

The Relative Strength of Monetary Policy Transmission Channels in the Small Open-Economy: Evidence from SVAR Analysis for Pakistan

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ABSTRACT

The objective of this study is to investigate the relative importance of four transmission channels (i.e. interest rate, credit, exchange rate and asset price channel) 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 method is undertaken to analyze 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 show that foreign shocks have contractionary effects on domestic economy and monetary policy. Interest rate channel has been less important on inflation rate than asset price and credit channel, although it is found important in output variations. Exchange rate channel has been found least important in both cases of inflation and output in Pakistan. This study has found that central bank of Pakistan can only utilize interest rate channel when it targets output, whereas to control inflation rate the asset price channel is relatively more useful.

Keywords: monetary policy; transmission channels; open-economy; SVAR

INTRODUCTION

The economy of Pakistan had witnessed stagflation¹ for almost a half decade since the 2008 global commodity price shock, among this inflation rate recorded a high and persistent rise comparing to the regional economies. In 2008 the year on year inflation rate was recorded 20%, highest ever in the history of Pakistan². However the economy has started recovery from that adverse shock, but the objection can be raised over the measures of monetary authority in Pakistan. The State Bank of

¹ Higher inflation accompanied by slow growth

² Source: IMF International Financial Statistics.

Pakistan (SBP) had continued tight policy measures to grip inflation³. Despite the tight measures on one end to address price stability while on other end it has been accommodating a fiscal deficit, which has led economy not only with high inflation but with high interest rate that remained around 14% on average from 2008 to 2012⁴. A steady and continuous rise in policy interest rates implies the reliance of SBP on traditional interest rate channel. Over reliance on this channel shall be taken cautiously because if financial markets are less developed then policy transmission may take longer time than anticipated, in addition if cost channel is in practice then it will only amplify the effects on inflation. In spite of any internal or external challenges posed to control inflation, it is the monetary policy that is held responsible for stabilizing key macroeconomic variables. Failure in such a case requires an investigation on a very mechanism of monetary policy.

Following the above stated facts, this study is aimed to establish a pertinent perspective on the relative strength of monetary policy transmission channels in Pakistan allowing external shocks. In order to accomplish this broad objective, this paper has studied four prominent channels of Monetary Policy Transmission Mechanism (MPTM), namely interest rate, credit, asset price and exchange rate channels, by employing a non-recursive Structural vector autoregressive (SVAR) modeling in an open economy context.

The relative strength of these channels will provide an insight to SBP in order to discover the contribution of each channel in addressing the key target variables, i.e. inflation and output. Furthermore SBP follows monetary aggregate regime. As a result of such regime, the policy response becomes passive comparing to interest rate targeting regimes. The passive response leads monetary policy to be exposed to any unanticipated adverse shocks. In order to safeguard such an exposed policy, information on MPTM in open economy frame work will serve a purpose.

However the inspiration to undertake such study is not only linked with the current issue of volatile inflation in Pakistan, but also in the gap of available literature on this subject. A study by Agha et al. (2005) discovered the relative strength of monetary policy transmission channels in Pakistan but they ignored external shocks and used recursive VAR in closed-economy. After the 2008 global commodity shocks it becomes important to consider these facts to understand the dynamic nature of MPTM in Pakistan.

The present study differs on two aspects from previous studies on relative strength of monetary policy transmission channels in Pakistan. One, it allows adverse shocks originating from external world that are equally important for any developing country. Second, by employing open economy SVAR model with non-recursive identification will allow identification of monetary policy based on economic theory rather than on pure recursive ordering in VAR. The result of this study has indicated that adverse external shocks have significant contractionary effects on the economy of Pakistan. While the role of interest channel has been least effective in influencing inflation rate but largely effective in influencing variations in output comparing to other three channels.

The rest of the paper is organized as follows. Section 2 provides literature review on the relative strength of transmission channels in developing countries. Section 3 briefly discusses the research methodology. Section 4 presents the empirical results based on structural impulse-response function, and Section 5 provides summary and conclusion.

LITERATURE REVIEW

Most of the research has been done in regard of transmission channels of monetary policy for developed and high income countries. see (B. Bernanke, & Blinder 1990; Christiano, & Eichenbaum 1992; Ramey 1993; Taylor 1995; Dale, & Haldane 1995; Favero, Giavazzi & Flabbi 1999; Fiore 1998;). But since last decade this area has received considerable amount of importance in developing countries as well, the relative strength of each transmission channel in most of the developing countries varies to their given economic skeleton and conduct of policy by their monetary authorities. Much of the literature for developing countries in this regard can be classified into open and close economy context. Where open economy framework is debated to be relevant for such countries, this is due to the recent facts about the effects of developed countries on the policy decisions of developing countries and on their economies. Following studies are aimed to reveal such effects.

³ Since 2005 SBP has continuously raised its policy rate, the highest rate of 15% was recorded in 2008.

⁴ The International Monetary Fund in its country report declared Pakistan's monetary policy as an accommodating, following a rise in 2008 global commodity prices and it has led economy exposed to external shocks (IMF Country Report, 2012).

For an open economy context, studies by Tang (2006), Aleem (2010), Mengesha & Holmes (2013), Perera & Wickramanayake (2013) used VAR models to find relative importance of transmission channels in specific developing countries. They reported that including external factors in their models have led significant results and eliminated any puzzling results that usually occur in VAR framework⁵. For example Tang (2006) has taken extensive study to find relative importance of four prominent channels of transmission mechanism in Malaysia. Using a shutdown methodology in VAR framework he found interest rate channel as most important channel in affecting output and inflation in Malaysia. He argues that considering external variables are highly important for developing country like Malaysia. This is due to the fact that developing countries are potentially affected by the changes in developed countries. Following similar argument Aleem (2010) found strong support for credit channel in India, whereas Mengesha & Holmes (2013) found bank lending channel as relevant in Eritrea. Perera & Wickramanayake (2013) also supported the bank lending channels in Sri Lanka.

Besides the above mentioned country specific studies on relative strength of transmission channels, the results are not much different for cross country studies as well. Davoodi et al (2013) in this regard found credit channel as an important channel in two out of three countries analyzed for this purpose. In order to strengthen the monetary transmission mechanism in Kenya, Rwanda and Burundi they highlighted the important role of credit channel in Kenya and Rwanda and found interest rate channel as relevant channel in this manner for Burundi. But Mishra, & Montiel (2012) put to gather a vast literature survey for monetary transmission mechanism in most of the developing countries. They have highlighted the dominant role of bank lending channel in such countries, due to their structural differences from developed countries. Adding further to the conclusion, they found methodological limitations in much of literature in order to comprehend transmission mechanism in developing countries. They advocated the use of open economy models in VAR framework which are equally important due to the fact that monetary authorities in developing countries do take external factors in their reaction function.

Much of the literature for the transmission mechanism in developing countries has been on close economy framework. Ramlogan (2004) found interest rate channel comparatively less important than other channels in Jamaica, Trinidad and Tobago, Barbados and Guyana. The study provided an argument that due to the underdeveloped money market in these countries the investors has to rely on banking sector to raise the funds which leads credit channel as highly contributing transmission channel in this regard. Sharifi-renani (2010) has explored into the transmission channels of Iranian monetary policy, where financial system is regarded as interest free and it compliance with Islamic modes of finance. This makes Interest rate channel as irrelevant for monetary authorities. This has allowed researcher to consider credit and exchange rate as potentially important channels. Whereas Fan, & Jianzhou (2011) applied a bench mark VAR model for china, takes in-depth structural economic changes in to account that has been under way for Chinese financial system, and they find bank lending channel as a dominant channel for monetary policy transmission. Wulandari (2012) proposed to the central bank in Indonesia to choose credit channel to enhance growth in the economy but it is ineffective to control inflation in the economy. All of these above mentioned studies used VAR and SVAR models but have ignored external variables.

Apart from methodological differences in above discussed studies broadly on close and open economy frame work, the findings has led to importance of not only one specific channel but to different channels of monetary transmission in developing countries.

Particularly in the case of Pakistan a study by Agha et al. (2005), made a first attempt to discover the relative importance of monetary policy transmission channels focusing on interest rate, credit, asset price and exchange rate channels. By applying a separate recursive VAR model with monthly data spanning from 1996 to 2004. They found interest rate and credit channel as highly effective where as exchange rate channel was regarded as weak channel among all, but their study revealed a strong price puzzle, which is regarded due to the misspecified VAR model (Sims, 1991) in addition their study ignored external variables. In contrast to this Hussain (2009) found exchange rate channel to be an effective in curbing inflation and minimizing output gap in Pakistan, using trivariate VAR model. Again his study is conducted in closed economy context, ignoring external factors that potentially affect domestic economy. However the trivariate model has its own limitations, as it is unable to capture the overall events in the economy due to its fixed set of variables.

⁵ There are many puzzles that can occur in VAR models i.e. price puzzle, output puzzle, exchange rate puzzle just to mention few, e.g. price puzzle arises when an increase in interest rate raises price level in the economy.

RESEARCH METHODOLOGY

Since the introduction of VAR by Sims (1980), VAR has been successful in modeling macroeconomics particularly monetary policy effects on real economy (Bernanke & Blinder, 1990)(B. S. Bernanke, & Gertler 1995). For more economic interpretation the Structural-VAR(SVAR) models were suggested by Sims (1986). Later on, SVAR has been successful tool for analyzing monetary policy transmission mechanism (Christiano, Eichenbaum, & Evans, 1999). For the case of small-open economy Cushman & Zha (1997) suggested SVAR methods for obtaining consistent results. For instance using the SVAR method Zaidi & Fisher (2010); Zaidi, Karim & Azman-Saini (2013); Perera, & Wickramanayake (2013) found consistent results for developing countries in small open-economy context.

Therefore to assess the relative strength of monetary policy transmission channels in Pakistan as a small open-economy, this study is aimed to estimate SVAR model with non-recursive identification structure. Such a model is not only consistent with economic theory, but non-recursive structure of SVAR model allows to capture salient features of the small open economies that are responsible for creating puzzles in recursive VAR (Elbourne & de Haan, 2006).

Data and Variable Descriptions

The quarterly data have been collected from 1992Q1 to 2012Q4. Data for world commodity price index (WCP), federal funds rate (FFR) inflation rate (INF), and six months tbill rate (TBILL) were collected from the IMF's International Financial Statistic. The GDP of Pakistan is collected from the Pakistan Bureau of Statistic. The annual GDP is converted into quarterly using frequency conversion method. Data on credit to private sector (CPS) and nominal effective exchange rates (NEER) has been collected from the State of Pakistan. The data for asset price (KSEI) represents Karachi stock exchange 100 index, which is a bench mark index and it is collected from the Karachi Stock Exchange. All variables are transformed into logs except for FFR, INF and TBILL, which are stated in percentage points.

These eight variables are divided into two blocks, foreign and domestic blocks. The foreign block consists of the world commodity price index (WCP) and federal funds rate (FFR) of US, in which both variables will serve as exogenous factors influencing domestic economy in an open economy framework. The selection of both variables in a small open-economy SVAR framework is in line with a recent study by Perera & Wickramanayake (2013). Specifically to include WCP has not only been guided by the prior literature Sims (1991); Tang (2006), Zaidi et al (2013) but it is also an important factor for turbulences in Pakistan's economy. Furthermore, FFR is used as a proxy to represent foreign monetary policy as employed by Cushman & Zha (1997); Kim, & Roubini (2000). The changes in FFR are expected to bring changes in monetary policy of small open economy along with macroeconomic imbalances (Abdul Karim, 2013).

The domestic block includes two target variables, the GDP and inflation rate (INF) (measured as percentage changes in CPI). The six month tbill rate (TBILL) is used for two purpose. One, it will indicate monetary policy stance in Pakistan, Second, it will also represent interest rate channel.⁶

The remaining three variables are used to represent other three transmission channels, Credit channel has been represented by the total amount of loans provided by scheduled banks to private sector (CPS). This variable will allow us to capture both elements of bank lending and balance sheet effects in credit channel (Tang, 2006). The Karachi stock exchange 100 index (KSEI) is used as a bench mark index to represent asset price channel and nominal effective exchange rates (NEER) exchange rate channel, any decrease in NEER will represent depreciation of domestic currency against the basket of currencies for all major trading countries to Pakistan and vice versa.

In addition to these variables, a dummy variable is also included to capture the crises period of 2008. All variables are seasonally adjusted using widely accepted X-11 procedure.

SVAR Modeling

The structural representation of VAR model is given as;

$$BX_t = \Gamma_0 + \Gamma(L)X_{t-1} + \varepsilon_t \quad (1)$$

Where B is contemporaneous matrix coefficients, X_t is (n x 1) vector of variables included in a system i.e $X_t = (WCP_t \text{ FFR}_t \text{ RGDP}_t \text{ INF}_t \text{ TBILL}_t \text{ CPS}_t \text{ NEER}_t \text{ KSEI}_t)$, Γ_0 is vector of constants, $\Gamma(L)$ is a square matrix polynomial in the lag operator L. ε_t is the vector of structural shocks which satisfies the

⁶ SBP uses discount rate as its policy rate but it announces this rate every two months, whereas tbill auction is conducted every two weeks. Thus tbill provides quick signals to financial markets in Pakistan.

condition of zero mean $E(\varepsilon_t)=0$ and time invariant covariance matrix $E(\varepsilon_t \varepsilon_t')=\Sigma\varepsilon$, that is Identity matrix.

Transforming equation (1) in to reduce form requires pre-multiplication with B^{-1} ,

$$X_t = B^{-1}\Gamma_0 + B^{-1}\Gamma(L)X_{t-1} + B^{-1}\varepsilon_t \quad (2)$$

Further simplification yields,

$$X_t = A_0 + A_1X_{t-1} + e_t \quad (3)$$

Where $A_0 = B^{-1}\Gamma_0$, $A_1 = B^{-1}\Gamma(L)$ and $e_t = B^{-1}\varepsilon_t$ satisfies the condition $E(e_t)=0$, $E(e_t e_t')=\Sigma e$, is a $n \times n$ symmetric matrix.

Equation (3) can be estimated using the data, but to generate impulse response functions, it is necessary to use the structural shocks (ε_t) rather than estimated residuals (e_t) (Enders 2004 p292). Structural shocks (ε_t) can be recovered from estimated residuals (e_t) from the relationship given below between variance-covariance matrix i.e. $\Sigma\varepsilon$, Σe .

$$\Sigma\varepsilon = E(\varepsilon_t \varepsilon_t') = E(B^{-1}e_t e_t' B^{-1}) = B^{-1}\Sigma e(B^{-1})' \quad (4)$$

Hence,

$$\Sigma\varepsilon = B\Sigma e B' \quad (5)$$

For a symmetric matrix $\Sigma\varepsilon$, consists $n^2+n/2$ unknown elements, which requires to impose $n^2-n/2$ additional restrictions to just identify the system, so as to recover all structural shock (ε_t) from the estimated residuals (e_t).

Identification Scheme

The SVAR model allows using economic theory to impose restrictions on the system that gives non-recursive structure on contemporaneous parameters, rather than the Cholesky decomposition that is to orthogonalize the estimated residuals from the reduced form VAR providing recursive structure of the identification.

The structural shocks can be recovered from estimating the equation (3) where $e_t = B^{-1}\varepsilon_t$, alternatively $\varepsilon_t = B e_t$. The appropriate restrictions are applied on B matrix that is shown below in the compact matrix form.

$$\begin{bmatrix} \varepsilon_{WCF} \\ \varepsilon_{FFR} \\ \varepsilon_{RGDP} \\ \varepsilon_{INF} \\ \varepsilon_{TBILL} \\ \varepsilon_{CPS} \\ \varepsilon_{NEER} \\ \varepsilon_{KSEI} \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ a_{21} & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ a_{31} & 0 & 1 & 0 & 0 & 0 & 0 & 0 \\ a_{41} & 0 & a_{43} & 1 & 0 & 0 & a_{47} & 0 \\ a_{51} & 0 & a_{53} & a_{54} & 1 & 0 & a_{57} & 0 \\ 0 & 0 & a_{63} & 0 & a_{65} & 1 & 0 & 0 \\ a_{71} & a_{72} & a_{73} & a_{74} & a_{75} & a_{76} & 1 & 0 \\ a_{81} & a_{82} & a_{83} & a_{84} & a_{85} & a_{86} & a_{87} & 1 \end{bmatrix} \begin{bmatrix} \varepsilon_{WCF} \\ \varepsilon_{FFR} \\ \varepsilon_{RGDP} \\ \varepsilon_{INF} \\ \varepsilon_{TBILL} \\ \varepsilon_{CPS} \\ \varepsilon_{NEER} \\ \varepsilon_{KSEI} \end{bmatrix} \quad (6)$$

The zero restrictions on matrix B in eq (6) are employed by following the method of Amisano & Giannini (1996), the system requires minimum $n^2-n/2 = 8^2-8/2 = 28$ zero restrictions to be exactly identified, where as in this case 32 restrictions are enough to over-identified SVAR system. The details of the above identification are explained below.

The first two rows of equation (6) represents foreign block, which includes world commodity prices and Federal funds rate of U.S. The foreign block has been set as complete exogenous to the domestic block. This implies that domestic block contemporaneously responds to the foreign block, but not other way around, the restrictions are also imposed on the lagged values of domestic block, owing to the fact that small economy has no influence on world economy. The order of foreign block to lead domestic block has been guided by the prior literature on SVAR modeling for small open economy (Cushman & Zha 1997; Dungey & Fry 2000; Dungey & Pagan 2000; Perera, & Wickramanayake

2013; Abdul Karim 2013). The inclusion of world commodity prices (WCP) ahead of federal funds rate (FFR) is in line with Kim & Roubini (2000), that US monetary policy response to inflationary pressure due to negative supply shock. Although they included world oil prices to represent as supply shocks, where as in this model world commodity prices (WCP) has been included instead, which is regarded as broader indicator for external supply shock than oil prices.

The domestic block leads with two target variables of monetary policy, output (RGDP) and inflation (INF). Assuming that output and Inflation contemporaneously responds to world commodity prices (WCP). As a developing country, Pakistan rely heavily on imports, a positive shock to the world commodity prices will instantly transmits into the domestic inflation and output. This leaves developing economies highly vulnerable to the commodity prices. Moreover domestic inflation also responds contemporaneously to the output and exchange rate along with commodity prices, this is due to the fact that price level has a tendency to move accordingly with any changes in real activity.

Row five represents the monetary policy reaction function which depends on the prices, real economic activity and exchange rates. The inclusion of prices and exchange rate in reaction function is in line with Kim & Roubini (2000), but inclusion of real economic activity is based on the fact that monetary authorities in Pakistan receives such information before making decision for change in policy stance (SBP, 2014). The variable for credit channel (CPS) responds contemporaneously with both policy variable TBILL and real GDP, this assumption is based on the features of demand for loans and supply of loans.

The exchange rate channel (NEER) in row seven is assumed to respond contemporaneously with all variables in foreign block and in domestic block, only excluding domestic asset price (KSEI). Whereas Asset price channel (KSE) in last row is assumed to respond contemporaneously with all variables in both blocks. Such identification is line with Abdul Karim (2013) for a small open economy.

Shutdown Methodology

In order to gauge the relative strength of each channel, the shutdown method proposed by Ramey (1993) has been used. This method allows shutting down a particular channel in a system to capture its contribution on target variables i.e. output and inflation. For instance, to gauge the relative strength of credit channel in our system, the impulse response function (IRF) is analyzed under two settings, one, the IRF of baseline model is compared with the IRF of appended model, where credit channel is set exogenous in the system. Second, the deviations of the IRF of appended model from the IRF of baseline model will trace the strength of credit channel, i.e. larger deviations will represent credit channel as a strong channel in affecting the target variables. This method has also been used accordingly by Morsink, & Bayoumi 2001; Disyatat & Vongsinsirikul (2003); Perera, & Wickramanayake (2013).

EMPIRICAL RESULTS

Preliminary Analysis⁷

A unit root test provided by Augmented Dickey-Fuller (ADF) and Kwiatkowski Philips Schmidt Shin (KPSS) showed that interest rate (foreign & domestic) and inflation rate are $I(0)$, where as all other series are $I(1)$. This will lead us to the debate in VAR modeling to whether estimate VAR in level or in first difference, but following Sims, Stock, & Watson (1990) and Lütkepohl & Reimers, (1992) this study estimates VAR in levels as it provides consistent results. Although there is a trade-off between loss of efficiency in level VAR and loss of long run information in first difference, but theoretical relationship among economic variables are based on level forms.

The optimal lag length under different information criteria suggested lag length of 1, 2 and 3 by Schwarz, Hannan-Quinn and Akaike information criterion respectively. As guided by the prior literature on monetary transmission mechanism with quarterly data Ramaswamy & Sloek (1997) and Disyatat & Vongsinsirikul (2003) the lag order of two has been selected.

As in this case the baseline SVAR model is over identified, the Likelihood Ratio (LR) test has been used to check the validity of over-identification⁸. The test suggests that identifying restrictions cannot be rejected at conventional 5% significant level.

⁷ Results of Unit root test, lag order selection criteria, Stability test and LR test for over-identification are not been presented in this paper due to the space limitation, but available with author upon request.

Structural Impulse Response Functions (SIRF)

Having established a valid baseline SVAR model the next step is to trace the structural impulse response functions (SIRF) of domestic variables to one-time shock of external and policy variables. Initially the response of domestic variables to foreign shocks have been presented in figure 1, secondly the response of domestic variables to monetary policy shock are then presented in figure 2. The solid line in SIRF represents estimated response where as two dashed lines represents the confident bands. These confident bands are calculated from Hall's bootstrapping method, where 95% confidence interval and 100 bootstrap replications were selected for estimation.

SIRF of Domestic Variables to Foreign Shocks

The figure 1 is consists of two panels A and B, both showing the response of domestic variables to the innovation in foreign shocks. Panel A shows the response of domestic variables including macroeconomic variables and domestic monetary policy to the innovation in world commodity prices. The response of domestic output to world commodity prices is negative and significant within fourth quarter, and the effects are long lived for almost whole horizon. The negative effects of the output are due to the fact that Pakistan is a net importing country from rest of the world, among its imports the major portion is consists of the raw materials and energy for the domestic industry. This finding indicates that any rise in world commodity prices will certainly have negative long lasting effects on the domestic output. Inflation responds is significantly positive within the first year, although positive beyond first year to third year but insignificant as both dashed line are not in the same domain of negative or positive values. Again this indicates that world commodity prices have significant pass through effect on domestic inflation within first year.

The response of domestic interest rate is significantly positive to world commodity prices; the highest response is in fourth quarter of 1.4 percentage point to one standard deviation shock to world commodity prices. One possible explanation is that monetary policy in Pakistan gives priority to control inflation rather than enhancing output, this is the one potential reason for implementing tight policy in the wake of increased world commodity prices. The domestic currency shows negative response to positive shock in world commodity prices; this is due to the fact that being a net importing country the rise in world price level increases the demand for foreign currencies relative to domestic currency increases that in turn leads depreciation of Pakistan Rupee⁹.

Panel B shows the response of domestic macroeconomic variables and monetary policy to the innovation in federal funds rate. The domestic output responds positively in short run but the effect is relatively small. Beyond one year the response turns downward and becomes negative in long run. This effect can be explained in way that Pakistan is net exporter to USA; any increase in federal funds rate will reduce the demand for Pakistani products in USA, ultimately affecting the domestic output. The domestic inflation responds negative to positive shock in federal funds rate, and the initially domestic inflation reduced to 0.3 percent to one percentage point increase in federal funds rate. The exchange rate initially responds positive showing appreciation in short run but the effect dissipate in long run and domestic currency continues its depreciating trend. One possible reason is that SBP follows de facto peg regime with US dollar to maintain domestic exchange rate.

SIRF of Domestic Variables to Monetary Policy Shocks

Figure 2 shows the response of domestic variables including target variables and intermediate variables to the innovation in monetary policy shocks. The domestic output has responded significantly negative to a positive shock in short term interest rate i.e. TBill. This show that unexpected tightening of monetary policy leads output to respond negatively and this can be explained by standard economic theory, that increase interest rate reduces aggregate demand and untimely reduces output. The response of inflation rate to interest rate shock is initially positive but significantly negative beyond fourth quarter. This shows that even the inclusion of world commodity prices have not removed the price puzzle as it was expected to eliminate such anomaly, the possible explanation that is provided in the literature is due to the existence of the cost channel in the economy. Rehman & Malik (2010) have shown that manufacturing industries in Pakistan are able to shift the cost of capital to their prices;

⁸ As in equation (6) of contemporaneous coefficients 28 zero restrictions were required to just identify the system, whereas total 32 zero restrictions were imposed to over identify the model.

⁹ The official name of Pakistan's currency is Pakistani Rupee (PKR).

hence there is a strong support for the existence of cost channel in Pakistan which is responsible to this price puzzle.

The exchange rate responds negatively to the positive shocks in interest rate, one possible explanation to this respond is, because domestic financial markets are underdeveloped in Pakistan and are unattractive to foreign investors, so the capital inflow may not be expected due to the rise in interest rate. However capital outflow can be expected due to the prevailing uncertainty regarding the commitment of central bank to control inflation which results in continuous rise in both interest rate and inflation rate side by side in the economy.

The effects of monetary tightening are significantly negative on credit to private sectors provided by scheduled banks¹⁰. Following a one percentage point increase in interest rate reduces the credit to private sector by one percent within a first year and it increases to two percent at the end of second year, the response is long lasting. The domestic stock market has also responded negatively with an increase in interest rate, within second quarter the stock prices significantly decrease by 4 percent following one percentage point increase in interest rate. This is because monetary tightening slowdowns all economic activity which affect dividend payments and ultimately reducing asset prices.

Relative Strength of Transmission Channels

Figure 3 and figure 4 provide the relative strength of transmission channels. Each figure consists of five impulse response combined together in order to compare the relative strength of each channel with all transmission channels. To distinguish among the channels each impulse response is labeled with their name i.e. "W/O Credit Channel" shall be read as without credit channel. The shutdown method has allowed us to trace these impulse responses. For example, to trace the impulse response of interest rate channel on inflation rate in figure 3, the base line model has been amended by setting the variables CPS, NEER and KSEI exogenous in the model. Similarly if only CPS is set exogenous in the baseline model, it will provide us the impulse response of inflation to interest rate without credit channel. In the same way the base line model was amended one by one for remaining channels.

Interest rate channel in figure 3 shows least contribution towards reducing inflation, in fact it has no effect in reducing inflation comparing to other channels. Whereas asset price channel accounts more than half of variations in inflation rate at the fourth quarter, it proves to be important channel in short run. Secondly credit channel also proves to be important in short run and also in medium run, although it only accounts one third of the variations in inflation rate at the end of first year. Exchange rate play important role after eighth quarter and in long run.

Figure 4 shows the strong interest rate channel in influencing output in short run, at the end of the fourth quarter the interest rate bring one third of the variations in output. Whereas other channels are not relevant in short run, but after sixth quarter beside interest rate channel the credit channel is also important followed by asset price channel. Exchange rate channel has been least important in influencing domestic output.

Robustness¹¹

In order to check the robustness of the base line model various procedures were considered, including, (i) recursive SVAR model, (ii) SVAR model with alternate identification schemes, (iii) eliminating block exogeneity in SVAR model, and (iv) SVAR model with money demand. Overall, the structural impulse response functions are robust with the baseline SVAR model.

SUMMARY AND CONCLUSIONS

This paper has taken 8 variable open economy SVAR model with non-recursive identification in order to reveal the relative strength of monetary policy transmission channels in Pakistan. The focal point of this study is to examine monetary policy effectiveness in the presence of adverse external shocks. In order to serve this objective, first this paper has examined the effects of adverse external shocks on domestic macroeconomic variables and domestic monetary policy. Second, in the presence of these adverse shocks the paper has revealed the response of domestic target variables and intermediate

¹⁰ Scheduled banks here refer to all commercial banks, Islamic Banks, Public Banks and Specialized Banks.

¹¹ The full results of robustness checking is not reported in this paper due to the space constraints, where as these results are available on request.

variables to the unexpected shocks of domestic monetary policy. Third, the relative strength of four transmission channel has been analyzed using shutdown methodology in SVAR modeling.

The empirical results based on structural impulse response functions have revealed following finding. First, the adverse shocks originating from the external world have significant contractionary affects on the domestic economy of Pakistan, in addition to this the domestic monetary policy also responds with tight policy stance. This nature of response by domestic monetary policy reveals that SBP gives strong priority to control inflation rather enhancing domestic output because in the case of output monetary policy would response by easing policy.

Second, monetary policy tightening has significantly slowdowns the domestic economic activity. Whereas monetary policy tightening has positive effects on inflation in very short run, however in medium and long run monetary policy has significant negative effects on inflation. A positive response by inflation in short run is referred as price puzzle in economic literature, in the case of Pakistan price puzzle is relevant due to the existence of active cost channel in the country. These findings suggest that monetary policy is effective in influencing all intermediate variables in addition to the output but ineffective on inflation in short run.

Third, the interest rate channel has proved to be ineffective in controlling inflation rate in Pakistan but highly effective in output variations, this implies that SBP shall only utilize this channel when the target is to enhance output rather controlling inflation rate. The asset price channel has been found highly important in controlling inflation but not effective in output variations, the asset price channel is also referred as wealth channel in transmission mechanism. The strong presence of wealth channel in Pakistan reveals that inflation in the country is demand driven. Credit channel has proved to be important in the presence of adverse external shocks; it is equally responsible for significant variations in both inflation and output in Pakistan.

On the basis of results the conclusion can be drawn in way that monetary policy is less effective in taming inflation rate in Pakistan, in other words there is delayed negative response of inflation. Although it is one of the key target variables of monetary policy, in fact results have showed that it is predominant target in the presence of external shocks. This lead us to focus on the nature of inflation in Pakistan, as the results have also showed that inflation in Pakistan is demand driven. There are quit many possible reasons for this. One, the size of informal economy in Pakistan is about 30 percent of total economy¹²; the informal sectors are untraceable to monetary policy so in return it asserts additional pressure on inflation rate. Secondly there is a positive relationship between interest rate and informal economy, the rise in interest rate leads rise in informal economy¹³. In this scenario SBP should cautiously increase interest rate as it will only amplify the positive effects on inflation rate. Second, Pakistan receives more than 6 percent of GDP as remittance from abroad by its workers¹⁴, and much of it goes into consumption purposes which also puts additional pressure on domestic inflation. In these given conditions monetary policy requires to be actively monitoring all possible pressures on inflation in the country and play its part to reduce the size of informal economy and channelize the remittance in productive sectors so as to reduce pressure on inflation.

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¹² Arby, Malik, & Hanif (2010) have studied the size of informal economy in Pakistan.

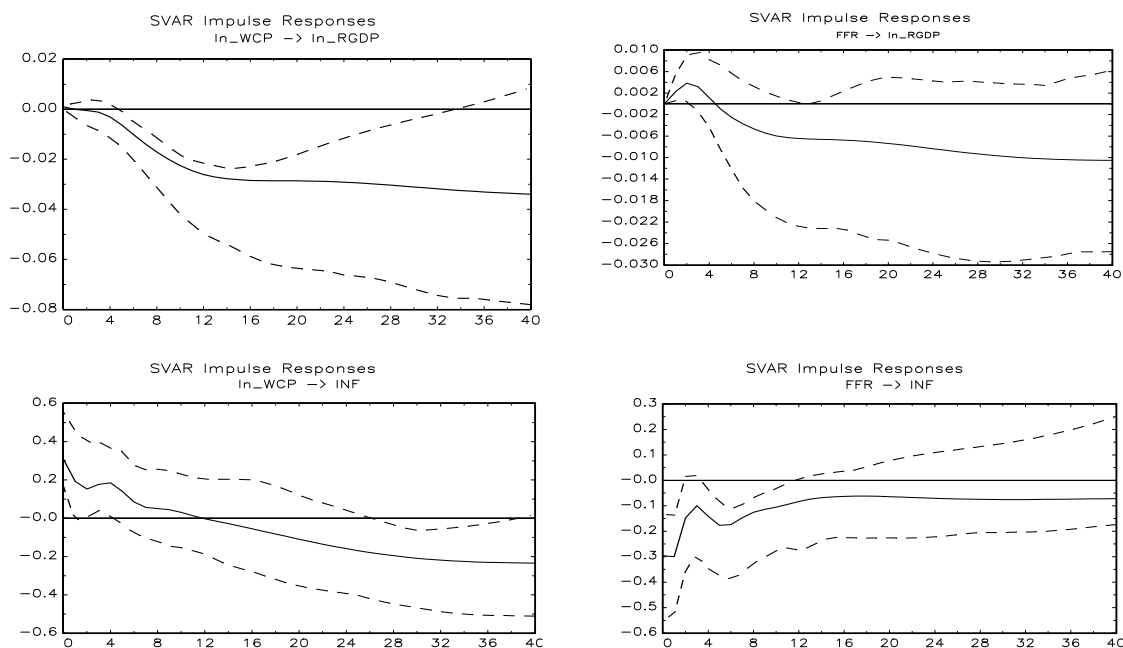
¹³ Kolev & Morales (2005) have reported positive relationship between informal economy and interest rate.

¹⁴ Source: World Bank Indicators 2013

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FIGURE 1: SVAR Impulse Responses of Domestic Variables to Foreign Shocks.



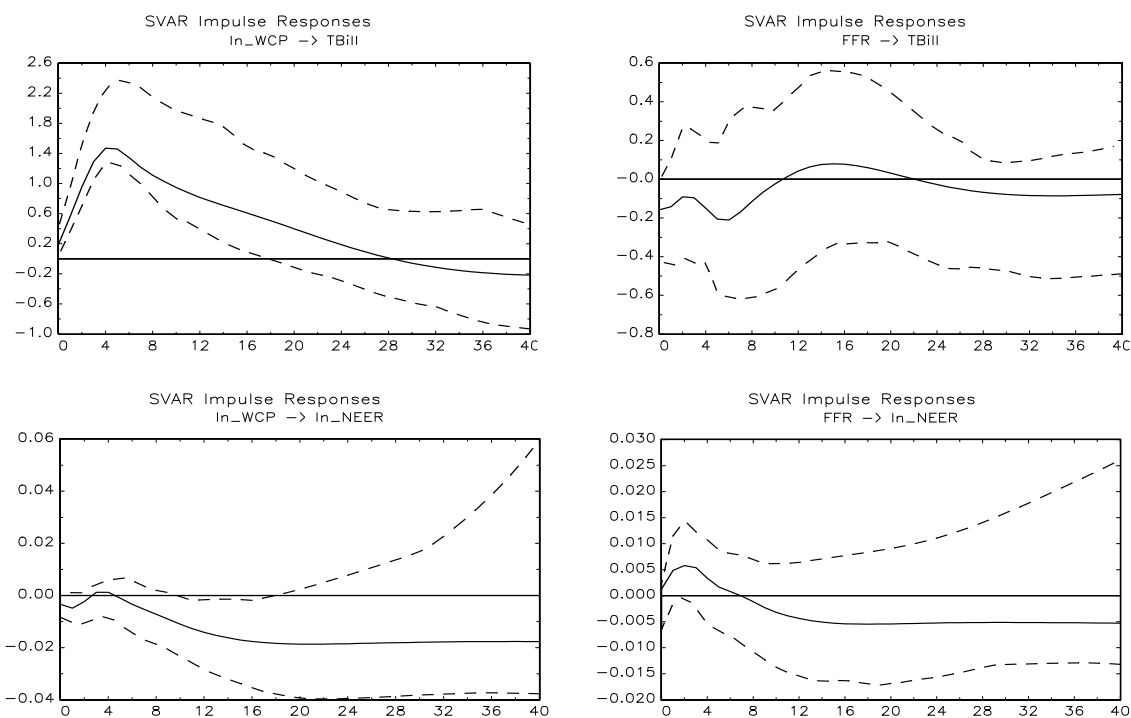
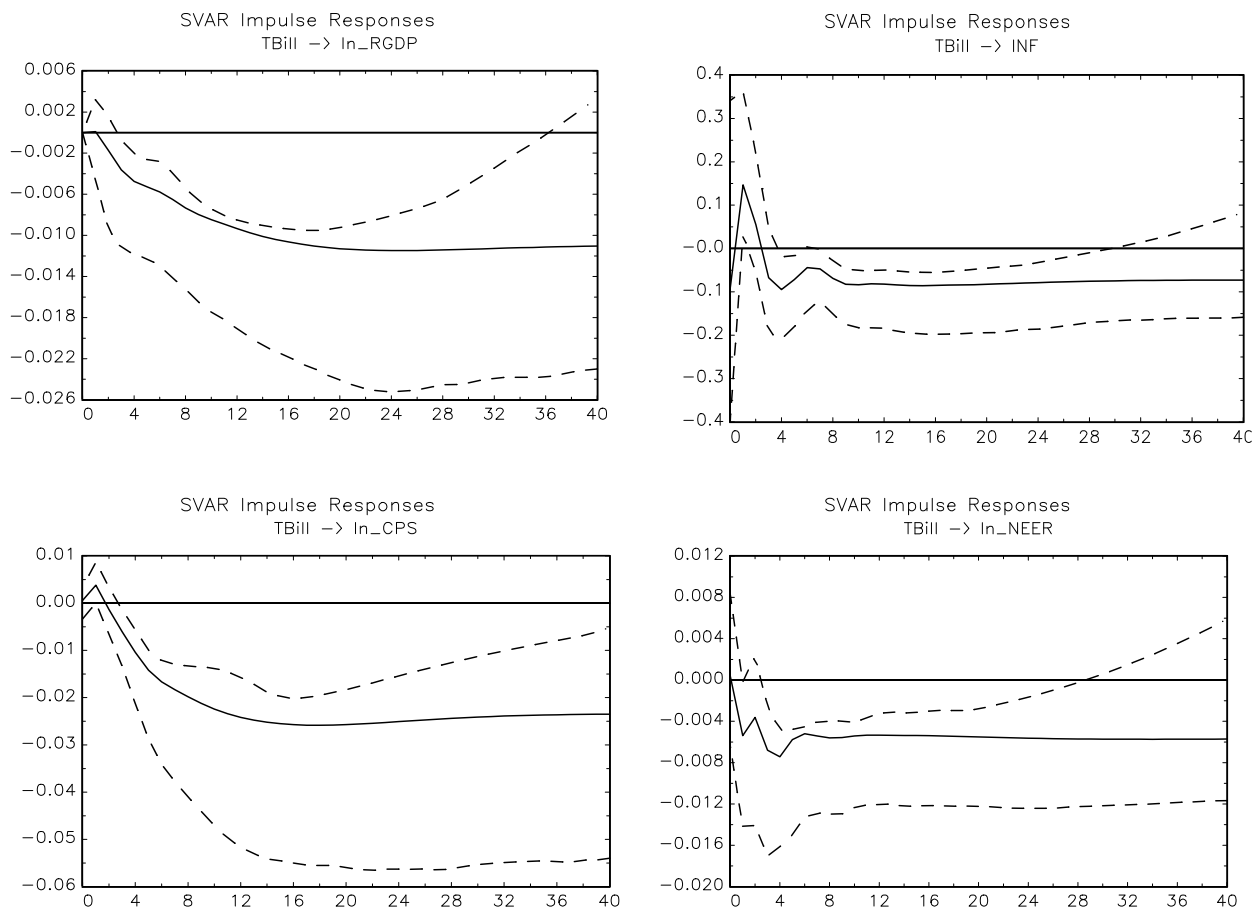


FIGURE 2: SVAR Impulse Responses of Domestic Variables to Monetary Policy Shocks.



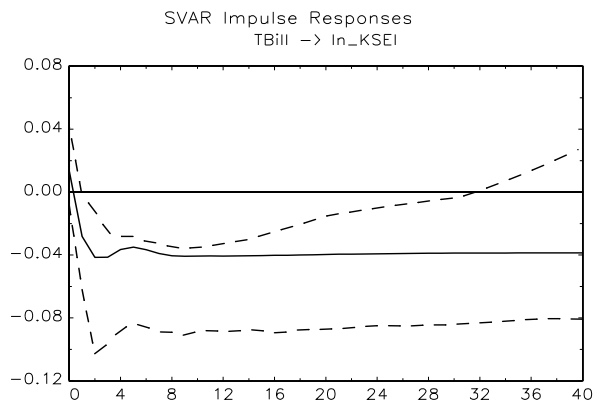


FIGURE 3: Relative Strength of different Channels over Inflation Rate.

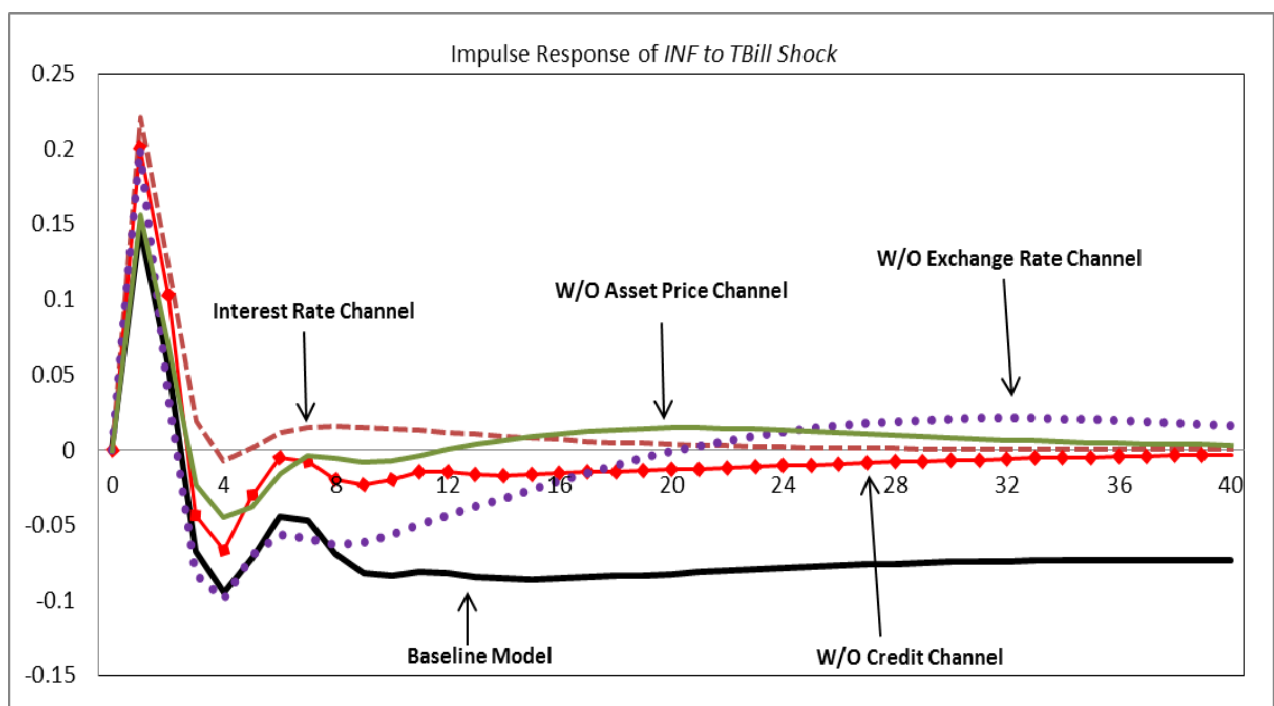


FIGURE 4: Relative Strength of different Channels over Output.

