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Analyzing the Impact of Monetory Policy Shocks on Output, Inflation and Exchange Rate Dynamics of Pakistan

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Chronicle	Abstract
  Hakimzadi Wagan, Iftikhar Ahmedh & Ghulam Hussain Wagan are currently affiliated with the Department of Agricultural Economics, Sindh Agriculture University, Tandojam, Sindh, Pakistan. **Email:** hakimzadi@gmail.com **Email:** Iftikharahmed.ss51@gmail.com **Email**: ghwagan@sau.edu.pk **Jumo Khan Bajkani** is currently affiliated with the PARC-SSRI, Tandojam, Sindh, Pakistan. **Email:** jumokhanbajkani@gmail.com **Rani Abro** is currently affiliated with the Department of Animal Nutrition, Sindh Agriculture University, Tandojam, Sindh, Pakistan. **Email:** abrosau@yahoo.com **Bushra Gul is currently** affiliated with the Department of Rural Sociology, Sindh Agriculture University, Tandojam, Sindh, Pakistan. **Email:** aghabushra@outlook.com	The major objective of this study is to analyse that how monetary policy of Pakistan had impact on output, inflation and exchange rate fluctuations during Global Financial Crisis 2008-2009 in Pakistan. Quarterly data was used for this purpose. Data spans from 1990Q1 to 2022Q4. Time varying parameter – vector auto regression model (TVP-VAR) of Jouchi Nakajima (2011) has been used for analysis. Through this model we selected the time horizons such as 2008, 2009 and 2015 mainly to study the impact of monetary policy on different selected variables. Our empirical finding indicates that monetary policy shock plays an important role in the economic dynamics of Pakistan. The impulse response of inflation is negative to tight monetary policy shock ($\varepsilon i \uparrow \rightarrow p$), this is in accordance with the standard economic theory. In case of Pakistan, after 1990 there is declining trend in volatility of output and a considerable reduction in business cycle fluctuations. Policy rate is more volatile during 1998. After 2000 there is decline in volatility of policy rate but in 2008-09 there is rise in interest rate because of Global Financial Crises in 2007 and 2008. The response of policy rate to inflation shock is in rising trend in 2007 and 2008. The inflation is increasing as a response to positive output shocks after 12th quarter this rising trend is also evident during 2008 where the impact of output on inflation is long term.

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INTRODUCTION

Monetary policy is the major central bank tool to control money supply and inflation in the economy. Over the past few decades' inflation has become a major issue in Pakistan, (Stylianou et al.., 2024). Achieving economic growth and price stabilization are its two major objectives. It aims at regulating money supply by controlling cost of borrowing money Central banks strive to decrease the level of unnecessary inflation to expedite the economic performance (Noman and Khudri, 2015). Hence its two major objectives are to control the price level and to reduce rate of unemployment in the economy. Central banks use discount rate to increase the economic growth (Ali et al., 2015). Information regarding the forces those increases the level of inflation is very necessary to control inflation. No doubt, inflation is a trend that is found everywhere (Friedman, 1963). Monetary policy management is one of the basic objective of the Central Bank of Pakistan. Monetary policy of Pakistan is supporting dual goals; to promote price stability and economic growth. However, in early 2000 a

loose policy stance was followed as it was assumed that higher growth can be achieved along with lower rate of inflation. However an increase in the rate of inflation in 2004 and 2005 forced to change loose monetary policy stance (SBP-MPS, 2006). Monetary policy of Pakistan is growth oriented. State Bank of Pakistan tries to implement more transparent monetary policy. Communication of monetary goals to economic agents, responsiveness of institutions and market based management are the major concerns of state bank of Pakistan (Chaudhry et al., 2012). The State Bank of Pakistan claims to follow contractionary policy since September 2004 to control core inflation. (SBP Annual Report, 2006-07). Inflation targeting and economic development are the major responsibilities of State Bank of Pakistan (Naveed, 2015). The variables through which monetary policy impact prices and output is known as transmission channels. There are real and financial variables which affect the level of output and prices. Various channels are involved in this process which are termed as 'black box' (Bernanke and Blinder, 1995). Interest rate channel and quantity of money supply are due to financial crises of 2008 nontraditional policy measures has been used for implementing monetary policy in different countries. Other measures were used gauge performance of monetary policy due to zero bound interest rate (Barnett et al., 2015). Barnett et al. (2015), examined that most of exchange rate analysis studies use discount rate to examine monetary policy.
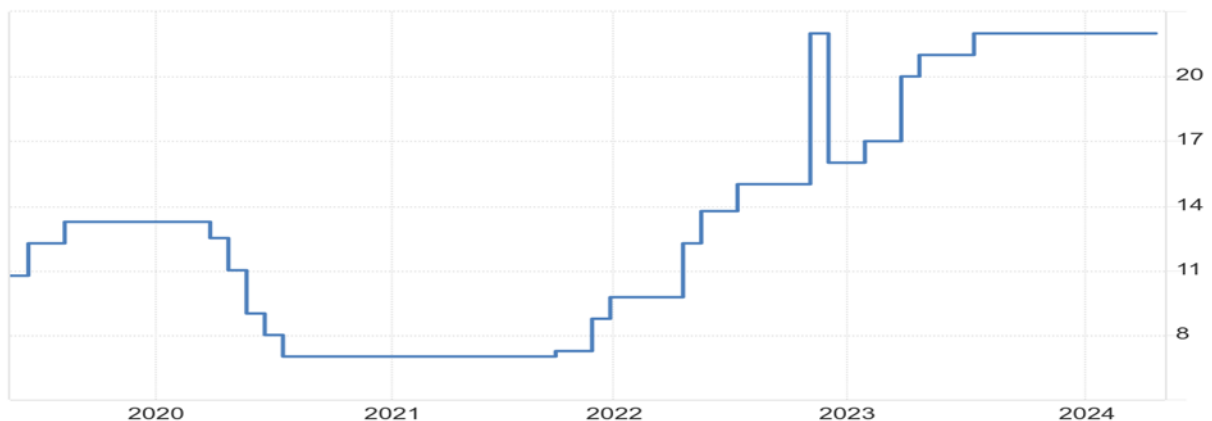
Interest Rate in Pakistan

Figure 1.
Pakistan Historical Interest Rate in Percent
Source: State Bank of Pakistan

Figure 1 shows the historical overview of discount rate of State Bank of Pakistan. During 2020 the key interest rate remained below 14% which significantly reduced to less than 8 percent which is due to controlled level of inflation during that period. After 2022 policy rate gradually increased which reached its all-time high that 22 in year 2024 which shows tight monetary policy stance of State Bank of Pakistan due to high level of inflation in the country. There are different reasons of inflation in Pakistan however it is true that major objective of State Bank of Pakistan is price stability (King, 1999 and Blejer et al., 2000). Folawewo and Osinubi (2006) suggest close relation between monetary policy and country's growth. Most of the countries pursue monetary policy to achieve the balance of payment surplus, increasing the rate of employment and expediting economic growth. Cassola and Morana (2004), found that loose policy increases economic output and tight policy decreases the level of output. The policy rate affect the variables over short to medium term. Changes in international market and domestic economy are the main determinant of monetary policy stance in

Pakistan. While state bank of Pakistan Act 1956 assigned two goals for maintaining low level of inflation and sustaining high financial growth in Pakistan, before 1990 state bank of Pakistan did not have any authority or appropriate tool to pursue these goals. Another important objective is to implement exchange rate policy. Managed float was pursued after 1982. From 1971 to 1990s, State Bank role to pursue exchange rate policy was limited. The major emphasis was given to allocation of credit at subsidized rate to priority areas (Choudhri et al., 2015). During the recent years, central bank implements monetary policy by controlling money supply which has major influence on inflation, output and exchange rate of the country. According to Noman and Khudri, (2015), the monetary policy of Pakistan pursues dual objectives promoting economic growth along with reasonable rate of inflation.
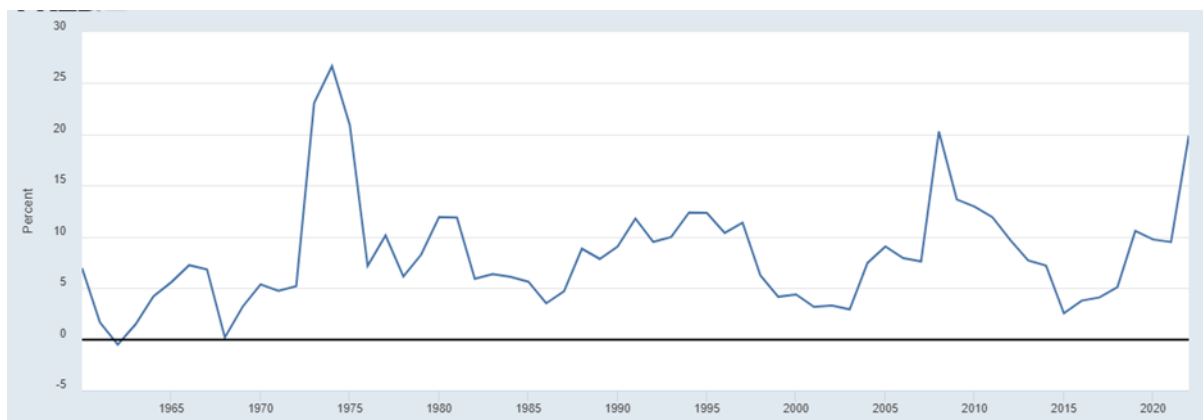
Inflation In Pakistan

Figure 2.
Pakistan Historical Inflation rate in Percent
Source. Federal Reserve Bank of U.S.A

Figure 2 shows the historical overview of inflation rate of Pakistan. The major reason behind increase in inflation in 2008 was rise in the prices of food, and food prices has a significant role in the general inflation. There was high inflation in 2008 as during recent years that's why State Bank of Pakistan pursued tight monetary policy. After 2009 inflation showed declining trend, in 2016 inflation was at low level so state bank of Pakistan implement loose monetary policy. This study contributes existing literature in several ways. One from methodological point of view where this study use TVPVAR model which better captures changing dynamics of economy and selected variable, secondly we examine impact during Global Financial Crisis which is very important as international events affect our economy significantly third this study contributes business cycle literature by studying impact on output in Pakistan. Following are the objectives of this study:

- To examine the major channel of transmission of monetary policy shocks in Pakistan during Global Financial Crisis 2008-2009.
- To analyze the impact of monetary policy shocks on output, inflation and exchange rate in Pakistan during Global Financial Crisis 2008-2009.
- To suggest the policy recommendation in the light of result.

LITERATURE REVIEW

Following section provides a detailed review of previous research and various techniques used for policy analysis purpose. It also documents various findings of the researchers in Pakistan as well as abroad. Gillani et al., (2021) documented that

monetary policy shapes economy by reducing inflation, balancing supply and demand and there by influencing investment in the economy. Chaudhry et al., (2021) found that over long term monetary policy have positive effect on foreign direct investment, savings and investment. Alam and Waheed (2006), examined the impact of monetary policy on different sectors of the economy by using quarterly data spanning from first quarter of 1973 to last quarter of 2003. They also studied major monetary policy changes during 1990s. They found that monetary policy impact different sectors of the economy in different ways on real terms. They also suggested some policy measures post reform period. Khan, Ahmed and Hyder (2007), by using data from 1972 to 2005 and by employing different econometric frameworks identified increasing import, private sector credit and loose policy stance resulted in rising levels of general prices. There are various studies in Pakistan which analyze the relationship between monetary policy and inflation in Pakistan.

Chaudhry et al. (2012), examines short run and long-term relationship between inflation and money supply in Pakistan by using co-integration analysis from 1972 to 2010. Their findings suggest that real exchange rate, credit to private sector are not inelastic and are among the major factors those impact real output in Pakistan. Stefan Gerlach and Frank Smets (1995), analyzed the impact of monetary policy on price level and real output among Group 7 countries. They found that medium term impact on output in all countries. Anzuini et al. (2010), examined the policy impact on various commodities prices in the United States by using Structural Vector Auto Regression framework. They found that loose policy stance increases the prices of different commodities. Barnett et al. (2015), by using recursive scheme found that there is not strong link between policy rate and real output and also central bank uses policy rate to target inflation. They present their results in terms of impulse response functions and variance decomposition.

Choudhry et al. (2015), found the effectiveness of monetary policy in controlling inflation in Pakistan. It is also effective in increasing the level of output in the country. Though anomalies in foreign exchange market and money market impact the effective transmission of monetary policy. They used DSGE model to support their findings. According to Usman and Haq (2015), the results of Vector Error Correction model shows that In Pakistan monetary and fiscal policy are effective in impacting the real GDP capita. Nizamani et al. (2015), studied the relative importance of exchange rate, interest rate, credit and asset price channel. Four transmission channels (i.e., and exchange rate) of monetary policy in achieving the internal balance for a small open-economy of Pakistan. This study has employed open-economy structural vector autoregressive (SVAR) model with non-recursive identification. This framework is employed to study the effects of external shocks on the domestic macroeconomic variables and on domestic monetary policy. The shutdown method in SVAR has also been used to gauge the relative importance of each channel. The results indicate that foreign shocks have contractionary effects on domestic economy.

Interest rate channel has major impact on asset price, output. Exchange rate channel has been found least important in both cases of output and inflation in Pakistan. They found that interest rate channel is more effective in targeting output, whereas to control inflation rate the asset price channel is relatively more useful. Chaudhary and Shabbir (2005), examined the relationship between budget deficit and money supply in Pakistan. They found that huge increase in money supply leads to excessive supply of money over demand resulting in foreign exchange reserve to outflow. All this can

be controlled through limiting budget deficit. According to Ali et al. (2015), studied the impact of inflation, interest rate on exchange rate volatility in Pakistan. They showed their results in the form of Impulse Response Function by using Vector Error Correction Model. They employed monthly data from 2000 to 2009. Their findings suggest that there is short term and long term relationship between inflation and exchange rate volatility. Increasing level of money supply leads to high rate of inflation leading to rise in exchange rate.

Agha, Ahmed, Mubarik and Shah (2005), also employed VAR approach to study transmission channels in Pakistan. Their findings suggest that tight policy decreases money supply resulting in low level of demand and gradual decrease in general price level with a lag. They identified interest rate and exchange rate channel as major channels. The concluded that banks can play an important role in controlling inflation in Pakistan.   Bokil and Schimmelpfenni (2005), employed various approaches to forecast inflation in Pakistan. Their best approach suggested monetary growth and credit to private sector for inflation forecasting. They employed VAR approach for analysis.

Data source

We used secondary data. Data was taken from State Bank of Pakistan, Bank of International Settlement (BIS), Pakistan Bureau of Statistics and Federal Reserve Bank of United States of America.

Data Transformation

Frequency of data was quarterly. Data were transformed into log levels to make the data stationary. Different variables were used in this study such as money market rate, consumer price index (CPI), gross domestic product (GDP) and exchange rate. Vector Auto regression (VAR) model was used for analyzing the impact of policy shocks on output, exchange rate and inflation in Pakistan. Results will be presented in the form of impulse response functions. This TVP VAR model captures the time varying nature of variables in the economy in more robust way as compared to constant VAR model where the parameters are constant in nature hence unable to capture true dynamics of the economy.

Model

Assume that tight monetary policy change is characterized as following a stochastic process by monetary policy shock modeled as reduced form vector auto regression (VAR). The monetary policy shocks impact all the variables contemporaneously. Letting A denotes monetary policy variable, the framework can be shown as:

$$\ln A_t = \left[B_{11}(L) B_{12}(L) \right]\!\left[\varepsilon_{1,t} \right] \quad (1)$$

Here $\varepsilon_{1,t}$ is conventional monetary policy shock. Here coefficients and parameters are all time varying.

RESULTS

Impulse Responses of TVP-VAR Models for the Variable Set of (p, x, i)

Figure 1, presents the impulse response functions of our three variables to all three of the shocks for chosen time period i.e. 1992Q4, 1995Q3, 2004Q2, 2009Q1. In the

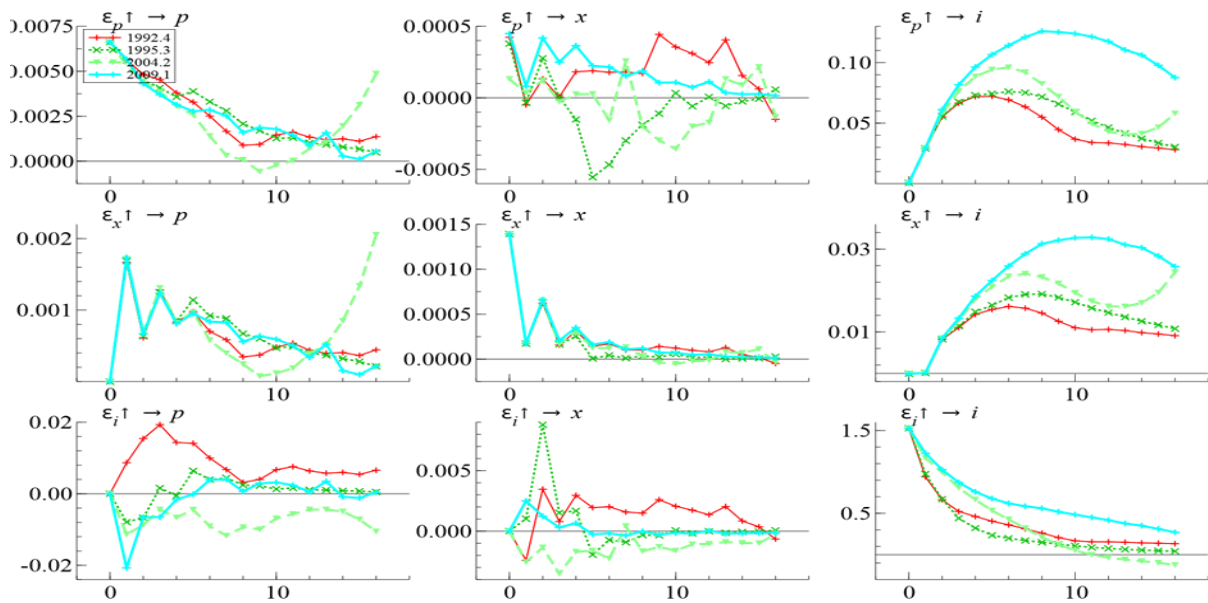respective model impulse response functions change considerably over selected time horizon.

Figure 1.

The output declines as a response to positive inflation shock ($\varepsilon_p \uparrow \to x$) in 1995Q3. This confirms basic economic theory that inflation shock have negative impacts on output over medium to long term. But in 2009Q1 it is opposite to basic economic theory, the output increase as a response to positive inflation shock. The result of 2009Q1 is similar to the result of Wagan (2012) for japan economy. The interest rate increase as a response to positive inflation shock ($\varepsilon_p \uparrow \to i$) in selected time period i.e. (1992Q4, 1995Q3, 2004Q2, 2009Q1). The impulse response of inflation to positive output shock ($\varepsilon_x \uparrow \to p$) is positive and more evident in 2009Q1, in Pakistan. There appears to be positive response of monetary policy to positive output shock ($\varepsilon_x \uparrow \to i$) in Pakistan

The spillover of interest rate innovation to output growth ($\varepsilon_i \uparrow \to x$) has decreased over the recent years in Pakistan. The most striking feature is that in Pakistan after initial positive response, these responses move in opposite directions mainly during 1995Q3 and 2009Q1. The impulse response of inflation is negative to tight monetary policy shock ($\varepsilon_i \uparrow \to p$), this is in accordance with the standard economic theory that contractionary monetary policy impact inflation negatively. Except in 1992Q4 there is increase in inflation as a response to increase in policy rate that is due the fact that inflation targeting was not the basic objective of central bank of Pakistan at that time and another reason may be that monetary policy was not successful in decreasing the level of inflation. Sims (1992) documented increase in price level followed by tight policy shock an VAR setting as Price Puzzle. This was due to the use of parsimonious set of information for analyzing monetary policy.

Posterior Estimates for Stochastic Volatility of the Structural Shock, for the variable set of (p, x, i)

Fig. 2, shows posterior estimates for stochastic volatility of structural shocks. In Pakistan after showing declining trend in early 2005 the inflation increases after 2007. This rising trend is due to increase in food and non-food inflation.
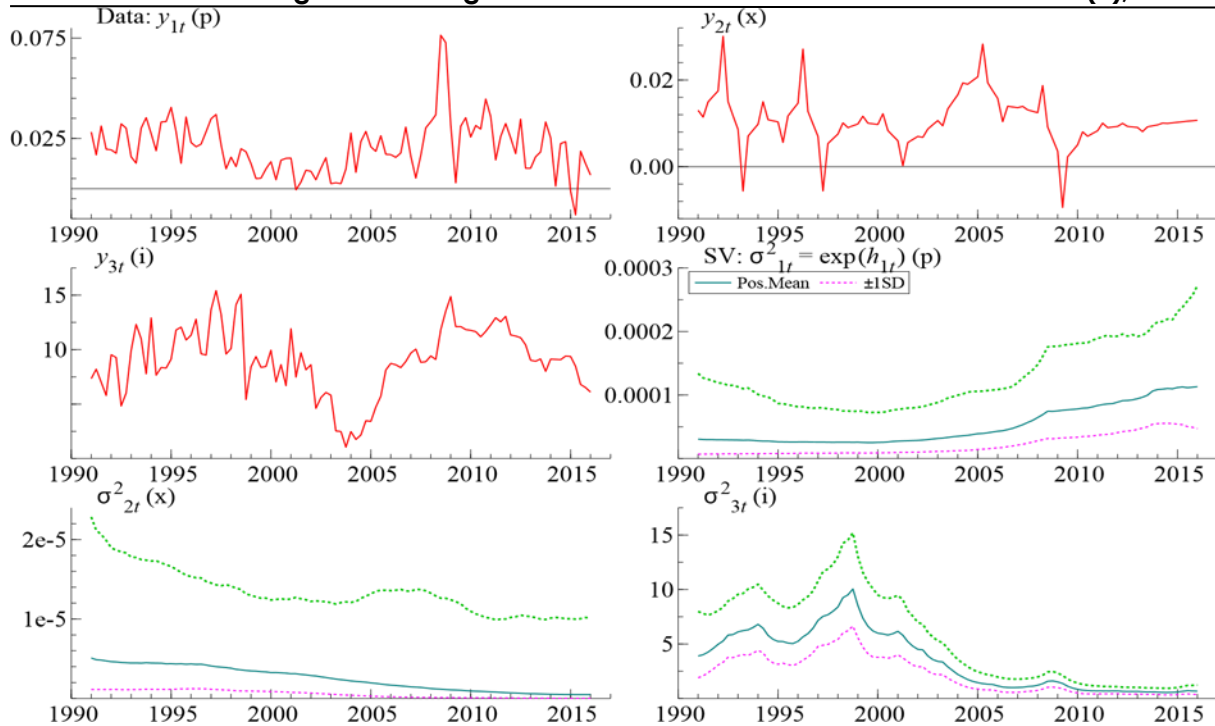
Figure 2.

Inflation in Pakistan over past 25 years can be expressed in four phases. From 1991 to 1997 inflation was in double digit. From 1997 till 2007, inflation was limited to single digit, from 3 to 9 percent. It became volatile in 2008 to 2012 and accelerated to double digit during that period. From 2013 to 2015 inflation decreases due to policy adjustments (Pakistan Bureau of Statistics).In case of Pakistan, after 1990 there is declining trend in volatility of output and a simultaneous moderation of business cycle fluctuations. In Pakistan country the reasons behind the decline in output volatility are political stability and terrorism. Ismail and Amjad (2014) studied various reasons behind terrorism in Pakistan. They studied inflation, low per capita GDP, poverty and unemployment. They found that terrorism in Pakistan is the major reason behind low GDP of Pakistan. Policy rate is more volatile during 1998. After 2000 there is decline in volatility of policy rate during 2007 and 2008 there was increase in world fuel prices, political unrest in the country, increased the level of inflation in Pakistan. Pakistani rupee devalued along with decline in foreign direct investment (Martin and Kronstadt 2008).

Impact of shock 4, 8 and 12 quarter ahead for the variable set of (p, x, i)

Figure 3 shows the results of impact of shocks 4, 8, and 12 quarter ahead of our all three variables p, x, i to all of the shocks. The output declines in 2007 and 2008 as a response to positive inflation shock. This decline is due to global financial crises 2007-8. The response of policy rate to inflation shock is in rising trend in 2007 and 2008. The inflation is increasing as response to positive output shocks after 12 quarter this rising trend is also evident during 2008 where the impact of output on inflation is in long term. Policy rate also increase as a response to positive output shock this is also more pronounced during global financial crises.
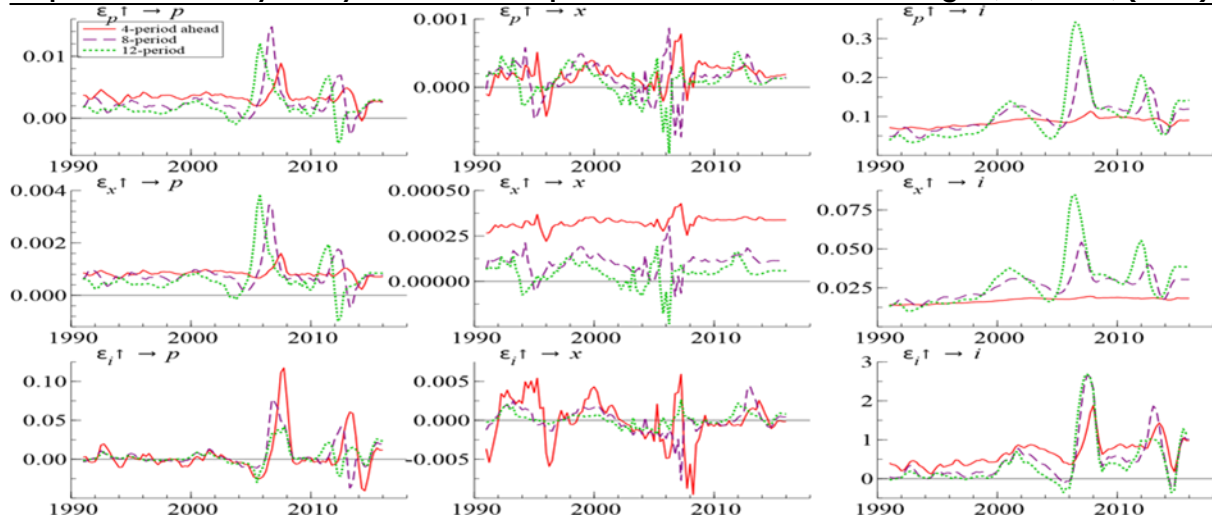
Figure 3.

The response of inflation to contractionary policy rate is still positive because of recessionary state of the economy during world financial crisis 2008-2009. Due to contractionary monetary policy output declines, this effect is more evident during the crisis period

DISCUSSION

Monetary policy plays key role to control the rise in general price level in Pakistan. In this research study quarterly data was used from 1990 to 2022 but due to unavailability of some variables on this time horizon analysis is performed mainly upto 2016. In research we take three variable inflation, output and interest rate of Pakistan. Time varying parameter (vector auto regression) model has been used for the research study result. We select four horizons from data span i.e. (1992Q4, 1995Q3, 2004Q2, 2009Q1). These four quarters were selected due to their importance for instance early 90sw as selected due to high inflation rate prevailing at that time and we were interested to study the role of monetary policy to control inflation whereas 2009 was selected due to global financial crisis. We compare our results with findings of different research papers.

Our findings describe that the output decline and interest rate increase as response to positive inflation shocks. But in 2009Q1 as response to positive inflation shock output increase. Our results show that inflation decreases and interest rate increases as response to positive output shock. As response to contractionary monetary policy, inflation decreases which is accordance with standard economic theory. In Wagan (2012) quarterly data was selected from 1980Q1 to 2014Q4 (except japan because there data set ends in 2010) three variables were selected inflation, GDP and interest rate for G7 countries researcher use TVP-VAR model for each country and select four quarter i.e. 1987Q4, 1994Q4, 2001Q4, 2008Q4 to see the result in TVP-VAR model.

Their findings suggest that the output decline in most of the G7 countries except Japan as response to inflation shock, this decline is more noticeable in 1994Q4 in UK and followed by other countries. In Japan, rise in inflation results in increase in output. The IRF of interest rate and inflation to positive output shock is positive in all G7 countries (except during 2008Q4 and 2001Q4 in Japan). As a response to interest rate shock, price puzzle becomes less evident in Canada, US, France and Italy over the recent quarters. Koop et al. (2009), details the same response of domestic inflation to

US monetary policy shocks, presence of price puzzle in the earlier periods can be attributed to the high inflation and high interest rate environment of the period While estimating domestic set of variables in case of Pakistan: (p, x, i) volatility of inflation is declining in early 2005 whereas volatility of inflation increases after 2007. The volatility of output decreases after 1990. Policy rate is more volatile during 1998. After 2000 there is decline in volatility of policy rate but in 2008-09 policy rate become more volatile because of global financial crises in 2007 and 2008.

Nakajima (2011) shows the volatility of inflation general downwards trend. Volatility of output remains just a little high in the early 1980s and the late 1990s. Interest rate volatility declines during the mid-1990s. When the bank of Japan followed zero bound policy rate. While estimating time varying impulse responses 4, 8 and 12 quarters ahead. Output declines in 2007 and 2008, 12 quarter ahead as response to positive inflation shock. Result shows that policy rate increase 12 quarter ahead as response to positive inflation shock this rising trend was in 2007. Response to positive output shock 12 quarter ahead inflation is in rising trend this rising trend is also apparent in 2008. Policy rate responds positive 12 quarter ahead as response to positive output shock. This study provides the roadmap for resolving the major economic issues of Pakistan as Pakistan is experiencing the worst economic crisis during 2024 with high rate of inflation that is more than 30 percent, depreciation of exchange rate by more than 20 percent and huge foreign debt.

CONCLUSION

This study examined the impact of monetary policy shocks on inflation, output, and interest rate dynamics of Pakistan by using TVP-VAR model. Research study result shows the importance of incorporating stochastic volatility into the TVP-VAR model. From methodological point of view this study contributed existing literature in three respects, first it quantified the impact of inflation, output and monetary policy in exogenous and endogenous, to depict the dynamics of Pakistan. Second, it identified posterior estimates for stochastic volatility of structural shocks. Third study forecasted the impact of inflation, output and monetary policy shocks 4, 8, and 12 quarter ahead.

From the research study it is concluded that the output have negative impact as response to positive inflation shocks in 1993 Q3 but in 2009 Q1 we identify that there is positive impact on output as response to positive inflation shocks. Studying the interest rate of Pakistan we concluded that as inflation is going to upward the central bank increase the policy rate to control the inflation in research study it can be seen clearly in 1992Q4, 1995Q3, 2004Q2 and 2009Q1. In study there is negative impact on inflation as response to tight monetary policy. Standard economic theory also stated that contractionary monetary policy impact inflation negatively.

While studying the posterior estimates for stochastic volatility of structural shocks. In 2005 there is decline in inflation but after 2007 inflation is in rising trend. This rising trend is because of rise in food and non-food inflation. The volatility of output after 1990 is decreasing. After 2000 volatility of policy rate declines but in period of global financial crises the interest rate increase in 2007 and 2008. Third the study examined the impact of inflation, output and monetary policy shocks to all of the shocks 4, 8, and 12 quarter ahead. In 2007-08 after 12 quarter the output decline as response to positive inflation shocks. In research study the inflation is going to upward as response to positive output shocks the major rising trend seen in 2008 after 12 quarters. During the period of global financial crises policy rate increase as response to output shocks and due to tight monetary policy output decline in 2008-09. The response of policy rate to inflation is in

rising trend these increase or decrease is due to the financial crises in the world. This study may be extended to TVP FAVAR model which incorporates more than 100 of variables for economic analysis purpose in time varying setting.

RECOMMENDATIONS

To improve the economic conditions of our country in terms of output, inflation and interest following recommendations have been made. State Bank of Pakistan should keep the policy rate at reasonable level to increase the level of output as it may indirectly increase the level of employment in the country. Central bank policy is an effective tool for controlling general inflation in Pakistan and for bringing economic stability in the country. State bank of Pakistan should implement effective policy for controlling inflation. During current economic situation where rate of inflation is very high central bank needs to pursue tight monetary policy to reduce the level of inflation in the country. This in turn will appreciate the exchange rate of Pakistan. Low rate of interest will increase the level of production which in turn will increase the level of output. Interest rate channel is the major channel of transmission of monetary policy, central bank can use this channel to control inflation and output.

DECLARATIONS

Availability of data and material: In the approach, the data sources for the variables are stated.
Authors' contributions: Each author participated equally to the creation of this work.
Conflicts of Interests: The authors declare no conflict of interest.
Consent to Participate: Yes
Consent for publication and Ethical approval: Because this study does not include human or animal data, ethical approval is not required for publication. All authors have given their consent.

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