furthermore, the result shows that price stability is not sufficiently achieved by changes in the short-term interest rate. The main finding also shows that the central bank used a combination of direct and indirect monetary policy tools.

Iwan (2018) examined the monetary transmission mechanism channels in Indonesia and their influence on the economy. The main findings indicate that interest rate is most influential in stabilizing output and price level, while exchange rate and asset price, credit channel does not play any significant role in the mechanism and is passed by Tobin q channels.

Rami and Bassam (2017) examined the influence of monetary policy tools on Jordanians' GDP growth and economic parameters. This study included quarterly data for 10 years, from 2005 to 2015. The findings show the inverse relationship between the rediscount rate and real GDP growth in Jordan up to the long-term and short-term monetary policy instruments.

Dina et al. (2017) the study examined the monetary transmission mechanism in European Union countries and examined the relationship between the real economy and monetary policy and their influence on demand and production and monetary transmission mechanism was divided into three channels interest rate, exchange rate, and asset prices. The main finding shows that asset prices influenced the credit channel interest rate variables influenced the stock market and the production index was influenced by the exchange rate and credit channel influenced in the long run.

Irshad (2014) the study analyzed the monetary policy influenced in the financial intermediation channel in Pakistan by the influence of interest rate, and credit rate channel. The main finding shows that both channels have varied during the last two decades. Since 2000 credit channels have become less effective in transmission mechanism channels. The interest rate became effective in this period.

Ulu and Ralf (2013) examined the comparison between the balance sheet and the lending channel in the monetary transmission mechanism. The main findings indicate that the balance sheet is an important factor and drives the policy toward the economy.

Rosoiou and Rosoiu (2013) explored how the central bank used the monetary policy channel for sustainable economic growth and price stability and the study used data from 1998-2012. The finding shows that interest rate and the exchange rate play an important work in Hungary, and the Czech Republic but not in Romania, and Poland, and macroeconomic indicators do not have any important role in this. And exchange rate channel becomes ineffective when adopting the euro currency in these countries. And thus, creating a more important OR powerful interest rate channel in the mechanism.

Elena (2012) the study examined the monetary policy that influenced the monetary transmission mechanism and studied the exchange rate channel in Romania. The finding shows that the interest rate channel was significant and measured the impact of demand and reveals the effect of the exchange rate channel.

Jamiloy and Rustam (2012) showed the monetary transmission mechanism in the Commonwealth independent state after the breakdown of the Soviet Union. The main finding shows that output is influenced by the (M2) and inflation is influenced by refinancing and remittances and the exchange rate plays an important role in output and inflation.

Matias and Helder (2011) estimated the credit channels' effects on the emerging economy. The results indicated that the influence of economic variables shocks on credit supply, and credit spread are smiler to credit channel theory. The study analyzed that these shocks in the interest rate were not directly transferred to the economy but via credit channels.

Hiled and Dag (2010) measured the monetary policy transmission mechanism and the work of housing prices in monetary transmission in Sweden, Norway, UK. The study used the quarterly data from 1983 – 2006. The results show that housing prices influenced the policy strongly. When decreased in housing prices it influences output and inflation. And the finding shows equal changes in interest rates and housing prices.

Bojan (2006) showed the significance of bank balance sheets on the monetary transmission mechanism. The main finding shows that bank capital important determinant of the monetary transmission mechanism and affected directly the bank balance sheet. And such influence is caused by the structural changes in the banking system.

Asif et al. (2005) the study analyzed the monetary transmission mechanism and the influence of monetary policy effectiveness. The main finding shows the tight monetary policy reduced the domestic demand, and investment was financed by lending channels which reduced the price pressure with important lags. And the study shows the asset price channel and exchange rate has less importance by comparison.

Rodrigo et al. (2003) revealed the bank lending channel in Chile. The study used the banking sector data and corporate data from 1990 to 2000. For the estimation of the data study used the VAR model. The main finding shows that during the sample period bank lending channel influenced the macroeconomic activity and drives as like as monetary transmission mechanism in Chile.

The literature review highlights the varying effectiveness of monetary transmission mechanisms across different economies, with interest rates, exchange rates, credit, and asset price channels playing key roles. While these channels significantly influence monetary policy, their effectiveness can be impacted by financial innovations, structural changes, and external shocks such as economic crises. Overall, the literature underscores the evolving nature of monetary transmission, emphasizing the need for adaptive strategies to address dynamic financial and economic challenges.

4. Model Specification

To evaluate the effectiveness of monetary transmission mechanisms channels in Pakistan, we have revisited the different specified models by Hayat et al. (2022).

Model 1: Fundamental Model

$$OL = f(MP)$$

$$PL = f(MP)$$

Model 2: Bank Lending (Credit Channel)

$$PL = f(C, INT)$$

$$OL = f(INT, C)$$

Model 3: Exchange Rate Channel

$$OL = f(ER, INT)$$

$$PL = f(INT, ER)$$

Model 4: Asset Price Channel

$$OL = f(MCG, INT)$$

$$PL = f(INT, MCG)$$

Model 5: Direct Interest Rate Transmission Channel

$$PL = f(C, ER, INT)$$

$$OL = f(ER, C, INT)$$

Bank Lending Channel (Credit Channel): GDPPCG, Interest Rate, C, INF

Exchange Rate Channel: GDPPCG, INF, Interest Rate, ER

Asset Price Channel: GDPPCG, Interest Rate, INF, MC

Direct Interest Rate Transmission Channel: GDPPCG, C, INT, INF
Where:
GDPPCG = GDP Per Capita Growth (Annual %)
INFD = GDP deflator inflation rate (Annual %)
C= Domestic Credit to Private sector (% of GDP)
MCG= Market Capitalization of Growth (Annual %)
INT= Lending Rate (Annual %)
ER= Doller-Rupee Exchange Rate
OL= Output Level
PL= Price Level
MP= Monetary Policy

5. Data and Methodology

In this study, we used the time series data from 1972-2023 and data have been gathered from World Development Indicators (WDI) and various Pakistan Economic Survey (PES). Used this data for the analysis of the various monetary transmission mechanism channels and probed their impact on the output and inflation of Pakistan. For the estimation, we have employed the Vector-Autoregressive (VAR) model or technique with Cholesky decomposition (CD), impulse response function (IRF), and Variance decomposition (VD).

5.1. Vector- Autoregressive (VAR) Technique

Vector autoregressive model is a technique or procedure, which describes that endogenous variable or (DV) is a function of delayed independent variables (IV). This model also includes the lagged values of the parameters. Furthermore, in (VAR) model each equation adds the "K" lagged values of X and Y variables in the model. Equations in (VAR) model are estimated by using the Ordinary least square method (OLS)

$$X_{1t}=\alpha+\sum_{j=1}^{k}\beta_j X_{t-j}+\sum_{j=1}^{k}\delta_j Y_{t-j}+\mu_{1t} \quad (11)$$

$$Y_{1t}=\alpha+\sum_{j=1}^{k}\theta_j X_{t-j}+\sum_{j=1}^{k}\delta_j Y_{t-j}+\mu_{2t} \quad (12)$$

In equations (11) and (12) μ_{1t} and μ_{2t} are the stochastic error terms, which are also called the impulse or shocks or innovations within the area of (the VAR) model. Usually, we will determine the optimal lag length of "K" before the estimation of the above equations. There are many ways to investigate the optimum lag length such as Final prediction error (FPE), Hannan-Quinn information methods (HQIM), and Akaike.

5.2. Impulse Response Function (IRF)

Basically, the impulse response function (IRF) is innovation or impulse to a VAR model.
When we give or put the shock to error terms, it identifies the endogenous variables' reactivity in the VAR model. Here, μ_1 and μ_2 are the error terms which are given below in equations (13) and (14).

$$Y=\beta_1+\beta_2 X_{t-j}\beta_3 Y_{t-j}+\mu_1 \quad (13)$$

$$X=\beta_4+\beta_5 Y_{t-j}\beta_6 X_{t-j}+\mu_2 \quad (14)$$

To examine the influence of each variable on the VAR system, applying one unit shock to each variable in the VAR system. While, before the estimation of the variables, the ordering of the variable is very important in the estimation. For this many methods are used but we have used or chosen the Cholesky def adjustment method for ordering the variables.

5.3. Variance Decomposition Function (VDF)

Variance decomposition is a system that is used for the analysis of complex stochastic systems. A stochastic system is a random process system that is used for the control of the behavior of random variables. The variance decomposition function also provides significant information on random innovations. This function or method splits the forecast error of a singular variable into the parts that denote each of the dependent variables. VDF is also presented in table form. Variance decomposition is also helpful to estimate the reactivity of individual variables to foreign shocks, for this SVAR model can be applied.

6. Results and Discussions

The results of the VAR model are not directly clear and unexplainable. The analysis is given in three separate parts, one of them is the lag order selection the second one is the impulse response function and the last one is the variance decomposition.

6.1. Basic Model: GDPPCG INF INT

This model finds out the optimum lag structure and estimates the overall significance of monetary policy on price and output.

Table 1: Vector Auto-Regressive Lag-Order-Selection: GDPPC INFD INT

Lag	Log L	LR	FPE	AIC	SC	HQ
0	-372.94	NA	1779.39	15.99	16.11	16.04
1	-345.63	49.97	817.40	15.21	15.69*	15.39*
2	-335.37	17.46*	778.97*	15.16*	15.99	15.47
3	-328.04	11.54	847.35	15.23	16.41	15.68
4	-319.73	12.02	894.21	15.26	16.80	15.84
5	-315.21	5.95	1126.85	15.45	17.34	16.16

Table 1 shows the lag-selection criterion of the VAR model. Table 1 reveals maximum lag period of the model is lag 2 since in this model value of LR is higher rather than the values of SC, HQ, AIC, and FPE.
Figure 1 shows that given a one SD positive impulse to GDPPCG, then primarily GDPPCG is affected significantly at year 1 and after that, it declines and touches the baseline at year 2 and becomes negative till year 3. Moreover, after that, it becomes positive for 6 years and after that, it converts into linear which is equal to the baseline. Applying the SD deviation to INF is

influencing the GDPPCG negatively at year 4 and after that, it becomes positive and parallel to the baseline at year 5. Furthermore, it becomes negative and parallel to the baseline till year 7, and after it becomes positive and stable or parallel to the baseline. Figure 1 also indicates that early INT influenced the GDPPCG negatively at year 6 after that, it touched the baseline at year 7. Additionally, after that, it becomes positive and gets closer to the baseline. Further, figure 1 explains that if we exert one positive shock of standard deviation to GDPPCG, it shows negative effects on inflation and declines at year 4 and after that, it becomes parallel to the baseline at years 5 and 7. When one positive impulse of standard deviation is given to inflation, it influenced positively at year 1 and after that, it declines and becomes negative till year 4. Afterwards, it becomes positive and touches the baseline at year 5, and after that becomes negative and parallel to the baseline. When one SD positive shock is given to the INT, INF is influencing positively declined and touching the baseline at year 6, after year 6 it becomes negative and parallel to the baseline. INT is affected negatively at year 1, after this, it increases and becomes positive at year 2. Moreover, after year 2 it declined negatively and stirred to the baseline at year 6 and became the parallel to the line at year 7 by giving the one SD positive shock to GDPPCG. Figure 1 highlights that one SD positive shock is given to the INF, INT is influencing positively and declined at year 4 and getting closer to the baseline after year 4. Besides, it becomes parallel to the baseline at year 6 and after that, it becomes negative and parallel to the baseline at year 7. Initially, the interest rate is positively affected and reduces at year 6 and after this, it transforms into a negative by giving the one SD positive shock to INT.

Figure 1: Impulse-Response Function (IRF) based on Fundamental Model

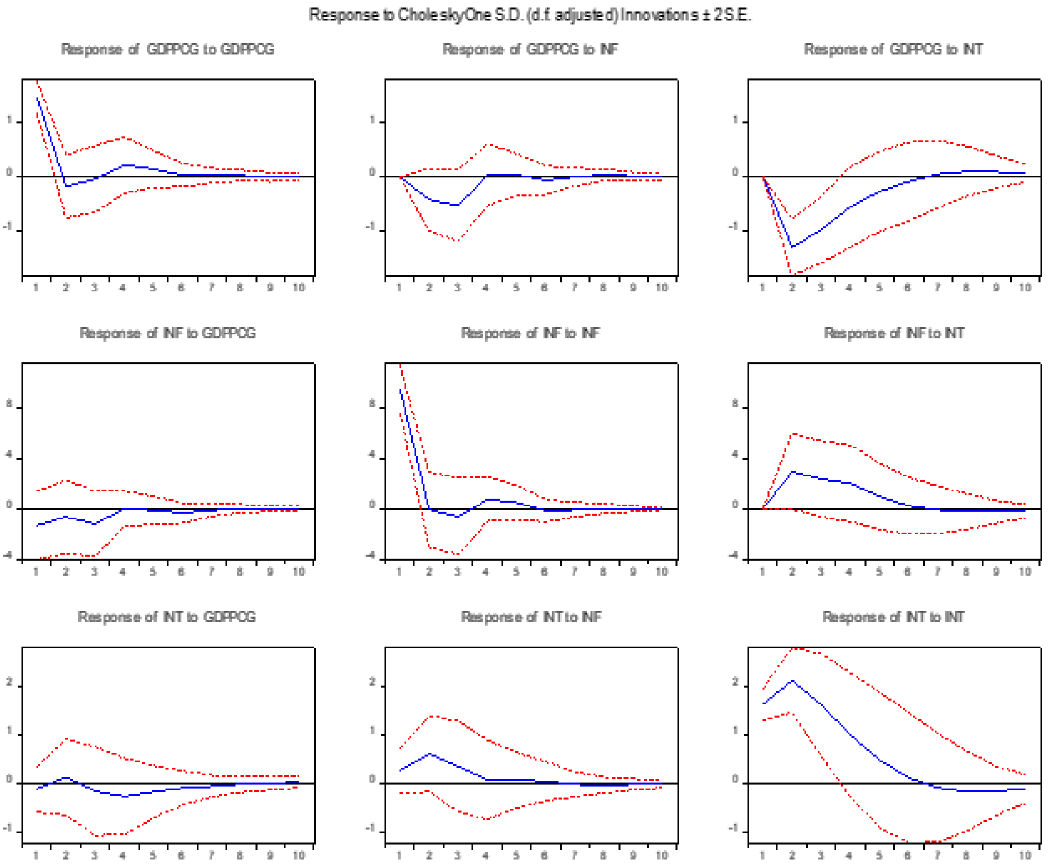


Table 2 explains the variance-decomposition (VD) of GDPPCG, INF, and interest rate (INT). The upper section of the table represents the variance-decomposition (VD) of Gross Domestic product per capita growth (GDPPCG). For the period of short-run, the impulse or shock for the annual 1 to GDPPCG accounts for 54.16 % changes of fluctuation in GDPPCG this instability in fluctuations is called own shock or internal shock. Disturbance to INF can cause a 4.4% fluctuation in GDPPCG, while a shock to INT can cause a 41.44% fluctuation in GDPPCG (cross shock). Results reveal that total instability becomes equal to 100% as a whole. The table indicates that after 2 years, the own shock to GDPPCG declines by 39.93% but the variation of instability in GDPPCG increases because of an increase in INF and interest rate (INT), and this process is called the cross impulse or shocks. Moreover, the middle section indicates the variance- --decomposition (VD) in INF. In INF 98.13% account for fluctuation occurred in the short-run period for the annual 1. 1.86% fluctuation in INF due to shock in GDPPCG, while shock to INT cannot fluctuate the variation in INF. So, the total influence of fluctuation is 100%. For the long-run duration, at year 2 shock to INF account declines variation of fluctuation in INF 89.40% due to own-shock. The instability in INF increasing because of an increase in GDPPCG and interest rate (INT) for a long-run length. At the end, the table reveals the variance distribution of the interest rate. Describes the short-run impact for the annual 1 to interest rate accounts for 97.01% of the variation of instability. Impact on GDPPCG can cause 0.52% changes in interest rate. Meanwhile, the impulse to INF causes the 2.45% fluctuation in INT (cross shocks). Changes in fluctuation are 100%. For the prolonged duration at year 2 shock to INT declined by 93.84% (own shock) while the fluctuation in INT increased due to an increase in GDPPCG (0.39%) and INF (5.75%) (cross shocks) for the whole period.

Table 2: Variance-Decomposition (VD) of the Fundamental Model

Period	S.E.	GDPPCG	INF	INT
		Variance-Decomposition (VD) of GDPPCG		
1	1.49	100.00	0.00	0.00
2	2.04	54.16	4.39	41.44
3	2.33	41.67	8.67	49.65
4	2.41	39.93	8.16	51.90
5	2.43	39.62	8.04	52.32
6	2.43	39.56	8.10	52.33
7	2.43	39.55	8.09	52.35
8	2.43	39.47	8.10	52.41
9	2.43	39.42	8.09	52.47
10	2.44	39.39	8.09	52.51
		Variance-Decomposition of INF		
Period	S.E.	GDPPCG	INF	INT
1	9.59	1.86	98.13	0.00
2	10.05	2.12	89.40	8.47
3	10.41	3.31	83.71	12.97
4	10.62	3.18	80.83	15.98
5	10.68	3.16	80.19	16.63
6	10.69	3.26	80.09	16.64
7	10.69	3.27	80.07	16.65
8	10.69	3.27	80.03	16.69
9	10.70	3.27	79.98	16.74
10	10.70	3.27	79.95	16.77
		Variance-Decomposition of INT		
Period	S.E.	GDPPCG	INF	INT
1	1.66	0.52	2.45	97.01
2	2.77	0.39	5.75	93.84
3	3.23	0.54	5.38	94.07
4	3.39	1.12	4.92	93.95
5	3.43	1.35	4.85	93.79
6	3.43	1.42	4.85	93.71
7	3.43	1.45	4.85	93.68
8	3.44	1.45	4.85	93.68
9	3.44	1.45	4.84	93.69
10	3.44	1.45	4.84	93.69

6.2. Bank-Lending-Channel (Credit channel)

This segment explains the credit (C) and how bank credit works through the bank lending channel. While credit of banks affects the supply of loanable funds, consumption (C), prices (P), investment, and output (Y). Changes in monetary policy can influence the supply of loanable funds and decrease bank reserves. These changes can affect consumption, output, investment, and prices. Here, analyzed the bank lending channel to understand the impact of the lending channel on the output (Y), consumption (C), interest rate (INT), investment (I), and prices (P).

Table 3: Vector-Autoregressive Lag-Order-Selection (LOS) Criterion: GDPPC, INFD, CREDIT, INT

Lag	Log L	LR	FPE	AIC	SC	HQ
0	-509.37	NA	36104.82	21.84	22.00	21.90
1	-420.56	158.72*	1634.38*	18.74*	19.53*	19.04*
2	-406.08	23.40	1772.16	18.81	20.22	19.34
3	-396.20	14.30	2392.67	19.07	21.11	19.84
4	-383.78	15.85	3012.84	19.22	21.90	20.23
5	-374.74	10.00	4632.29	19.52	22.82	20.76

Table 3 illustrates the VAR lag-order-selection (LOS) criterion of the Bank Lending Channel. For the estimation consider lag 1 because in lag 1 the values of SC, AIC, and HQ are lower and the value of LR is high. So, therefore, a table represents, that the maximum delayed duration of the model is one (1).

Figure 2 shows the impulse response function on the credit channel. Reveals that, Subject to imposing the one (1) S.D. impulse to the GDPPCG, initially GDPPCG is affected positively at year 1 and after that, it becomes negative at year 2. Moreover, after year 2, it improved and became positive at year 3 and after that, it became steady and parallel to the baseline at year 6. When one SD positive shock is given to the INF, GDPPCG is affecting the negative decline till year 4. Thereafter, it becomes positive at year 5 and after that, it becomes negative and closer to the baseline. Figure 2 shows that employing the one Standard-Deviation (SD) innovation to CREDIT, GDPPCG is influenced positively at year 2 and after that, it declined negatively until year 6. Furthermore, it becomes positive and parallel to the baseline after year 6. GDPPCG is affected negatively when one SD shock is given to the INT. GDPPCG decreases negatively at year 7 and after that it becomes positive. Figure 2 shows that INF is negatively affecting throughout the whole period when one SD positive shock is given to the GDPPCG. INF is negatively influenced at year four (4) and then it is achieved to become equal to the baseline. If one SD positive shock is given to the INF, early INF is influencing positively and after that, it declines and becomes negative at year 4. Additionally, after year 4 it becomes positive at 5 and in year 6 (6), it goes increasingly negative and near the baseline. INF is positively affected when the one SD positive shock is given to the INT. INF is significantly influenced and declined in the annual year six (6) and the slope becomes negative and parallel to a baseline at year 10. If we give the one SD positive shock to GDPPCG, CREDIT is influenced positively overall the duration. CREDIT is positively affecting and becomes steady at year 10. While CREDIT is negatively affected, when one SD positive shock is given to INF, CREDIT is affected negatively wholly. Figure 2 shows the positive influence of the CREDIT, when one SD positive shock is given to the CREDIT, CREDIT is positively influenced overall. If one SD positive shock is given to the INT, CREDIT is affected negatively throughout.

Figure 2 also reveals when the one standard deviation (SD) positive impulse to GDPPCG, interest (INT) is negatively influenced at year 1, and after that, it touches the baseline at year 2. Afterward, it declined negatively at year 5, and then it got closer and became parallel to the baseline at year 8. By giving the one (1) standard deviation impact to inflation (INF), interest rate (INT) is successfully effective in year four (4) and then, gets closer and parallel to the baseline at year 5. Initially, INT is influenced positively at year 6 and after that, it becomes negative and parallel to the baseline at year 8, if given one SD positive shock to CREDIT, INT is affected positively, when one SD positive shock is given to the INT, INT is positively declined till year 8 and after that, it getting close and parallel to the baseline.

Figure 2: Impulse Response Function: Bank Lending Channel

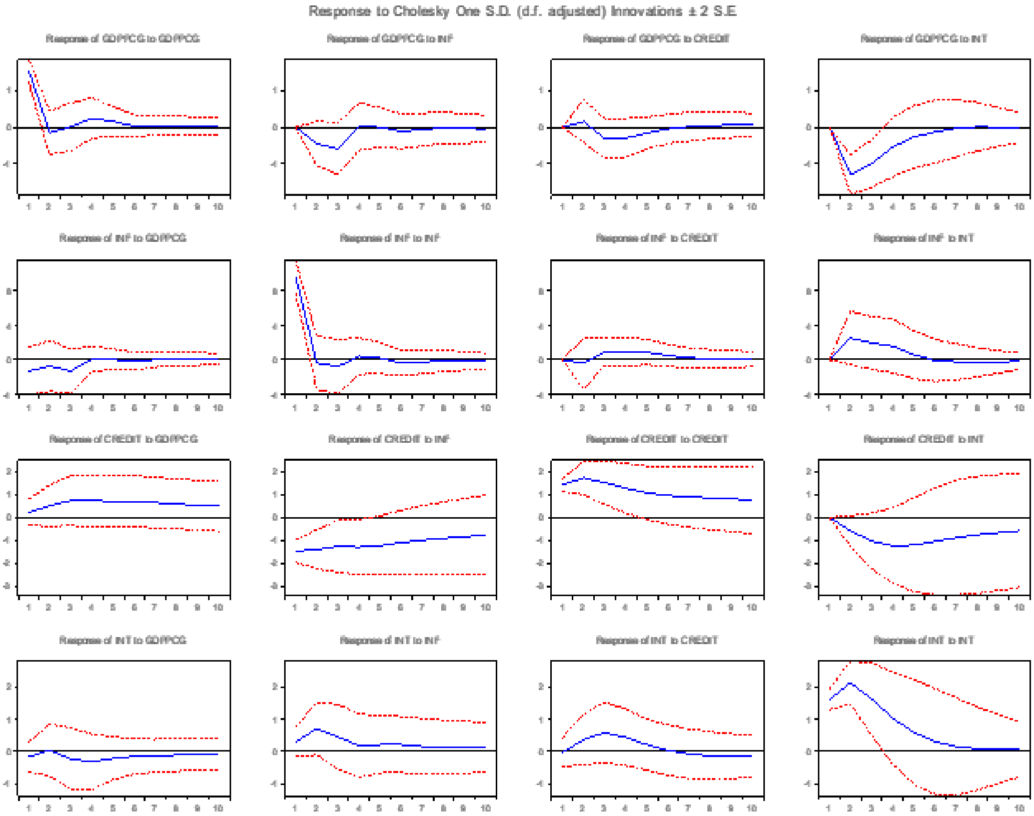


Table 4 evaluates the variance-decomposition (VD) of GDPPCG, INF, CREDIT, and INT. Initially, this table explained the variance decomposition (VD) of GDPPCG. Impact on GDPCCG-account for 100% fluctuation in GDPPCG within year one and this shock is called the own shock, while impulse on the INF, CREDIT, and INT (cross shock) cannot cause the variation of fluctuation in GDPPCG. The findings indicate 100% changes in fluctuation. Beyond the annual year one (1) innovation to GDPPCG declines (55.52%), meanwhile fluctuation in GDPPCG increase due to an increase in INF (4.82%), CREDIT (0.58%), INT (39.07%) (cross shocks) in the long run. Afterward, table 4 explains (VD) of inflation (INF). Influence of impulse to INF accounts for 98.22% of changes in INF in the short-run (SR) period, while innovation on GDPPCG can cause the 1.77% fluctuation in INF, and after that shocks to CREDIT and INT (cross shocks) cannot fluctuate in INF in the short run period. Furthermore, gross variations go to 100% in the entire period. Eventually, beyond year one changes in instability decline in INF (91.36%), while fluctuation in INF increases due to an increase in the (cross shocks) GDPPCG, INT, and CREDIT in the long run period. Furthermore, table 4 illustrates the (VD) of CREDIT (C). By giving the impulse to CREDIT account for 47.62% changes in instability in CREDIT (C), Impact to GDPPCG can cause 1.23% instability in CREDIT, and shock to INF can cause 51.14% to fluctuate the CREDIT, while shock to INT cannot cause the fluctuation in CREDIT in entire period. Gross variation is equal to 100% in the short run. Over the long-term trend, shock to CREDIT increases the variation of fluctuation in CREDIT in the long run period. Shock to INF can cause a 42.08% fluctuation in CREDIT and shock to GDPPCG can cause a 3.26% fluctuation in CREDIT while a shock to INT can cause a 3.61 fluctuation in CREDIT in the long run period. The last section demonstrates the (VD) of INT. Within the year one (1) innovation to INT accounted for 95.69% of variations in INT in the short run (SR) duration. Meanwhile, influence on GDPPCG can cause a 1.01% fluctuation in INT, and CREDIT shock can cause a 0.01% fluctuation in INT, while shock to INF can cause a 3.26% fluctuation in INT in a concerning period (cross-shocks). Moreover, the total fluctuation in INT becomes 100% in the whole period. After year one (1) (own-shock) to interest rate (INT) decreases because of an increase in the fluctuation of INT in GDPPC, INF, and CREDIT (cross-shocks) for the entire period.

Table 4: Variance-Decomposition (VD) of Bank-Lending (Credit Channel)

Period	S.E.	GDPPCG	INF	CREDIT	INT
		Variance-Decomposition (VD) of GDPPCG			
1	1.52	100.00	0.00	0.00	0.00
2	2.05	55.52	4.82	0.58	39.07
3	2.38	41.46	9.64	2.16	46.71
4	2.47	39.46	8.95	3.47	48.10
5	2.49	39.06	8.78	3.81	48.33
6	2.50	38.87	8.95	3.83	48.34
7	2.50	38.85	9.01	3.83	48.30
8	2.50	38.85	9.01	3.86	48.26
9	2.50	38.83	9.02	3.91	48.22
10	2.50	38.80	9.05	3.95	48.18
		Variance-Decomposition of Inflation (INF)			
Period	S.E.	GDPPCG	INF	CREDIT	INT
1	9.72	1.77	98.22	0.00	0.00
2	10.08	2.15	91.36	0.15	6.31
3	10.43	3.58	85.91	1.03	9.46
4	10.61	3.48	83.21	1.83	11.46
5	10.66	3.44	82.42	2.47	11.65
6	10.68	3.45	82.23	2.69	11.61
7	10.69	3.44	82.16	2.73	11.65
8	10.70	3.46	82.09	2.74	11.69
9	10.70	3.47	82.04	2.75	11.73
10	10.70	3.47	82.01	2.75	11.75
		Variance-Decomposition of Credit (C)			
Period	S.E.	GDPPCG	INF	CREDIT	INT
1	2.06	1.23	51.14	47.62	0.00
2	3.13	3.26	42.08	51.03	3.61
3	3.91	5.65	37.40	47.67	9.25
4	4.54	6.74	35.83	43.12	14.30
5	5.02	7.51	35.31	39.78	17.38
6	5.38	8.24	34.94	37.86	18.94
7	5.65	8.78	34.74	36.83	19.63
8	5.87	9.13	34.67	36.28	19.89
9	6.04	9.39	34.63	36.01	19.95
10	6.19	9.59	34.58	35.88	19.94
		Variance-Decomposition of Interest- Rate (INT)			
Period	S.E.	GDPPCG	INF	CREDIT	INT
1	1.64	1.01	3.26	0.01	95.69
2	2.80	0.38	7.37	1.83	90.40
3	3.33	0.74	7.03	4.32	87.88
4	3.54	1.46	6.56	5.36	86.61
5	3.61	1.74	6.69	5.50	86.05
6	3.63	1.87	6.96	5.44	85.70
7	3.64	1.99	7.12	5.45	85.42
8	3.65	2.07	7.23	5.56	85.13
9	3.65	2.11	7.34	5.69	84.83
10	3.66	2.15	7.44	5.82	84.57

6.3. Exchange-Rate (ER) Channel

This portion explored the exchange rate (ER) channel and what way it responds when there are monetary shocks or changes occur in monetary policy. As well as examined this channel and found its strength based on the reactivity of exchange-rate (ER) to monetary variations, liberalization of the economy, and the responsiveness of net export (X-M) to exchange-rate (ER) fluctuations.

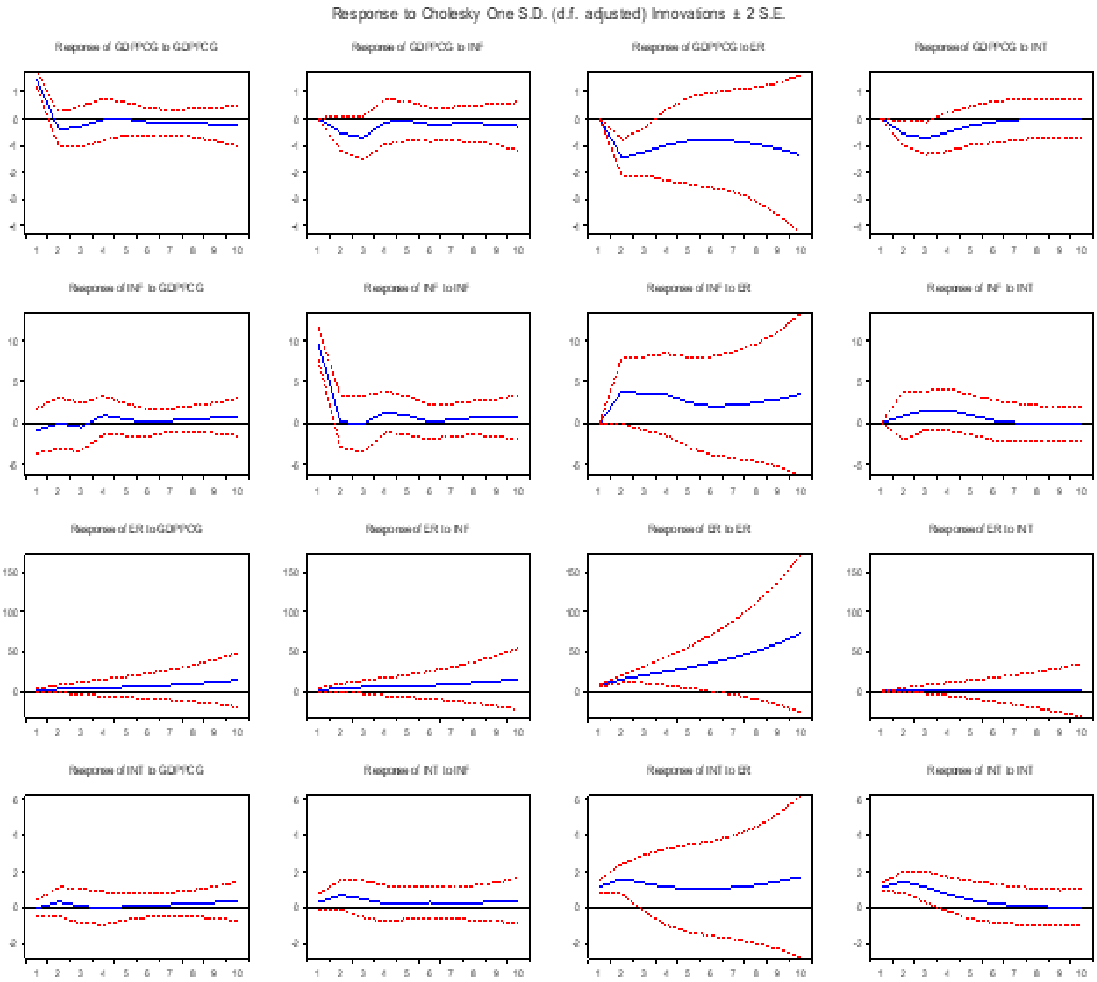
Table 5: Vector-Autoregressive Lag-Order-Selection (LOS) Criterion: GDPPCG, ER, INF, INT

Lag	Log L	LR	FPE	AIC	SC	HQ
0	-627.37	NA	5473819.	26.86	27.02	26.92
1	-490.98	243.75	32723.23	21.74	22.53*	22.04
2	-473.83	27.72	31664.19	21.69	23.11	22.22
3	-451.81	31.86	25505.06	21.43	23.48	22.20
4	-418.98	41.91*	13471.19*	20.72*	23.39	21.72*
5	-411.16	8.64	21822.22	21.07	24.37	22.31

Table 5 demonstrates the lag-order selection of the vector-autoregressive (VAR) model. This table shows the optimum lag length of the model. The best lag length is 4 because lower the values of AIC, SC, FPE, and HQ and higher the value of LR.

Figure 3 shows the impulse-response-function (IRF) of the exchange rate (ER) channel. By giving the one standard deviation (SD) positive influence on GDPPCG, GDPCCG affects positively on year one (1) and after that, it becomes negative and declines till year 4. Moreover, it getting closer and touching the baseline at year 6. Consequently, after 7 years it becomes parallel to the baseline. GDPPCG is influenced negatively and declines at year 4 when we give the one SD positive shock to INF and after that, it touches the baseline at year 5. Furthermore, after year 5 it becomes parallel to the baseline. Figure 3 demonstrates that GDPPCG is completely negatively effective when applying the one-standard-deviation (SD) response to the exchange rate (ER) and GDPPCG is also affected negatively when giving the one-standard-deviation (SD) significant impulse to INT. Moreover, touching the baseline at year 6, it becomes parallel to a baseline at year 7. Figure 3 shows that one-standard-deviation (SD) impact is given to GDPPCG, INF was affected negatively and touched the baseline at year 3 after that, it became positive and touched the baseline till year 7. Consequently, after year 7 it goes to similar to the baseline. Employed the 1 standard-deviation impulse to INF, early INF is affecting favorably and declined on annual year 2 after then it increasing positively at year 6. Moreover, after year 6 it touches the base line and then it becomes parallel to the base line. INF is wholly influencing positively when one SD positive shock is given to the ER. One impulse to INT, INF is affecting successfully at year 6 after that it touches the baseline. Figure 3 illustrates that when one SD positive shock is given to the GDPPCG, ER is affected positively and becomes parallel to the baseline at year 5 and after that, it increases continuously. If one SD positive shock is given to the INF, ER is affected positively and parallel to the baseline at year 3 and after that, it sequentially increases. ER is fully positively influencing and after that, it steadily increases upward when one standard-deviation impulse is given to ER. Furthermore, interest rate (INT) goes stable and touches the baseline throughout, subject to impact on ER. Figure 3 expounds that when one SD positive shock is given to GDPPCG, initially INT is affecting positively at year 3, and after that, it touches and parallel to the baseline till year 7. Afterward, it increased and got closer to the baseline at year 10. If one SD positive shock is given to INF, INT is impacting positively at year 4 and after that, it getting closer and parallel to the baseline. INT is completely influenced positively when one SD positive shock is given to the ER. The figure shows that when we applied the impulse to interest rate (INT) then the interest rate indicates the vital positive effect at year seven (7) and it becomes stable and parallel to the baseline.

Figure 3: Impulse Response Function: Exchange Rate Channel



It discusses the variance decomposition of the exchange rate channel (GDPPCG, INF, ER, INT). Initially, describes the variance-disturbance of the GDPPCG. Innovation to GDPPCG within the year one (1) accounts for 100 % fluctuation in GDPPCG. While impulse in INF, ER, and INT cannot cause the steadiness in GDPPCG. The findings show 100% changes in fluctuation in the short-run (SR) period. In the long run (LR), beyond year one (1) shock to GDPCCG decreases because the variations in GDPPCG increase because of shocks in INF, ER, and INT in concerning duration. Furthermore, the table illustrates the variance decomposition (VD) of INF. In the short-run (SR), within the annual one impulse to INF accounts for 99.11% of the changes in fluctuations in INF. While impact to GDPPCG 0.88% can cause the fluctuation in INF and shock to ER and INT cannot cause any fluctuation in INF (cross shocks). Total fluctuation becomes 100% in INF in the entire period. In the long run, after the year shock to INF (own shock) declines because of an increase in fluctuation in INF due to (cross shocks) in the long run period. Table 6 explains the variance decomposition (VD) of ER. In the short-run (SR), annual 1 innovation to ER accounts for a 96.15% fluctuation in ER in own shock (OS). The impulse to GDPPCG can cause a 0.42% fluctuation in ER and shock to INF can cause a 3.41%fluctuation in ER, while shock to INT cannot cause any fluctuation in ER in the short run (cross shocks). Consequently, the sum of fluctuation becomes 100% in that period. In the long run (LR), beyond the year 1 shock to ER (own shock) (OS) decreases because of an increase in fluctuation in ER because of an increase in (cross shocks) in the long run period. The last section illustrates the variance decomposition (VD) of interest rate (INT). In the short-run (SR), the annual impact on interest rate (INT) accounts for 47.53% changes of instability in interest rate (INT). Innovation to GDPPCG can cause a 0.06 fluctuation in INT and shock to INF can cause a 2.86 fluctuation in INT, while shock to ER can cause a 49.53% fluctuation in ER (cross shocks). The sum of total fluctuation in that period becomes 100%. In the long-run (LR), beyond year one impulse to INT account decreases due to an increase in the cross shocks in the entire period.

Table 6: Variance-Decomposition (VD) of Exchange Rate (ER) Mechanism

Period	S.E.	GDPPCG	INF	ER	INT
		Variance-Decomposition (VD) of GDPPCG			
1	1.43	100.00	0.00	0.00	0.00
2	2.22	45.16	5.67	42.44	6.72
3	2.75	30.57	10.39	47.67	11.35
4	2.97	26.31	9.12	51.94	12.60
5	3.09	24.24	8.50	54.85	12.39
6	3.21	22.71	8.35	57.23	11.69
7	3.32	21.33	8.15	59.59	10.91
8	3.46	19.87	7.78	62.29	10.04
9	3.66	18.21	7.40	65.35	9.03
10	3.91	16.36	7.01	68.74	7.87
		Variance-Decomposition of INF			
Period	S.E.	GDPPCG	INF	ER	INT
1	9.68	0.88	99.11	0.00	0.00
2	10.48	0.75	84.64	13.85	0.74
3	11.18	0.85	74.32	22.21	2.60
4	11.91	1.36	66.77	27.76	4.09
5	12.24	1.40	63.71	30.36	4.51
6	12.42	1.36	61.89	32.27	4.45
7	12.62	1.38	60.07	34.21	4.32
8	12.88	1.49	57.85	36.49	4.14
9	13.23	1.61	55.07	39.38	3.93
10	13.71	1.74	51.51	43.07	3.66
		Variance-Decomposition of Exchange Rate (ER)			
Period	S.E.	GDPPCG	INF	ER	INT
1	8.06	0.42	3.41	96.15	0.00
2	18.09	2.62	6.29	90.36	0.71
3	28.44	3.02	6.19	89.68	1.09
4	38.85	2.97	5.49	90.47	1.05
5	49.93	2.99	5.07	91.06	0.86
6	62.25	3.08	4.85	91.39	0.66
7	76.33	3.17	4.69	91.63	0.48
8	92.79	3.26	4.56	91.81	0.35
9	112.32	3.33	4.47	91.92	0.26
10	135.66	3.40	4.40	91.99	0.19
		Variance-Decomposition of Interest Rate (INT)			
Period	S.E.	GDPPCG	INF	ER	INT
1	1.64	0.06	2.86	49.53	47.53
2	2.78	1.31	7.04	49.34	42.29
3	3.31	0.97	6.9	50.88	41.15
4	3.58	0.84	6.37	53.56	39.21
5	3.76	0.78	6.24	56.23	36.73
6	3.93	0.83	6.24	58.77	34.13
7	4.09	0.93	6.12	61.39	31.54
8	4.28	1.09	5.94	64.19	28.76
9	4.54	1.34	5.76	67.21	25.67
10	4.87	1.63	5.57	70.49	22.30

6.4. Asset-Price (AP) Channel

This segment describes the asset-price (AP) channel and analyzes how asset-price (AP) reacts or responds to monetary innovations impulses or shocks.

Table 7: Vector-Autoregressive Lag-Order-Selection Criterion: GDPPCG, INF, INT, MC,

Lag	Log L	LR	FPE	AIC	SC	HQ
0	-535.83	NA	111338.7	22.97	23.12	23.03
1	-496.41	70.45	41224.63	21.97	22.76*	22.27*
2	-484.09	19.91	48994.01	22.13	23.54	22.66
3	-462.78	30.83	40678.24	21.90	23.95	22.67
4	-441.13	27.64	34570.22	21.66	24.34	22.67
5	-412.48	31.69*	23075.85*	21.12*	24.43	22.37

Table 7 describes the lag-selection order of the vector-autoregressive (VAR) model. The maximum lag length is 5 due to the higher value of LR rather than the lower values of AIC, SC, HQ, and FPE.

Figure 4 shows the impulse-response-function (IRF) of the asset-price (AP) channel (GDPPCG, INF, MCG, INT). Subject to the one-standard-deviation impulse to GDPPCG, primarily GDPPCG is affected positively then declines till it becomes negative after year 2 till year 4. Afterward, it becomes positive and parallel to the baseline at year 9. When one SD positive shock is given to the INF, GDPPCG is influencing negatively at year 4 and after that, it becomes positive and parallel to the baseline at year 5. Moreover, after year 5 it becomes negative and gets closer to the baseline. GDPPCG is positively affected and it becomes stable and parallel to the baseline at year 10 if given the one SD positive shock to MC. Moreover, when one SD positive shock is given to the INT, GDPPCG is affected negatively and increases towards the baseline and touching the baseline at year 7, and after that, it becomes positive and parallel to the baseline. Figure 4 describes that when one SD positive shock is given to the GDPPCG, initially INF is affected negatively and touches the baseline at years 2 and 3, and after that, it becomes positive and parallel to the baseline at year 5. Furthermore, after year 5 it becomes negative and parallel to the baseline at year 6. Given the one (SD) significant impulse to INF, early, INF is influenced significantly declined at year 1, and after that, it becomes negative in year 4, then it becomes positive and parallel to the baseline. INF is completely negatively affecting and at year 10 it becomes parallel to the baseline, imposing the one standard-deviation impulse to MC. When one standard deviation (SD) innovation to INF, the interest rate (INT) is positively declined and becomes parallel to the baseline at year 7. Figure 4 depicts that if one SD positive shock is given to the GDPPCG, early MC is positively influencing at year 1 and touching the baseline at year 2 and after that, it becomes negative at year three 3. Additionally, it goes similar to the baseline. Employed the one-standard-deviation impulse to INF, MC is completely negatively influenced at year 4 and after that, it gets closer to the baseline at year 5 and becomes parallel to the baseline at year 7. MC is positively influencing and getting closer to the baseline at year 10, applying the standard deviation innovation to MC. While MC is wholly negatively affecting then becomes parallel to the baseline at year 8, enforced the one-standard-deviation (SD) impulse to interest-rate (INT). Figure 6.4 describes that when one SD positive shock is given to GDPPCG, initially INT is influenced significantly in year two (2) and then it touches the baseline at year 3. Moreover, after year 3 it gets closer to the baseline and becomes parallel to the baseline. When one SD positive shock is given to the INF, INT is completely positively influencing and touching the baseline at year 4 and after that, it moves similarly to the baseline. Given the one standard deviation (SD) innovation to MC, interest rate (INT) is completely negatively influenced and getting closer to the baseline at year 9. Figure 4 illustrates that when inflicted the one-standard-deviation impulse to interest rate (INT), INT is positively affected then touching the baseline in year 6, and after that, it becomes negative and gets closer to the baseline.

Figure 4: Impulse Response Function: Asset Price Channel

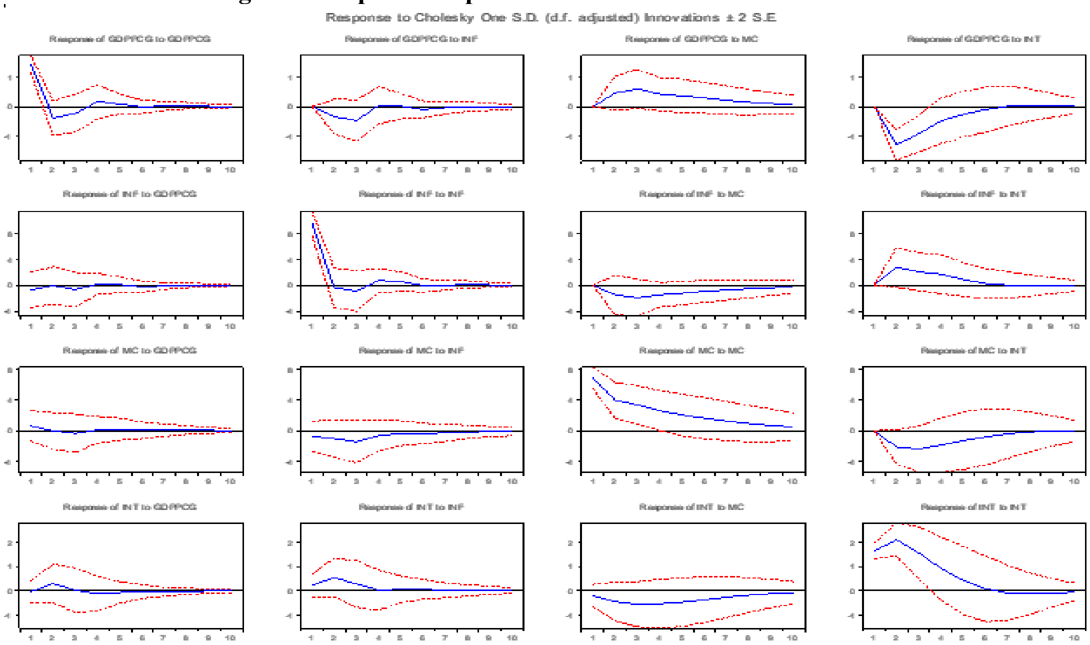


Table 8 describes the variance-decomposition (VD) of the asset price channel (GDPPCG, INF, MCG, INT). Initially, the table demonstrates the variance decomposition of GDPPCG. In the short-run, for year 1 impulse to GDPPCG accounts for 100% instability in GDPPCG this impulse is called own-shock (OS), while innovations to INF, MC, and interest-rate (INT) cannot cause any fluctuation in GDPPCG. The findings indicate 100% instability in the duration of (SR). In long-run (LR), beyond the year one shock to GDPPCG decreases, because of an increase in fluctuation in GDPPCG because of an increase in cross-shocks (CS) INF, MC, and INT in the long run period. While in the short-run (SR), for year one innovation to INF accounted for 99.51% of changes in inflation (INF) (own-shock). While the impulse to GDPPCG can cause the 0.48% fluctuation in INF and shock to MC, INT cannot fluctuate in INF (cross shocks). The gross changes go to equal 100% instability in inflation (INF). In the long-run (LR), after the year one (1) shock to the INF account (own shock) declines because of an increase in fluctuation due to an increase in cross shocks GDPPCG, MC, and INT in the long run. Table 8 shows that in the short-run (SR), the annual one (1) impulse to MC accounts for a 98.03% discrepancy of instability in MC (own-shock). While innovation to GDPPCG can cause a 0.78% fluctuation in MC shock to INF can cause a 1.18% fluctuation in MC and shock to INT cannot fluctuate in MC (cross shocks). Consequently, the sum of gross instability moves to 100% in the entire period. In the long- run (LR), after year one (1) shock to MC account (own shock) declines because of an increase in fluctuation in MC due to an increase in cross shocks in the concerning period. The last segment of the period shows the variance decomposition (VD) of the interest rate (INT). In the short-run (SR), for year one (1) innovation to interest rate (INT) accounts 96.68% variation in INT (own-shock). While impulse to GDPPCG can cause a 0.039% fluctuation in INT shock to INF can cause a 1.89% fluctuation in INF and shock to MC can cause a 1.38% fluctuation in INF (cross shocks). The total sum of fluctuation becomes 100% fluctuation in INT in the short run. Beyond the annual one shock to interest-rate (INT) account (own-shock) decreases because of an increase in fluctuation in interest-rate (INT) because of an increase in cross-shocks (CS) GDPPCG, INF, MC in the whole period.

Table 8: Variance-Decomposition (VD) of Asset Price Channel

Period	S.E.	GDPPCG	INF	MC	INT
		Variance-Decomposition of GDPPCG			
1	1.43	100.00	0.00	0.00	0.00
2	2.04	52.49	2.81	4.96	39.72
3	2.37	39.72	6.04	9.89	44.33
4	2.46	37.35	5.63	11.98	45.03
5	2.50	36.23	5.45	13.60	44.70
6	2.52	35.63	5.52	14.69	44.13
7	2.53	35.39	5.51	15.26	43.82
8	2.54	35.27	5.49	15.53	43.70
9	2.54	35.20	5.48	15.66	43.64
10	2.54	35.17	5.49	15.72	43.60
		Variance-Decomposition of Inflation (INF)			
Period	S.E.	GDPPCG	INF	MC	INT
1	9.62	0.48	99.51	0.00	0.00
2	10.13	0.43	89.82	2.14	7.59
3	10.58	0.78	83.00	5.27	10.94
4	10.85	0.78	79.41	6.83	12.95
5	10.98	0.77	77.91	7.91	13.39
6	11.02	0.81	77.28	8.54	13.35
7	11.04	0.81	76.96	8.90	13.30
8	11.06	0.81	76.80	9.10	13.27
9	11.06	0.81	76.72	9.19	13.26
10	11.07	0.81	76.68	9.23	13.26
		Variance-Decomposition of MC			
1	6.96	0.78	1.185	98.03	0.00
2	8.35	0.54	2.34	90.76	6.34
3	9.43	0.56	4.21	83.83	11.37
4	9.99	0.51	4.20	81.59	13.68
5	10.29	0.51	4.07	80.90	14.50
6	10.46	0.50	4.08	80.76	14.65
7	10.54	0.49	4.08	80.84	14.56
8	10.59	0.49	4.07	80.95	14.47
9	10.61	0.49	4.07	81.01	14.41
10	10.62	0.49	4.07	81.04	14.37
		Variance-Decomposition of Interest (INT)			
Period	S.E.	GDPPCG	INF	MC	INT
1	1.68	0.03	1.89	1.38	96.68
2	2.81	1.15	4.51	3.04	91.28
3	3.28	0.85	4.02	5.01	90.10
4	3.46	0.89	3.64	6.84	88.61
5	3.51	0.89	3.55	8.38	87.16
6	3.54	0.89	3.54	9.36	86.18
7	3.55	0.90	3.52	9.84	85.72
8	3.55	0.90	3.51	10.05	85.52
9	3.56	0.90	3.51	10.13	85.44
10	3.56	0.90	3.51	10.17	85.41

6.5. Direct-Interest-Rate (INT) Channel

This section describes the direct interest rate (INT) channel and examines what way the traditional interest rate (INT) channel reacts when monetary shocks or fluctuations occur in the economy.

Table 9: Vector-Autoregressive Lag-Order-Selection (LOS): GDPPCG, INT, INF, CREDIT

Lag	Log L	LR	FPE	AIC	SC	HQ
0	-509.37	NA	36104.82	21.84	22.00	21.90
1	-420.56	158.72*	1634.38*	18.74*	19.53*	19.04*
2	-406.08	23.40	1772.16	18.81	20.22	19.34
3	-396.20	14.30	2392.67	19.07	21.11	19.84
4	-383.78	15.85	3012.84	19.22	21.90	20.23
5	-374.74	10.00	4632.29	19.52	22.82	20.76

Table 9 describes the lag-order selection (LOS) of the vector-autoregressive (VAR) model. For the direct interest rate channel optimal lag is 1 because here FPE, AIC, SC, and HQ have lower values while LR has a larger value. So, our optimal lag is 1 in the model.

Figure 5: Impulse-Response-Function (IRF): Direct-Interest-Rate (INT) Channel

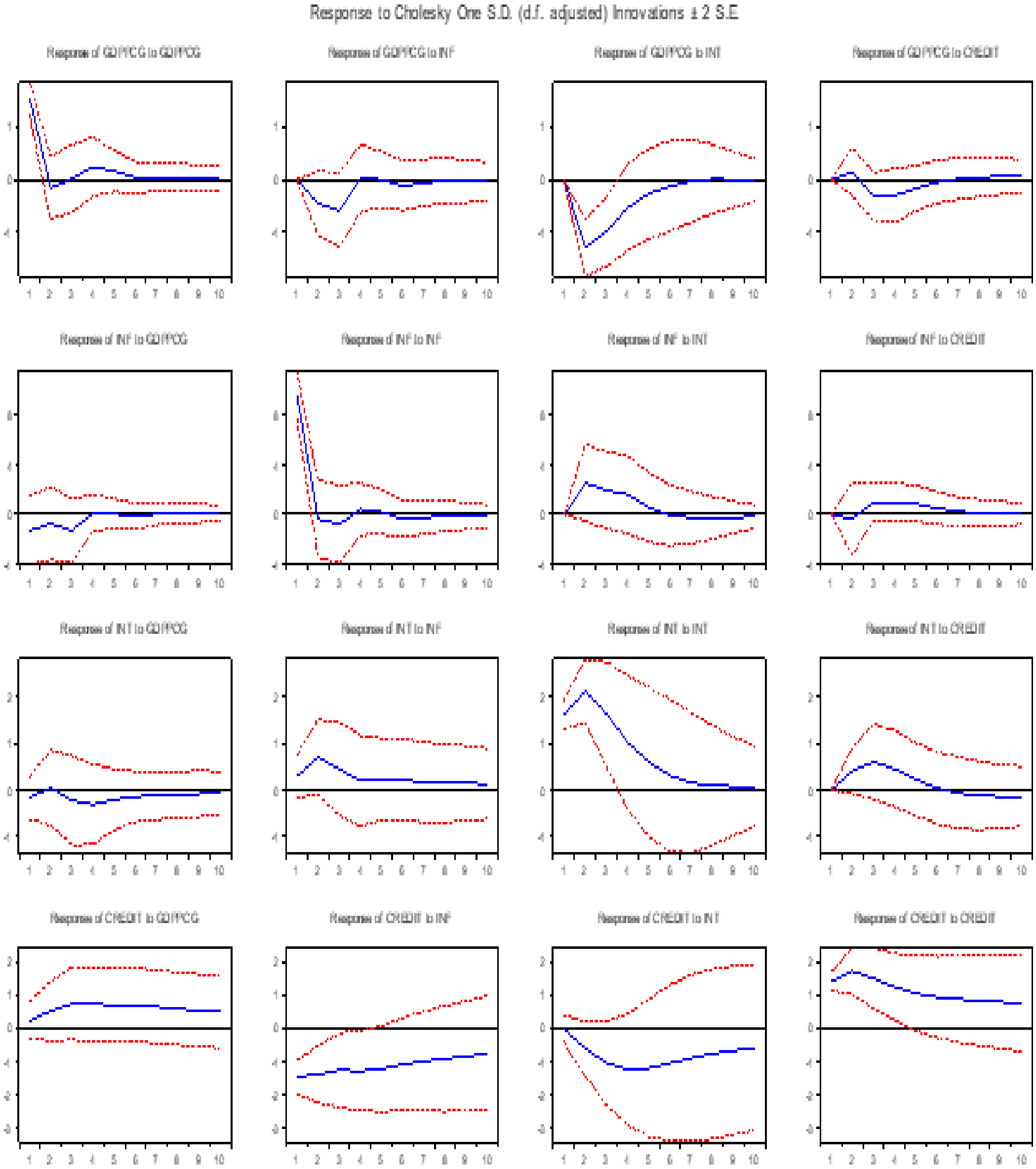


Figure 5 Indicates the impulse-response-function (IRF) of the direct-interest-rate (INT) channel (GDPPCG, INF, INT, CREDIT). Figure 5 shows that when enforced the one standard deviation (SD) significant impulse to GDPPCG, primarily GDPPCG is affected significantly at year one (1), and after that, it declined and becomes negative till 3. Moreover, after that, it becomes stable and parallel to the baseline at year 6. Imposing the one standard-deviation innovation to INF, GDPPCG is influencing negatively then touching the line at 4 and after that, it becomes positive and parallel to the baseline at year 5. Furthermore, after that, it becomes negative and parallel to the baseline at years 6 and 7. GDPPCG is affected negatively and stirring the baseline at year 7 and after that, it becomes positive and parallel to the line at year 8 when giving the one-standard-deviation (SD) impulse to interest rate (INT). Next by inflicting the one standard-deviation (SD) innovation to CREDIT, GDPPCG is influencing positively at year 2 and after that, it becomes negative and touches the baseline at year 6. Besides, it becomes positive and parallel to the baseline at year 7 and gets closer to the baseline at year 9. Figure 5 describes that gives

the one-standard-deviation (SD) shock to GDPPCG, INF is negatively influenced then touching the baseline at 4 after year four (4) it becomes parallel to a baseline at year 6. Enforced the one-standard-deviation (SD) impulse to INF, early INF is affecting positively at year one (1) and after that, it becomes negative and touches the baseline at year 4. In addition, it becomes positive and parallel to the baseline at year 5 and after that effective negatively and closer to the baseline at year 7. Furthermore, it becomes parallel to the baseline at year 8. INF positively influences and touches the baseline at year 6 after that, it becomes negative and equal to the line if imposed the one standard-deviation innovation to INF. Figure 5 shows that if the one-standard-deviation (SD) shock to INF, primarily CREDIT is affected negatively then parallel to a baseline at 1 and after that, it gets closer to the baseline at year 2. Additionally, after that, it becomes positive and parallel to the line at year 7. Employed the one-standard-deviation (SD) impulse to GDPPCG, interest-rate (INT) is negatively affected and touches the line at 2 after this, it gets closer to the baseline at year 6 and becomes parallel at year 9. When one SD positive shock is given to the INF, INT is completely positively affected and becomes parallel to the baseline at year 10. Figure 5 illustrates that if the one-standard-deviation innovation to interest rate (INT), INT is completely influencing positively and getting closer to the baseline at year 6 and becomes parallel to the baseline at year 9. INT is positively affected and touches the baseline at year 6 after that, it becomes negative and parallel to the baseline at year 7. Furthermore, after that it getting closer to the baseline at year 8. Figure 5 also explains that if the one-standard-deviation impulse to GDPPCG, CREDIT is affecting thoroughly positively. While inflicting the one standard deviation (SD) shock to inflation (INF), CREDIT is influencing negatively. Employed the one-standard-deviation innovation to interest-rate (INT), early CREDIT was affected negatively and touched the baseline at 1 and after that, it declined negatively. CREDIT is also affected positively when we give the one SD positive shock to CREDIT.

Table 10 explains the variance-decomposition (VD) of the direct-interest-rate (INT) channel (GDPPCG, INF, INT, CREDIT). The upper section indicates that in the short-run (SR), for the annual one (1) impulse to GDPPCG accounts for 100% variation in fluctuation in GDPPCG (own-shock). Shock to INF, INT, and CREDIT (C) (cross-shocks) cannot cause any instability in GDPPCG in the short run as well as the sum of the total fluctuation becomes 100% in the short-run period. In the long-run (LR), after the year one (1) shock to GDPCCG own-shock (OS) decreases because of an increase in the fluctuation in GDPPCG due to an increase in the (cross shocks) INF, INT, CRED. Now we discuss the variance-decomposition (VD) of INF. In the short-run (SR), for the year one (1) impulse to INF accounts for 98.22% changes in instability in INF own-shock (OS). While innovation to GDPPCG can cause 1.77% changes in INF while shocks to INT, CREDIT cannot fluctuate in INF. Total fluctuation becomes 100% in the entire period. In the long run, after year 1 shock to INF declines because of increased fluctuation in INF due to an increase in (cross shocks) in the long run period. Table 10 also presents the variance-decomposition (VD) of INT. In the short-run (SR), for year one (1) impulse to INT accounts for 95.71% variation-fluctuation (VF) in INT own-shock (OS) while innovation to GDPPCG can cause the 1.01% changes in INT and shock to INF can cause the 3.26 variation in INT and credit shock cannot fluctuate in INT (cross shocks). The sum of gross instability is equal to 100% in the short-run (SR). In the long-run (LR), after year one (1) shock to INT declines because of an increase in the cross shocks. The ending section reveals the variance decomposition (VD) of the CREDIT. In the short-run (SR), for year one (1) impulse to CREDIT accounts for a 47.61 discrepancy of instability in CREDIT own-shock (OS) while the impulse to GDPPCG can cause a 1.23% fluctuation in CREDIT, and shock to INF can cause the 51.14% fluctuation in CREDIT and shock to INT can cause the 0.008% changes in CREDIT (cross shocks). Moreover, fluctuation becomes 100% in CREDIT in the short run. In long-run (LR), after year one (1) innovation to CREDIT increases for 50.74% variation-fluctuation (VF) in CREDIT while the impulse to GDPPCG can cause 3.26% fluctuation in CREDIT and shock to INF can cause the 42.08% fluctuation in CREDIT and shock to INT can cause the 3.90% fluctuation in CREDIT in long run.

Table 10: Variance-Decomposition (VD) of Direct Interest Rate (INT) Channel

Period	S.E.	GDPPCG	INF	INT	CFREDIT
		Variance-Decomposition (VD) of GDPPCG			
1	1.52	100.00	0.00	0.00	0.00
2	2.05	55.52	4.82	39.19	0.45
3	2.38	41.46	9.64	46.65	2.23
4	2.47	39.46	8.95	47.97	3.60
5	2.49	39.06	8.78	48.19	3.95
6	2.50	38.87	8.95	48.19	3.97
7	2.50	38.85	9.01	48.15	3.97
8	2.50	38.85	9.01	48.12	4.00
9	2.50	38.83	9.02	48.07	4.05
10	2.50	38.80	9.05	48.03	4.09
		Variance-Decomposition of INF			
Period	S.E.	GDPPCG	INF	INT	CFREDIT
1	9.72	1.77	98.22	0.0	0.00
2	10.08	2.15	91.36	6.34	0.13
3	10.43	3.58	85.91	9.43	1.06
4	10.61	3.48	83.21	11.40	1.89
5	10.66	3.44	82.42	11.58	2.54
6	10.68	3.45	82.23	11.54	2.76
7	10.69	3.44	82.16	11.58	2.80
8	10.70	3.46	82.09	11.62	2.81
9	10.70	3.47	82.04	11.66	2.81
10	10.70	3.47	82.01	11.68	2.82
		Variance-Decomposition of Interest-Rate (INT)			
Period	S.E.	GDPPCG	INF	INT	CFREDIT
1	1.64	1.01	3.26	95.71	0.00

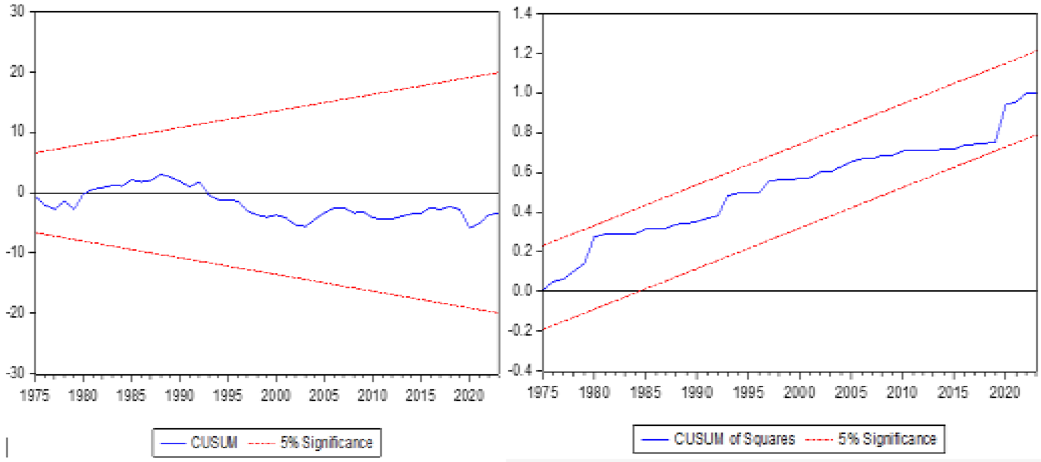
2	2.80	0.38	7.37	90.12	2.12
3	3.33	0.74	7.03	87.45	4.76
4	3.54	1.46	6.56	86.12	5.84
5	3.61	1.74	6.69	85.56	5.99
6	3.63	1.87	6.96	85.21	5.93
7	3.64	1.99	7.12	84.94	5.94
8	3.65	2.07	7.23	84.65	6.03
9	3.65	2.11	7.34	84.36	6.17
10	3.66	2.15	7.44	84.10	6.29
		Variance-Decomposition of CREDIT (C)			
Period	S.E.	GDPPCG	INF	INT	CFREDIT
1	2.06	1.23	51.14	0.00	47.61
2	3.13	3.26	42.08	3.90	50.74
3	3.91	5.65	37.40	9.72	47.21
4	4.54	6.74	35.83	14.85	42.57
5	5.02	7.51	35.31	17.97	39.19
6	5.38	8.24	34.94	19.54	37.26
7	5.65	8.78	34.74	20.25	36.21
8	5.87	9.13	34.67	20.51	35.66
9	6.04	9.39	34.63	20.58	35.38
10	6.19	9.59	34.58	20.57	35.25

6.6. Stability Tests

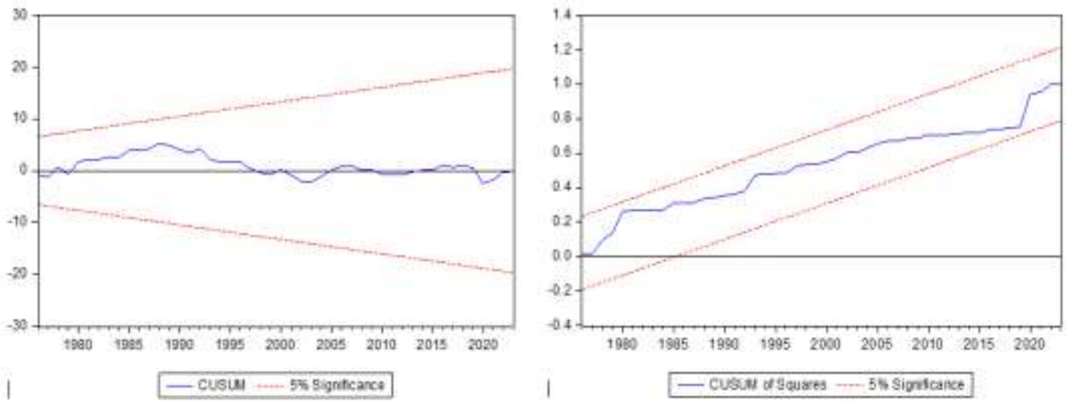
To check the test of stability in all parameters, we have employed the cumulative sum of squares (CUSUM) to investigate the test consistency of all models that are used in this study. Test stability of all models is given below:

Figure 6: Stability Tests

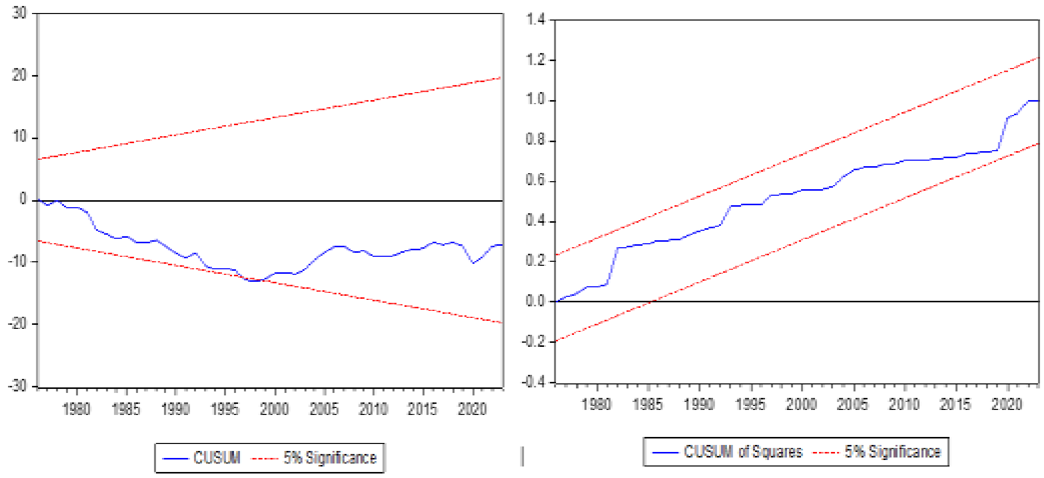
Fundamental Model



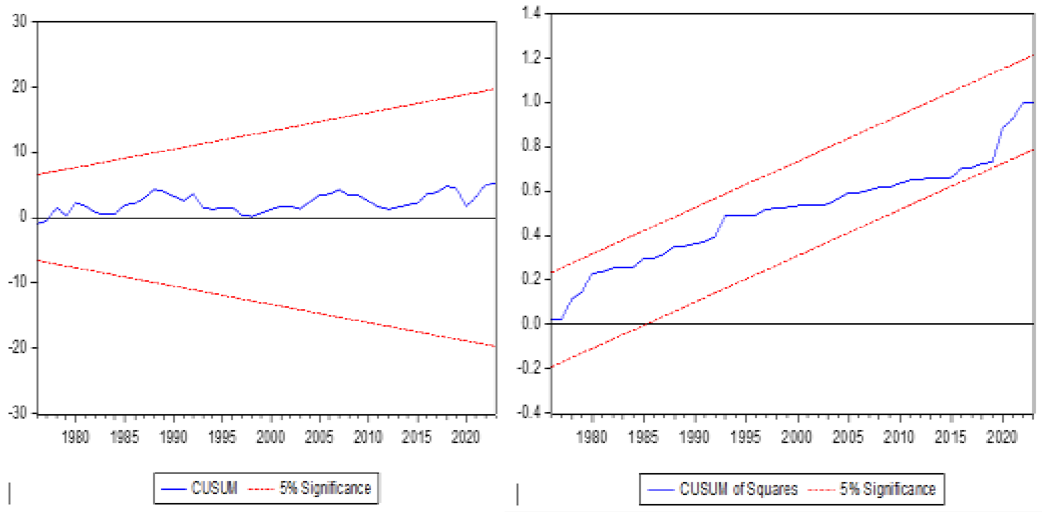
Bank-Lending-Channel (Credit Channel)



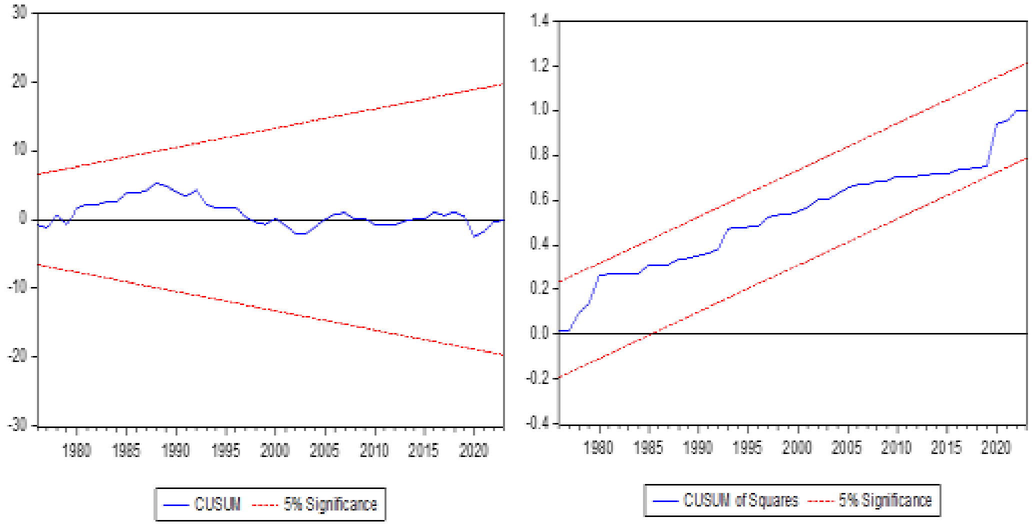
Exchange Rate (ER) Channel



Asset Price (AP) Channel



Direct Interest-Rate Channel



7. Conclusions and Policy Recommendations

This study aims to analyze the effectiveness of monetary transmission mechanism channels in Pakistan. This study used the VAR (vector autoregressive) model with the variance decomposition and impulse response. The study has three particular objectives: to evaluate the impact of changes in the bank lending rate on the output level and price level. Examine the relationship between exchange rate fluctuations and the output and price levels. To investigate the effect of asset price changes on the output level and price level. To attain these objectives study applied the VAR model and used the time series data from 1972 to 2023. The significant results are summarized below:

The findings show that traditional or direct interest rate shows a minor influence on monetary policy innovation and in variance decomposition revealed a moderate reaction as compared to the other monetary transmission mechanism channels. While impulse response indicates that monetary shocks on GDP and inflation gradually increase its influence remains moderate as compared to the other channels. The bank lending channel illustrates the specific influence of transmitting the monetary shock to GDP and prices. Credit variation in variance decomposition indicates a minor influence on the output and inflation. In the impulse response function, credit availability is effective by monetary policy, and its impact on macroeconomic parameters is not significant. The exchange rate is the most effective monetary transmission mechanism channel in Pakistan as compared to the other monetary transmission mechanism channels. The exchange rate innovations more significantly influence the GDP and inflation variations in variance decomposition findings. The impulse response function identified that the exchange rate channel has a more specific and larger impact on the fluctuations of GDP and inflation in the case of Pakistan. Variations in exchange rate influence the export and import prices as a result it affects the economic GDP and inflation because the economy of Pakistan is based on external trade. Furthermore, the asset price channel shows a lower impact on the GDP and inflation fluctuations. Changes in asset prices due to changes in monetary innovation are least supporting as revealed in the impulse response function and variance decomposition function. Pakistan is less connected with the monetary transmission mechanism because of immature financial markets.

The findings of the impulse response and variance decomposition function indicate that the exchange rate channel is the most significant in transmitting innovations or shocks in Pakistan as compared to the other monetary transmission mechanism channels. The exchange rate channel has a powerful and significant impact on the GDP and inflation fluctuations and highlights the vital position in the economy.

- The policy makers should encourage a reliable monetary policy that reduces the extreme variations in exchange rates and decreases the instability for investors and exporters.
- The planners should increase export effectiveness by concentrating on enhancing the trade balance via the expansion of exports and resolving structural problems.

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