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EXTERNAL MONETARY CONSTRAINTS IMPOSED BY DEVELOPED ECONOMIES ON DEVELOPING ECONOMIES: EMPIRICAL EVIDENCE FROM PAKISTAN

Muhammad Ali Rizwan[1]
Muhammad Zeeshan Younas[2+]
Hafiza Sadaf Zahra[3]
Zartaj Jamil[4]

[1]*M.Phil Graduate, Quaid-I-Azam University, Islamabad Pakistan.*
Email: ali.rizwan880@yahoo.com
[2]*PhD. Scholar, Quaid-I-Azam University, Islamabad Pakistan.*
Email: mzeeshan@eco.qau.edu.pk
[3]*M.Phil. Graduate, Pakistan Institute of Development Economics (PIDE), Islamabad Pakistan.*
Email: sadafzahra66@yahoo.com
[4]*M.Phil. Graduate from National University of Science and Technology (NUST), Islamabad Pakistan.*
Email: zartajkhan906@gmail.com

(+ Corresponding author)

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ABSTRACT

The problem with the most of the developing economies is that their monetary policy is constrained by external shocks and developed economies central banks especially FED and ECB. In this research, we examine the effects of major external shocks like global oil price shocks, foreign interest rate shocks and global food price shocks on the major macro variables of Pakistan which creating hurdles for the SBP to achieve its monetary policy objectives independently. The results stating that the global oil price and global food price shocks have direct impacts on the major macro variables of Pakistan and put inflationary pressure on the Pakistan economy which making difficult for the central bank to achieve its predetermined dual objective of monetary policy i.e. full employment and stable inflation. Additionally, we examine how the changes in US monetary policy effects Pakistan economy and find that positive foreign interest rate shock has minor impacts on the major macro variables of Pakistan except for the exchange rate and domestic inflation rates which is also imposing an external constraint on the monetary policymaking process of Pakistan central bank. In a nutshell, all these external shocks are creating hurdles and imposing monetary constraints on the Pakistan which making difficulties for Pakistani central bank to achieve its monetary policy objectives.

Contribution/ Originality: In this research, we examine the effects of key external shocks like global oil price shocks, foreign interest rate shocks and global food price shocks on the major macro variables of Pakistan which creating hurdles for the State Bank of Pakistan (SBP) to achieve its monetary policy objectives independently.

1. INTRODUCTION

The monetary policy of an economy is based on a dual mandate which is: full employment level with stabilized prices or inflation rate (Surico, 2007; Rudebusch and Williams, 2016; Punnoose and Wadsworth, 2018). There are plenty of internal, external and other monetary constraints that making Pakistan's central bank independence doubtful in order to attain dual mandate (Taylor, 2013). Like any other law, the independence of the State Bank of Pakistan needs to be implemented and protected continuously over time which is a fundamental responsibility of political institutions. But the external constraints like oil price shocks, global food prices shocks global financial

crisis, exchange rate swings of foreign exchange reserves, political aspects and international monetary policy coordination making hurdles in achieving these independence objectives (Fernández-Albertos, 2015; Garriga, 2016).

There is a bulk of literature available that deals with the monetary policy, its transmission channels and independence of policymaking process (Kuttner and Mosser, 2002; Aleem, 2010; Ireland, 2010; Iqbal, 2013; Wang *et al*., 2018; Auclert, 2019). But there is no serious attempt has yet been made that cope up with the problem of external shocks or monetary constraints and its impacts on the domestic monetary policy process. The research in hand is incorporating these external constraints impact on Pakistan economic markets like goods market, money market or foreign exchange markets. In simple words, we will explore the impacts of these external shocks on the major macro variables of Pakistan which creating hurdles for the central bank of Pakistan to achieve its monetary objectives independently.

In this study, our key assumption is that the developing countries cannot regulate monetary policy independently rather monetary policy in such economies has external constraints from different international institutions, for example, Federal Reserve Bank of United States of America and ECB of Euro Area etc. (Gertler *et al*., 2007; Jansen and Tsai, 2010; Buch *et al*., 2019). International monetary policy coordination issues have emerged since the culmination of the global financial crisis in 2008. US Monetary policy impacts asset prices in U.S. markets and all over the world (Devereux *et al*., 2019; Husted *et al*., 2019).

The Question that whether changes in monetary policy can impact the real variables like real GDP remained a subject of unremitting debate among the researchers of monetary economics and macros. Nevertheless, after the publication of "Monetary History" by Friedman and Schwartz in 1963 in which they have established the impact of monetary policy changes on the real sector at least during short-run, recently the gist of the debate among proponents and opponents of monetary nonneutrality to the real sector has transformed (Rudebusch and Williams, 2016). The nub of contemporary debate among researchers on the subject is related to the magnitude of monetary non-neutrality and the relative importance of channels through which changes in monetary policy are transmitted to the real sector, which is termed as monetary transmission channels (Wang *et al*., 2018).

The monetary transmission mechanism is quite fascinating as well as an intricate phenomenon (Rudebusch and Williams, 2016). Economists and researchers worked extensively to investigate the subject in a range of perspectives owing to its significance for the policy-making due to following reasons (Auclert, 2019). In the first place, we can identify the stance of monetary policy after having scrupulous knowledge about monetary transmission mechanism. In the second place, study of monetary transmission mechanism helps researchers and policy makers to evaluate the time lags i.e. both inside lag and outside lag of monetary policy (Baek and Miljkovic, 2018). In the third place, the impact of monetary policy on real economy can be estimated accurately and efficiently by studying monetary transmission mechanism (Mukhtar and Younas, 2019).

Finally, it also provides information regarding relative efficacy, importance, and impact of each monetary transmission channel and thus monetary policy makers can select monetary instrument in a better way to target relatively significant transmission channels (Mishkin, 1995). Moreover, it would be quite difficult for policy makers to ensure financial stability and to mitigate uncertainty regarding the lags and effectiveness of monetary policy in absence of thorough knowledge about monetary transmission (Mueller *et al*., 2017; Erceg *et al*., 2018; Kurov and Stan, 2018).

The problem with the most of the developing economies is that their monetary policy is constrained by the developed economies central banks especially Federal Reserve's Bank USA and ECB. Numerous other reasons like exchange rate stability, the International Monetary Fund's restrictions due to external debt, and interest rate linkages etc. also restricting the developing countries central banks to work independently (Garriga, 2016). Consequently, these developing economies cannot follow a discretionary monetary policy. Hence, it is quite essential to reconsider behavior and efficacy of monetary transmission mechanism given these constraints to have a

better understanding of it. As compared to the developed economies, different model specification is required for these economies (Ireland, 2010).

There exist an ample literature on the impact of monetary policy changes on real macro variables in both developed and developing economies by assuming that each economy can operate independent monetary policy (Aleem, 2010; Iqbal, 2013; Punnoose and Wadsworth, 2018). However, this is not the case and a little is known regarding the impact of economic constraints faced by developing economies in the form of managed floating or even de-facto pegged exchange rate and interest rate linkages with developed economies on each monetary transmission channel. The current research would fill this lacuna by meeting the following objectives.

- To estimate the relative importance of each transmission channel and its impact on aggregate demand in the selected developing economy, which is Pakistan here, by taking external constraints into consideration.
- To evaluate the impacts of changes in developed economies policies i.e. European central bank or US monetary policy on the SBP monetary policy and major macro variables of Pakistan.

In order to meet the above-mentioned objective, this would take the following detailed research questions as well:

- How changes in developed economies policies i.e. Federal Reserve's constraints the State Bank of Pakistan policies?
- Why changes in the US or European central banks policies creating complications for the State Bank of Pakistan to get the anticipated outcomes?
- Is the US monetary policy changes have an influence on the Pakistani macro variables?
- What is the magnitude of an external monetary policy shock to affect real economy under external constraints in Pakistan?

This research work contains six chapters: the *first chapter* describes the introduction, *second chapter* deals with the literature review which explore some prominent previous studies related to the external constraint imposed by the developed or leading economies, *third chapter* defines the research methodology, *fourth chapter* provides the results of the thesis along with empirical analysis on the basis of chapter three, and *fifth chapter* summarizes and concludes the research concisely.

2. LITERATURE REVIEW

The global monetary policy coordination has been a widely discussed topic in the last couple of decades. Many researchers and economists wrote papers on the international monetary policy linkages. This monograph summarizes some of the key papers and their findings related to the monetary policy transmission mechanism, independence of monetary policy, international monetary policy coordination, external shocks linkages with monetary policy and global financial crises role in external monetary constraints (Mukhtar and Younas, 2019).

Before exploring these key ideas, we need to enlighten that there are two main types of monetary policies which includes expansionary monetary policy and contractionary monetary policy. The expansionary means increase in money supply while contractionary means a reduction in the money supply of an economy (Mukhtar and Younas, 2019). Friedman and Schwartz (1963) conducted a seminal study and established the importance of changes in monetary policy for real macro variables. Mishkin (1995) highlighted various channels for monetary transmission in his influential study. Taylor (1995) stated that shocks in monetary policy can be transmitted to real variables via interest rate channel in which consumption and investment are influenced due to change in real interest rates.

Bernanke and Blinder (1992) identified the bank lending channel or credit channel in which credit aggregates are influenced due to changes in interest rate. This channel is an extension of the traditional interest rate channel and emphasizes the role of banks in monetary transmission. The exchange rate channel is also a significant channel that focuses on the impacts of monetary policy shocks on the exchange rate and consequently on aggregate supply and aggregate demand (Mukhtar and Younas, 2019). Taylor (1995) asserted that the magnitude of the exchange

rate channel relies on the exchange rate regime of the economy. Mishkin (1996) identified another channel named balance sheet channel that influences the real macro variables through affecting the creditworthiness and net wealth of firms and households. Asset price channel of monetary transmission operates through influencing the value of assets like real estate, and shares etc. Finally, Taylor (1995) also explored another channel named expectation channel through which monetary policy changes are translated into changes in the expectations of economic agents in the economy and thus affects the real variables. Figure 1 summarizes the open market operation channels of a central bank.

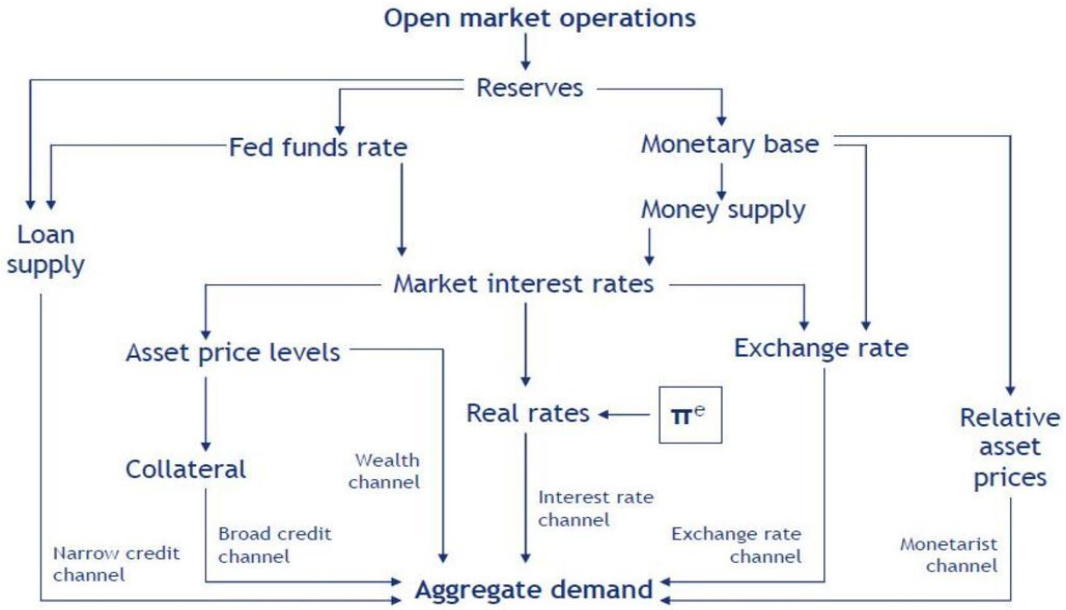

Figure-1. Monetary policy transmission mechanism.

Source: (Kuttner and Mosser, 2002).

2.1. External Shocks Relationships with Monetary Policy

This section begins with a short review of the literature regarding different external shocks. Due to an important source of macro fluctuations, researchers and economists worked expansively to examine the external shocks in a range of perspective owing to its implication for the policymaking process of the central bank. These shocks are considered as external monetary constraints imposed by developed or leading economies on developing economies like Pakistan (Younas and Khan, 2018).

According to standard economics textbooks, a shock can be defined as any irregular or unanticipated incident that put a significant impact on the economic performance of the country. These shocks can be positive or negative depends on the consequences (Punnoose and Wadsworth, 2018; Auclert, 2019). Additionally, These external shocks sometimes known as exogenous shocks because they are determined outside the economic model of a country. In simple words, these external shocks have severe impacts on the Pakistan economy but not in control of the State Bank of Pakistan or finance ministry of Pakistan. Some important external shocks that have an impact on the macro performance of a country like Pakistan includes external oil price shocks, global gold price shocks, exchange rate shocks and global food price shocks (Mukhtar and Younas, 2019). The monetary policy of an economy based on a dual mandate which is: full employment level with stabilized prices or inflation rate[1] (Surico, 2007; Rudebusch and Williams, 2016). Majority of the goods in the basket are strongly correlated with the oil price shocks. So whenever the oil price changes, the prices of these basket goods changes which ultimately causes inflation rate and fails the monetary authority to meet their dual mandate. As far as the external constraint is concerned here, these oil price shocks can be external in nature. In other words, oil prices can be changed by OPEC which is like exogenous factor

[1] The inflation rate, also known as consumer price index, is a measure that inspects the weighted average of the consumer basket of goods.

for the State Bank of Pakistan policymakers. So, it is a constraint which put by the oil exporting countries on the central bank of Pakistan (Khan and Malik, 2017). Global food price shocks is another type of external shock which have a significant impact on the macro performance of an economy including the monetary policy perspectives (Younas and Khan, 2018). The monetary authority of the central bank of Pakistan have another external challenge is how to cope up with the large swings in world food prices. In simple words, whenever the global food prices increase the import bills of that country decreases which ultimately disturb the trade balance and payment of the account. From another perspective, the primary objective of the State Bank of Pakistan is to stabilize the inflation rate which is always disturbed whenever any global food prices shock occur (Mukhtar and Younas, 2019). Hence, the global food price shock is recognized as another external constraint which is imposed on the developing or small economies by rest of world and create a serious problem for the central bank policymaking process (Tang *et al.*, 2010) and Alom (2011) thoroughly examined the external oil price shocks and global food price shocks with the perspective of macro impacts including monetary policies. The following Figure 2 is summarizing the macro impacts of these external shocks via different transmission channels.

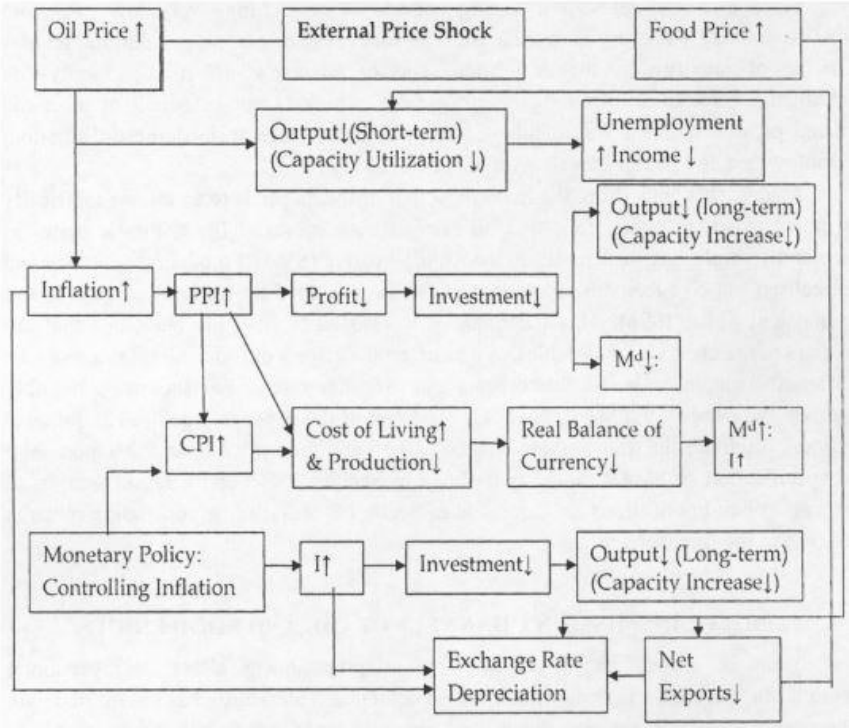

Figure-2. Transmission channels of oil price and food price shocks.

Likewise, global gold price shocks also have direct associations with the macro performance of a country and monetary policy implications. The gold is considered as an important part of central bank reserves and the money can be printed on the basis of these reserves (Zhu *et al.*, 2018). If the global gold prices swings then it will not only affect the gold market but also the central bank policymaking process which is totally based on these types of reserves commodities. From another viewpoint, the State Bank of Pakistan affects the economic performance of Pakistan with the help of manipulating the money supply (Akbar *et al.*, 2019). The strong correlation between the gold reserves and monetary policymaking process becomes another external constraint for the central bank to form policies without difficulty.

2.2. Global Financial Crisis as External Monetary Constraint

There are three prominent events in the history of economics which have remarkable importance including the Great Depression 1929, Asian Financial Crisis 1997 and Global Financial Crisis 2007-08 (Hansen, 2019). The emphasis of this section will be on global financial crisis 2007-08 which are also known as sub-prime mortgage

crisis. This financial crisis is considered as worst ever after the Great Depression (Rey, 2015). It begins with the collapse of major financial institutions of America for instance, Barclays, Goldman Sachs, Morgan Stanley, and Merrill Lynch Deutsche Bank. These events invigorated by the breakdown of the house price market of America[2] (Ricci, 2015). The reason behind the selection of Global Financial crisis 2007-08 among all three is that because after 2007-08 the international monetary policy coordination significantly increases (Chen *et al.*, 2016). In other words, this crisis had spillover effects which mean not only in that particular region but all over the world. The argument behind the spillover effects of this crisis is the international recognition and uses of the American dollar. As mentioned earlier, whenever there is something bad happened to the American, there must be spillover effects on the global economy (Rey, 2015). So these types of foreign shocks are also considered as a special type of external constraint that making difficult for the State Bank of Pakistan to get desirable outcomes from the monetary policy.

2.3. International Monetary Policy Coordination

With the passage of time, an extensive literature has developed on international monetary policy coordination and its impact on the economic growth process of a country. According to Berge and Cao (2014) the United States central bank monetary policy have significant impacts not only on the domestic asset prices but across the world. These impacts considerably increase after the global financial crisis of 2007-08. As well, Ehrmann and Fratzscher (2007) claimed that there is a strong correlation between the financial openness and monetary policy coordination. In other words, the stock prices react more to the Fed monetary policy if there is greater financial openness by the United States. A seminal contribution made by Hausman and Wongswan (2011) in which they comprehensively examined the Federal Reserve's monetary policy surprises over the time series data from 1994 to 2005. The results concluded that there was a significant impact of monetary policy surprises on the foreign interest rate in the short run as well as in log run during the understudy time period. On the other hand, a report by the International Monetary Fund claiming that international policy coordination is thoroughly and extensively being discussed in the literature but hardly ever seen in the real world. Moreover, Taylor (2013) specified that multi-country models of monetary policy revealed that the domestic policy tightness has greater quantitative gains than the international monetary policy coordination. From another perspective, global monetary policy coordination has utmost importance in terms of central bank reserves. Most probably, the policies of the Federal Reserve of the United States have countless prominence in the world because the dollar is an international currency. If anything bad happened to the American dollar, it means it will affect not only the US economy but all others who have dollar denominations in their foreign exchange reserves. Consequently, we cannot neglect these transmission channels of international monetary policy coordination with the State Bank of Pakistan policies (Mukhtar and Younas, 2019). In sum up, these impacts of international monetary policies on the Pakistan monetary policies can be considered as an external constraint from developed economies.

2.4. External Constraints and State Bank Independence

The central bank independence has also been extensively debated topic during the last two or three decades (Garriga, 2016). Many research analysts provide some importance stylized facts related to the monetary policy independence impacts on the credibility of monetary policy. For the purpose of central bank independence, many central banks around the world including the State Bank of Pakistan have implemented reforms. These reforms postulating that there is a negative correlation between the central bank independence and rate of inflation in an economy (Fernández-Albertos, 2015). In this section, we will explore some important external constraints imposed by developed or leading economies on developing economies like Pakistan that making the State Bank independence

[2] The name sub-prime mortgage crisis originated from the provision of the loan facility to those Americans who have a bad credit history or falling below the mortgage loan requirements.

debatable. The central bank independence can be measured with an index which is proposed by Cukierman *et al.* (1992). There are four key elements or legal characteristics which are used in this index to assess the independence of the central bank. First of all, the central bank of the country will be more independent if a chief executive or governor of the bank is employed by the board of bank rather than president or finance ministry of the country. Secondly, if there is no intervention of government in the policymaking process for the central bank then it is recognized as the independence of the institute. Thirdly, index stating that the central bank independence required fundamental goal of the monetary policy should be the stability of price. Lastly but most importantly, to be an independent institute there must be stringent restrictions on the government to borrow from the central bank (Iqbal, 2013). There are some external and internal constraints that making the State Bank of Pakistan independence doubtful. The internal constraints mean those restrictions, within the boundaries of Pakistan, which affecting the State Bank of Pakistan independence. These restrictions include legal aspects, price stability objective aspects, monetary policy and deficit financing, internal political aspects, accountability and transparency aspects. On the other hand, external constraints mean those restrictions, outside the boundaries of Pakistan, which affecting the State Bank of Pakistan independence (Younas and Khan, 2018). These restrictions include exchange rate aspects, foreign exchange reserves, global and regional financial crisis, international political aspects, external shocks to energy like international oil price shocks or gold price shocks etc. (Auclert, 2019). Figure 3 is showing some changes in the global economy that can affect the monetary transmission channel of State Bank of Pakistan.

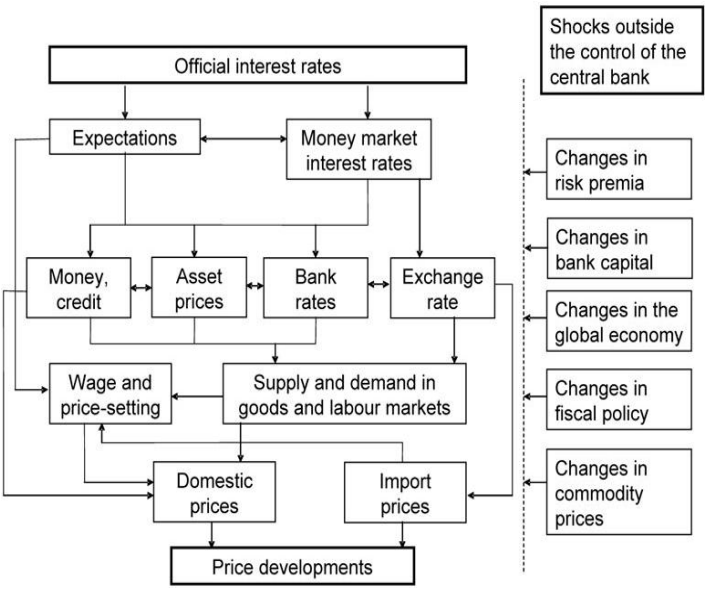

Figure-3. Shocks outside the control of central bank.

In a nutshell, we can say that these internal and external monetary and other constraints making Pakistan's central bank independence doubtful. Like any other law, the independence of the State Bank of Pakistan needs to be implemented and protected continuously over time which is a fundamental responsibility of political institutions. But the external constraints like oil price shocks, global food prices shocks global financial crisis, exchange rate swings of foreign exchange reserves, political aspects and international monetary policy coordination making hurdles in achieving these independence objectives.

3. METHODOLOGY OF THE STUDY

3.1. Variable Constructions

The study in hand is dealing with eight variables where three consider as exogenous variables and five as endogenous variables. Exogenous variables, which we also titled as external constraints in this research, include

Global Oil Price, Global Food Price, and Foreign Interest Rate. On the other hand, endogenous variables include real GDP, Real Effective Exchange Rate, Money Supply M2, Inflation Rate and Nominal Interest Rate. Different types of proxies and data sources are used in this research work. To examine the impacts of global oil price shocks as an external constraint, we used West Texas Spot Crude Oil Price in dollars denomination. Likewise, Federal Fund Rate of US central bank is used to explore the external monetary constraint imposed by the developed economies on developing country like Pakistan. Also, the global food price index is used for the global food price shocks investigation. The monthly data on the real GDP of Pakistan is not regularly available so we used a proxy of Industrial Production Index for it. Additionally, the Inflation rate used in this study is calculated from the consumer price index where we take the log difference of it and multiplied by 100. To inspect the money market we used M2 definitions of Money Supply. The nominal interest rate is proxified by the call money rate. Lastly, the REER is used as a proxy for the exchange rate.

3.2. Data Sources and Statistical Package

The *Federal Fund Rate*, which is the official interest rate of Federal Reserves, is obtained from the official website of US central bank. The *world food price index* data is acquired from the Food and Agriculture Organization of the United Nations. While the *West Texas Spot Crude Oil Price* data is retrieved from the International Financial Statistics (IFS CDROOM-2014) and remaining two years data supplemented by IMF website. The *real effective exchange rate* is obtained from the State Bank of Pakistan website. Moreover, the *industrial production index* data is also retrieved from the IFS CDROOM-2014 and SBP website. Similarly, the *call money rate* is retrieved from the IFS CDROOM-2014 and supplemented the remaining data from the SBP website. Additionally, the *inflation rate* of Pakistan is obtained from the Economic surveys of Pakistan from 2002 to date. As well, the *money supply* data obtained from the State Bank of Pakistan website. An important thing to mention here is that the West Texas Spot Crude Oil Price was in dollar denomination which converted into the Pakistani rupees to eliminate the exchange rate swings. The statistical package E-Views 9.0 is used for the estimation purposes.

3.3. Structural Vector Autoregressive (SVAR) Model

The central jobs of Macro econometricians to deals with four basic issues which consists of data summarization, macro forecasting, and quantitative analysis related to the economic structure, and to advise the policymakers about suitable strategies. But the 1970s oil price shocks and breakdown of Philips curve, most probably the Keynesian Economics, none of the univariate or structural time series models appeared reliable. The Vector Autoregressive (VARs) model family provides the solutions to all these problems. The word "autoregressive" means the right-hand side of an equation will have the lagged value of the dependent variable. On the other hand, "Vector" means that we are dealing with more than one variable at a time.[3] The Vector Autoregressive (VARs) model family developed by Sims (1980) after the collapse of standard macro-econometric models during 1970s crisis. It is recognized as a new framework for macro policymaking process and has inspiring significance in economic times past. When a researcher dealings plenty of time series at a time, he/she need to consider the interdependence of the series among each other. One method to deal with this issue is to estimate them via simultaneous equation system which based on two important steps. First, demonstrate the variables in two segments of exogenous and endogenous variables. Second, impose the restrictions on model parameters for the purpose of identification problems. Sims (1980) criticized these steps via stating that this process involves arbitrary decisions and replaced it with the VAR model. The VAR methodology is very popular among researchers nowadays due to its simplicity and Ordinary Least Square method applicability on it for estimation purpose.

[3] In VAR models, we treat all variables as endogenous where each variable is explained by the lags of its own and all other variables of the model.

3.4. Standard SVAR Model of Study

As far as our study in hand is concerned, we used standard Structural Vector Autoregressive (SVAR) model which consists of eight variables including global oil price, global food price, foreign monetary policy rate, exchange rate, money supply, call money rate, real GDP and rate of inflation. As mentioned earlier, in the estimation of Vector Autoregressive model we treat all variables as endogenous or within the model determination. The standard SVAR model with the order (p) can be specified as follows:

$$AX_t = A_1X_{t-1} + A_2X_{t-2} + \ldots\ldots\ldots\ldots + A_pX_{t-p} + e_t \quad (1)$$

In equation one X_t is considered as the vector of all above-mentioned variables and A is recognized as (n x n) matrix for the contemporaneous correlation among the endogenous variables coefficients. In other words, A matrix is used to explore the dynamic interaction among the model variables. Likewise, p is showing the number of lags in the study and e_t is a (n x 1) vector of the structural error terms which are assumed to be linearity linked to structural shocks, showing by U_t, where $U_t = Be_t$ and B is (n x n) matrix of structural coefficients. So we can write the Equation 1 as following way of Equation 2:

$$AX_t = A_1X_{t-1} + A_2X_{t-2} + \ldots\ldots\ldots\ldots + A_pX_{t-p} + Be_t \quad (2)$$

The structural equation models must be identified for the purpose of inference and policy implications. The reduced form equation can be estimated with the help of standard ordinary least squares because in reduced form the endogenous variables are not a function of other endogenous variables (Asteriou and Hall, 2015). In simple words, the reduced form equation shows the single variable as a function of its own and all other variables lags. The reduced form equation of our model can be shown as follow in Equation 3.

$$X_t = A_1 * X_{t-1} + A_2 * X_{t-2} + \ldots\ldots\ldots\ldots + A_p * X_{t-p} + u_t \quad (3)$$

The left-hand side of equation three is showing global oil price, global food price, foreign monetary policy rate, exchange rate, money supply, call money rate, real GDP and rate of inflation while $A_i^* = A^{-1}A_i$ and $U_t = Be_t$. The following Figure 4 is summarizing the whole theoretical background of research methodology that is used in this study to examine the impact of external constraints on Pakistan economy.

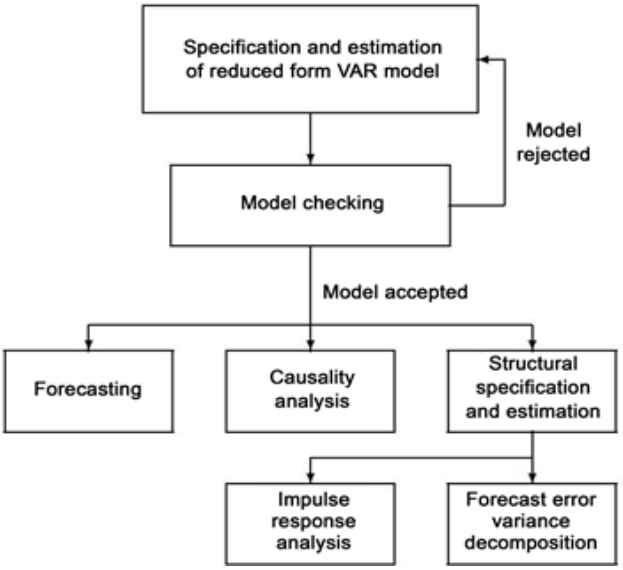

Figure-4. Vector autoregressive (VAR) methodology chart.

3.5. Identification Problem of Model

There are two main types of parameters, structural parameters, and reduced parameters. The structural parameter means those parameters which explain or give us information about the structure of the economy (Asteriou and Hall, 2015). Every structure parameter has an economic theory behind which must be incorporated in the estimations of Vector Autoregressive models. Furthermore, there are two main types of restrictions that can be imposed in econometric modeling, first is a short run and the second is a long run. The Vector Autoregressive models deal with the short run restrictions. These restrictions can be imposed with the help of formula $n^2-(n^2+n)/2$. As far as our model is concerned, there are eight variables so we need 28 additional restrictions for our model to make it identified (Enders, 2015).

There are two main types of identification in the Vector Autoregressive models, structural and recursive method. Both methods show different forms of restriction matrix. In the structural method, we imposed restrictions on the basis of an economic theory for each understudy equation. On the other hand, in recursive method Cholesky decomposition consider the lower diagonal form of restriction matrix where the order of the variables plays a key role in identification problem (Asteriou and Hall, 2015; Enders, 2015). In our research, we will use the recursive VAR methodology for identification. The recursive Vector Autoregressive Model of our study can be represented in form of linear equation system with respect to different variables in Equation 4, 5, 6, 7, 8, 9, 10 and 11.

$$loilp_t^* = E_{t-1}^* loilp_t^* + \varepsilon_t^{loilp^*} \quad (4)$$

$$lwfpi_t^* = E_{t-1} lwfpi_t^* + \omega_1 \varepsilon_t^{loilp^*} + \varepsilon_t^{lwfpi^*} \quad (5)$$

$$ffr_t^* = E_{t-1} ffr_t^* + \omega_2 \varepsilon_t^{loilp^*} + \omega_3 \varepsilon_t^{lwfpi^*} + \varepsilon_t^{ffr^*} \quad (6)$$

$$lrgdp_t = E_{t-1} lrgdp_t + \omega_4 \varepsilon_t^{loilp^*} + \omega_5 \varepsilon_t^{lwfpi^*} + \omega_6 \varepsilon_t^{ffr^*} + \varepsilon_t^{lrgdp} \quad (7)$$

$$lm2_t = E_{t-1} lm2_t + \omega_7 \varepsilon_t^{loilp^*} + \omega_8 \varepsilon_t^{lwfpi^*} + \omega_9 \varepsilon_t^{ffr^*} + \omega_{10} \varepsilon_t^{lrgdp} + \varepsilon_t^{lm2} \quad (8)$$

$$cmr_t = E_{t-1} cmr_t + \omega_{11} \varepsilon_t^{loilp^*} + \omega_{12} \varepsilon_t^{lwfpi^*} + \omega_{13} \varepsilon_t^{ffr^*} + \omega_{14} \varepsilon_t^{lrgdp} + \omega_{15} \varepsilon_t^{lm2} + \varepsilon_t^{cmr} \quad (9)$$

$$lex_t = E_{t-1} lex_t + \omega_{16} \varepsilon_t^{loilp^*} + \omega_{17} \varepsilon_t^{lwfpi^*} + \omega_{18} \varepsilon_t^{ffr^*} + \omega_{19} \varepsilon_t^{lrgdp} + \omega_{20} \varepsilon_t^{lm2} + \omega_{21} \varepsilon_t^{cmr} + \varepsilon_t^{lex} \quad (10)$$

$$inflation_t = E_{t-1} inflation_t + \omega_{22} \varepsilon_t^{loilp^*} + \omega_{23} \varepsilon_t^{lwfpi^*} + \omega_{24} \varepsilon_t^{ffr^*} + \omega_{25} \varepsilon_t^{lrgdp} + \omega_{26} \varepsilon_t^{lm2} + \omega_{27} \varepsilon_t^{cmr} + \omega_{28} \varepsilon_t^{lex} + \varepsilon_t^{inflation} \quad (11)$$

In above recursive Vector Autoregressive system of equations,

$loilp_t^*$ is representing the log form of global oil price

$lwfpi_t^*$ is representing the log form of global food price

ffr_t^* is representing the foreign interest rate

$lrgdp_t$ is representing the log form of real GDP

$lm2_t$ is representing the log form of the money supply by SBP

cmr_t is representing the call money rate

lex_t is representing the log form of real effective exchange rate

$inflation_t$ is representing the rate of inflation

Furthermore, all variables of the study are showing in the log form except the rate of interest and "w" are showing the impulse response coefficient while the E_{t-1} representing the conditional expectations operator. Also, there are two types of disturbances in the above equations where one is representing the structural disturbance and other is reduced form errors (Asteriou and Hall, 2015). The above all equations can be symbolized in matrix form as follows in Figure 5.

$$\begin{bmatrix} u_t^{loilp} \\ u_t^{lwfpi} \\ u_t^{ffr} \\ u_t^{lrgdp} \\ u_t^{lm2} \\ u_t^{cmr} \\ u_t^{lex} \\ u_t^{infl} \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ b_{21} & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ b_{31} & b_{32} & 1 & 0 & 0 & 0 & 0 & 0 \\ b_{41} & b_{42} & b_{43} & 1 & 0 & 0 & 0 & 0 \\ b_{51} & b_{52} & b_{53} & b_{54} & 1 & 0 & 0 & 0 \\ b_{61} & b_{62} & b_{63} & b_{64} & b_{65} & 1 & 0 & 0 \\ b_{71} & b_{72} & b_{73} & b_{74} & b_{75} & b_{76} & 1 & 0 \\ b_{81} & b_{82} & b_{83} & b_{84} & b_{85} & b_{86} & b_{87} & 1 \end{bmatrix} \begin{bmatrix} e_t^{loilp} \\ e_t^{lwfpi} \\ e_t^{ffr} \\ e_t^{lrgdp} \\ e_t^{lm2} \\ e_t^{cmr} \\ e_t^{lex} \\ e_t^{infl} \end{bmatrix}$$

Figure-5. Matrix form of model.

The above matrix is an alternative way to represent the recursive VAR equation system which can be explained as the global oil price, which is the first variable of the model, respond to its own shock only while the next variable responds to the shock of the first variable and its own shock. Similarly, the third variable responds to its own shock and the shocks to the first two variables. This mechanism continues until the last variable reached where all variables shocks respond to the system. There is an important thing to mention here is that the ordering of the variables has significant importance in the recursive system of VAR model for shock identification (Enders, 2015). For this purpose, a strong background of the economic theory is required, for instance, the global oil price affect the inflation significantly.

3.6. Impulse Response Function

The impulse response function means the shock to vector autoregressive model (Asteriou and Hall, 2015). It is used to track the time frame of variable response to any external shock within the model. In simple words, how the

dependent variable responds with time passes due to the shock to all variables in the Vector Autoregressive model. So we can say that there will be four impulse response functions if the Vector Autoregressive model has 2 variables and 9 has 3 variables. The impulse response function is an ideal approach to examine the impacts of external monetary constraints or external shocks on the major macro variables of Pakistan economy. As mentioned earlier, the ordering of variable has vital importance in the vector autoregressive model, same is applicable for the impulse response function. There are plenty of approaches to order the variables in the model but we choose Cholesky dof adjusted method (Enders, 2015; Kočenda and Cerný, 2015).

3.7. Forecast Error Variance Decomposition Analysis

The variance decomposition analysis is another extension of the vector autoregressive model which is used to explore the dynamics of the VAR model (Asteriou and Hall, 2015; Kočenda and Cerný, 2015). It explains the movement in dependent variable proportionally due to shocks to other variables of the system versus its own shocks. Moreover, it provides the picture of h-step ahead forecast error variance due to an innovation or impulse to an independent variable (where h= 1,2,…). In the language of econometrics, the variance decomposition analysis is used to examine the spillover impacts of an external shock or monetary constraint, for example, global oil price shock or foreign interest rate shock. The variance decomposition analysis works on a very simple principle. First of all, we need to fit the vector autoregressive model then we use variance decomposition analysis to explore the contribution of each variable in the model (Enders, 2015). In a nutshell, the variance decomposition analysis point out how much forecast error variance of each variable can be explained by the shocks like oil price shock or foreign interest rate shock.

4. ESTIMATIONS AND RESULTS

4.1. SVAR Model for Pakistan Economy

Now the question is how many variables should be included in the vector autoregressive model is a serious debate among the scholars. Some researchers suggesting that there should be eleven variables in the model while other claiming that there should be seven variables in the VAR model. As Pakistan is a small economy so we will consider the global oil price, global food prices and foreign interest rate as exogenous because these variables are determined outside the model. In sum up, there are eight variables are used in the Structural Vector Autoregressive Model for Pakistan economy.

4.2. Stationarity Problem in VAR Model

The fundamental problem of dealing with time series data is stationarity problem. If the mean, variance, and covariance of the time serious data changes over time it means that the series is nonstationary. In other words, for example, we are dealing with the data over the period of 1950 to 2000 then the means, variance, and covariance of the data should be same no matter which point of time we are checking these statistics. An appropriate solution to this problem recommended by econometrician is to take the difference of non-stationary time series to make it stationary. But these processes will through away the important data dynamics which have key importance to explain the economic relationships.

Some other studies postulating that the prime job of vector autoregressive (VAR) model is policy analysis, for instance, fiscal or monetary policies, with the help of using impulse response and variance decomposition analysis (Negro and Primiceri, 2015). The identification problem of the VAR model has more importance than the stationarity problem. There are bulks of studies available claiming that if we estimate the Vector Autoregressive models at the level, no matter if the data is nonstationary, then the obtained parameters will be super consistent estimates. Moreover, the simple parameters of the estimated VAR model have less importance because the prime

focus is to do policy analysis on the basis of the impulse response and variance decomposition analysis of the model (Jawadi *et al*., 2016).

4.3. Optimal Lag Length Selection

Choose that criteria which have the lowest value, for example, we also use the same principle and put two lags in the estimation of the Vector Autoregressive (VAR) model on the basis of Akaike Information Criteria. Table 1 provides the results for our model selection.

Table-1. Optimal lag length selection.

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-583.5286	NA	1.34e-07	6.878239	7.024634	6.937636
1	1344.616	3654.506	5.17e-17	-14.79786	-13.48030*	-14.26329*
2	1444.111	179.3237	3.44e-17*	-15.21060*	-12.72188	-14.20086
3	1490.410	79.13871	4.27e-17	-15.00477	-11.34489	-13.51986
4	1548.938	94.59637*	4.66e-17	-14.94113	-10.11010	-12.98106
5	1599.388	76.84844	5.65e-17	-14.78358	-8.781379	-12.34833
6	1648.442	70.15950	7.11e-17	-14.60979	-7.436435	-11.69938
7	1703.807	74.03449	8.50e-17	-14.50939	-6.164866	-11.12380
8	1750.442	58.02182	1.16e-16	-14.30746	-4.791779	-10.44670

Note: * indicates lag order selected by the criterion.
LR: sequential modified LR test statistic (each test at 5% level).
FPE: Final prediction error.
AIC: Akaike information criterion.
SC: Schwarz information criterion.
HQ: Hannan-Quinn information criterion.

4.4. Contemporaneous Structural Coefficients

The following Table 2 is showing the contemporaneous coefficients of the estimated Vector Autoregressive (VAR) model. In other words, it provides the estimates of the recursive vector autoregressive matrix which we defined in the previous chapter of research methodology of the study. The Akaike Information Criteria is used in this estimation of Vector Autoregressive model where we imposed 28 restrictions for the purpose of making it just identified. The p-value of the contemporaneous coefficients can be examined to assess the significance of the parameters. The estimated parameters are providing the baseline of relations exists among the model variables. Furthermore, the LR test giving the numeric of 4.25 which claiming that do not reject the null hypothesis and the restrictions are valid.

4.5. Stability of Estimated SVAR model with AR Root Table

To check that if the estimated Vector Autoregressive model is stable or no the AR root table is the best option. It is used to examine that the stationarity problem is affecting the model or not. The results of the AR root table states that all the roots in modulus are less than one that suggesting us that no root lies outside the unit circle. It means we can say that the stability condition is satisfied by the estimated Vector Autoregressive (VAR) model.

4.6. Impulse Response Function of Oil Price Shocks

In order to apply impulse response function on our model, first, we need to estimate the Vector Autoregressive (VAR) model which we have already done. In Figure 6, the Impulse response function is applied on the basis of the Cholesky dof order method. The ordering of the variables has significant importance in the impulse response function analysis. A strong economic theory is required while ordering these variables in the model, for example, because the rate of inflation is highly sensitive to the global oil price shocks so we give it a top priority and ordered first.

Table-2. Contemporaneous coefficients of var model.

	Coefficient	Std. Error	z-Statistic	Prob. Value
b_{21}	0.107924	0.025096	4.300371	0.0000
b_{31}	0.254743	0.099915	2.549606	0.0108
b_{32}	-0.051247	0.284016	-0.180436	0.8568
b_{41}	0.113047	0.079364	1.424414	0.1543
b_{42}	0.024242	0.221609	0.109391	0.9129
b_{43}	0.031234	0.058478	0.534103	0.5933
b_{51}	-0.020265	0.023019	-0.880362	0.3787
b_{52}	0.190034	0.063914	2.973262	0.0029
b_{53}	-0.008898	0.016879	-0.527181	0.5981
b_{54}	0.014068	0.021616	0.650798	0.5152
b_{61}	0.720225	1.055945	0.682066	0.4952
b_{62}	0.580799	2.997379	0.193769	0.8464
b_{63}	-1.100452	0.773207	-1.423230	0.1547
b_{64}	-3.562358	0.990649	-3.595985	0.0003
b_{65}	-2.038331	3.430902	-0.594109	0.5524
b_{71}	-0.019960	0.013032	-1.531674	0.1256
b_{72}	-0.019883	0.036947	-0.538140	0.5905
b_{73}	0.006537	0.009584	0.682033	0.4952
b_{74}	-0.007486	0.012646	-0.591969	0.5539
b_{75}	0.087580	0.042328	2.069072	0.0385
b_{76}	0.000908	0.000924	0.982475	0.3259
b_{81}	0.790764	1.005775	0.786224	0.4317
b_{82}	-2.876906	2.835239	-1.014696	0.3103
b_{83}	0.590598	0.735816	0.802644	0.4222
b_{84}	-0.410989	0.970564	-0.423453	0.6720
b_{85}	-1.824071	3.284342	-0.555384	0.5786
b_{86}	0.028510	0.071025	0.401409	0.6881
b_{87}	11.78502	5.747063	2.050617	0.0403

Note: Likelihood Ratio (LR) test for restriction identifications: $X2\ (2) = 4.25[0.114]$.

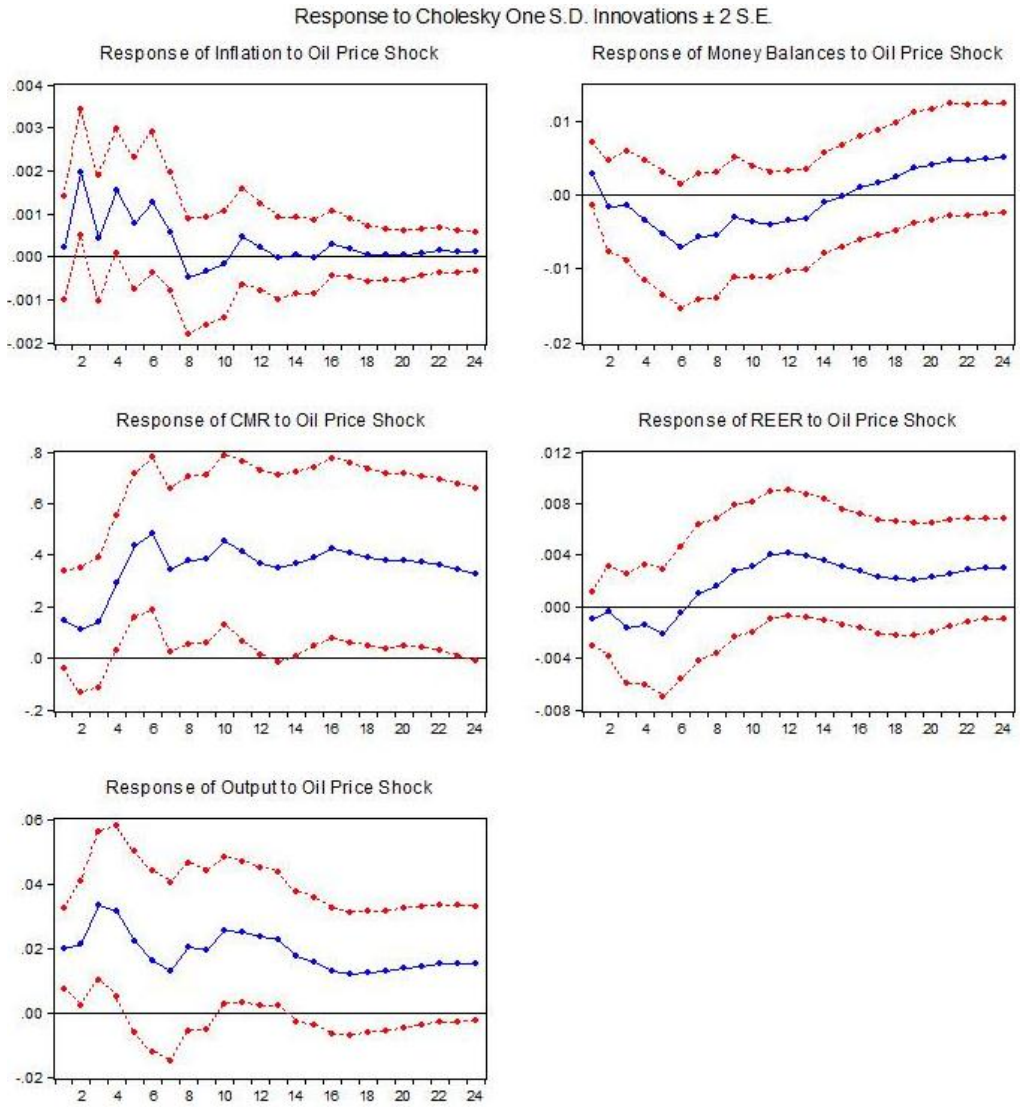

Figure-6. Impulse response function of oil price shocks.

Consistent with a strand of previous studies on different datasets (Cunado *et al.*, 2015; Khan and Malik, 2017) a positive one unit standard deviation shock is given to the global oil price for the purpose of examining its impact on the major macro variables of Pakistan. Above five graphs are showing the swings in major macro variables of Pakistan over the period of 24 months due to global oil price shocks. The first graph is showing the response of inflation to global oil price shock. In other words, it tells how the inflation respond to oil price increase over the period of 24 months. The inflation rate initially shoots up for the two months due to increase in oil prices in the global market and show swings up to six months. In simple words, the shock of oil prices increase in the global market have almost six months impact on the inflation rate of Pakistan and completely dies out after that period.

The second graph showing the response of money balances to global oil price shock. As mentioned in the first graph, the oil price shock has a sudden direct impact on the inflation rate. To cope up with this inflationary pressure problem, the central bank of Pakistan will lower down the money supply because more money means more inflation. This economic theory can be observed in the second graph easily. In sum up, the first graph we observed up to 6 months shooting up of inflation which is cope up by the central bank via lowering the money supply in the second graph. Moreover, according to economic theory when money supply decreases the interest rate of the economy will increase which can be observed in the third graph where interest increases up to six months and then started dying out with an increase of money supply.

Similarly, the positive oil price shock also affects the real effective exchange rate of Pakistan. In other words, oil price shock immediately affects the exchange rate after oil price shock which appreciates it. After two to four months start depreciating for the next two years which is consistent with the overshooting monetary exchange rate models due to its mean-reverting pattern. Lastly, the output or real GDP of Pakistan economy is not very sensitive to the oil price shocks. However, due to oil price shock, the increment of goods prices force the producers to produce it more for the purpose of capturing the high prices but this will work only for two months and total effect starts to die out later.

4.7. Forecast Error Variance Decomposition Analysis of Oil Price Shock

The following Table 3 refers to the generalized Forecast Error Variance Decomposition Analysis of Oil Price Shock. It describes the 24 months horizon movements via using Cholesky ordering of variables.

Table-3. Generalized forecast error variance decomposition of oil price.

Period	LOILP	LWFPI	FFR	LRGDP	LM2	CMR	LEX	Inflation
1	100.0000	0.00000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
4	77.15863	11.8912	2.087759	7.203576	0.082006	0.243393	0.842380	0.490973
8	53.66055	23.98293	2.730151	15.74190	0.193654	0.432085	2.063635	1.195088
12	43.65392	29.59998	3.163847	18.08625	0.197717	0.364932	3.408569	1.524781
16	39.26426	32.10291	3.789413	18.51211	0.182524	0.333177	4.239458	1.576150
20	37.23543	32.91961	4.525922	18.77654	0.169465	0.374797	4.467086	1.531161
24	36.23760	32.86912	5.270069	19.15070	0.173181	0.430700	4.401667	1.466967

The first column of the table is showing the swings in oil prices due to its own shock which is 100 percent in the first month and slowly dies out and showing decreasing trends over two years. Similarly, all columns are showing the contribution of oil price shocks to all other variables of the model. The spillover effect of oil price to output stating that the variation in output remains 7.20 percent to 19.15 percent over 24 months. Similarly, the real effective exchange rate remains 0.84 to 4.40 percent, money supply from 0.082 to 0.173, call money rate from 0.243 to 0.4307 while inflation remains 0.49 to 1.47 percent. So, overall we can conclude that the generalized Forecast Error Variance Decomposition Analysis of Oil Price Shock stating the shock effects the major macro variables of Pakistan significantly. And these results are also supported by the Impulse Response Function analysis of oil price shocks.

4.8. Impulse Response Function of Food Price Shocks

We examine the global food price shocks impacts on major macro variables via giving one standard deviation positive shock to food prices on the basis of Cholesky ordering of variables. The following charts are summarizing the responses of food price shocks to Pakistan economy.

In Figure 7, the first sub-figure is stating that the inflation rate of Pakistan quickly responds to the global food price increases and shot up suddenly which remain increasing over the next 12 months. After that, it starts dying out and shows decreasing trends which mean food price shocks have strong short-term impacts on the inflation of Pakistan. In order to cope up with this inflationary pressure, the State Bank of Pakistan must have to respond. The inflation can be controlled with the help of lowering the money supply because there is a positive correlation between inflation and money supply. Our argument is invigorated by the second figure which is showing the reduction in money supply over the same period of time where inflation increases. Similar findings by Furceri *et al.* (2016); Bhat *et al.* (2018).

The Liquidity Preference Theory stating that there is an inverse relationship between the money supply and interest rate. So when a central bank reduces money supply the interest rate will increases which can be observed in the third graph. So we can sum up these three arguments as, global food price shocks put inflationary pressure on

Pakistan which is controlled by the central bank via reducing money supply that increases the rate of interest. As far as the output of Pakistan is concerned, the global food price shock forced the producers to produce more and get benefit from these increasing trends of prices. This argument can be confirmed from the last figure of the impulse response function where output increases initially only up to four months and started to dying out after that. Lastly, the real effective exchange rate is highly sensitive to the increase in global food prices and starts decreasing over the next two years.

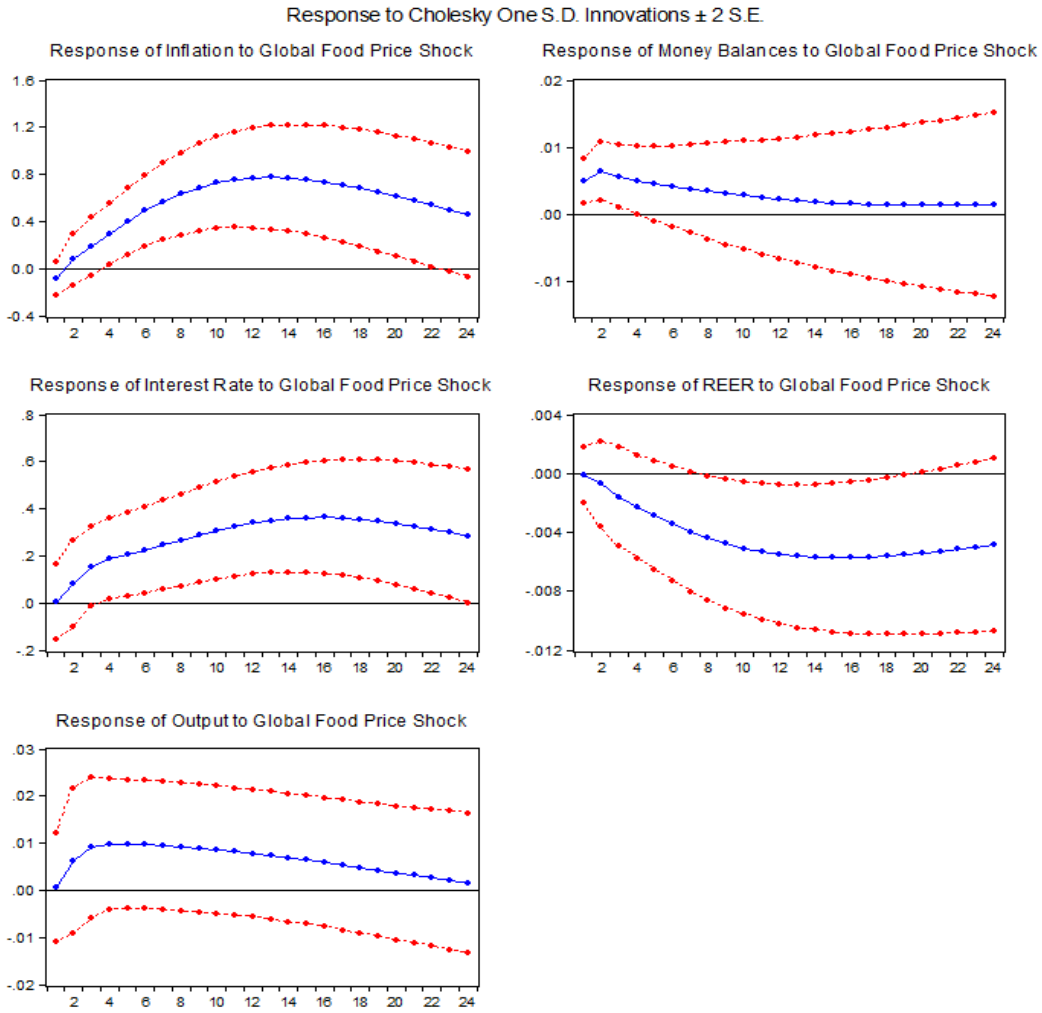

Figure-7. Impulse response function of food price shocks.

4.9. Forecast Error Variance Decomposition Analysis of Food Price Shock

The following Table 4 describes the generalized Forecast Error Variance Decomposition Analysis of global food price shocks. It provides the 24 months horizon movements via using Cholesky ordering of variables.

Table-4. Generalized forecast error variance decomposition of food price.

Period	LOILP	LWFPI	FFR	LRGDP	LM2	CMR	LEX	Inflation
1	9.411618	90.58838	0.000000	0.000000	0.000000	0.000000	0.000000	9.411618
4	7.121754	87.03233	0.022929	0.392519	1.026634	0.593014	3.798339	7.121754
8	5.236626	84.62000	0.187940	2.067547	0.922508	0.367080	6.225103	5.236626
12	4.540893	82.54022	0.703808	2.973301	0.757524	0.321758	7.472088	4.540893
16	4.518411	80.56972	1.497107	3.739592	0.652764	0.462668	7.743018	4.518411
20	4.856543	78.47952	2.428960	4.614957	0.626164	0.650816	7.523057	4.856543
24	5.362602	76.25103	3.367204	5.578084	0.682913	0.788026	7.188732	5.362602

The second column of the above table is showing the swings in global food prices due to its own shock over the period of 24 months. It starts with 91 percent and then showing declining trends over the next two years. The output responds to global food price shock starts with 0.39 to 5.58 percent, the money supply 1.02 to 0.68 percent, the call money rate from 0.59 to 0.788, the real effective exchange rate from 3.79 to 7.188 percent and inflation starts with 9.41 percent in the first month which ends with 5.36 percent in the 24th month. Overall we can conclude that the generalized Forecast Error Variance Decomposition Analysis of global food price shocks stating food price shocks affects inflation, exchange rate and output of Pakistan highly as compared to money supply and interest rate over the 24 months. In other words, the money market is not highly affected by but goods market responds rapidly to the global food price shocks. These results are well-matched with our findings of Impulse Response Function.

4.10. Impulse Response Function of Foreign Interest Rate

Now, we are examining the foreign interest rate shocks impacts on major macro variables via giving one standard deviation positive shock to United States central bank interest rate, which is also known as Federal Fund Rate, on the basis of Cholesky ordering of variables (Chen *et al.*, 2016). The reason for checking the impulse response function analysis of US interest rate is to explore the claim that whether there is any monetary policy coordination between US and Pakistan exists or not (Belke *et al.*, 2017). In other words, we want to check that whether the changes in US monetary policy affect the major macro variables of Pakistan. Additionally, it is providing us empirical answers that whether the United States is imposing any monetary constraints on Pakistan or making a problem for the State Bank of Pakistan in achieving its monetary policy targets. The following Figure 8 is summarizing the responses of foreign interest rate shocks to Pakistan economy.

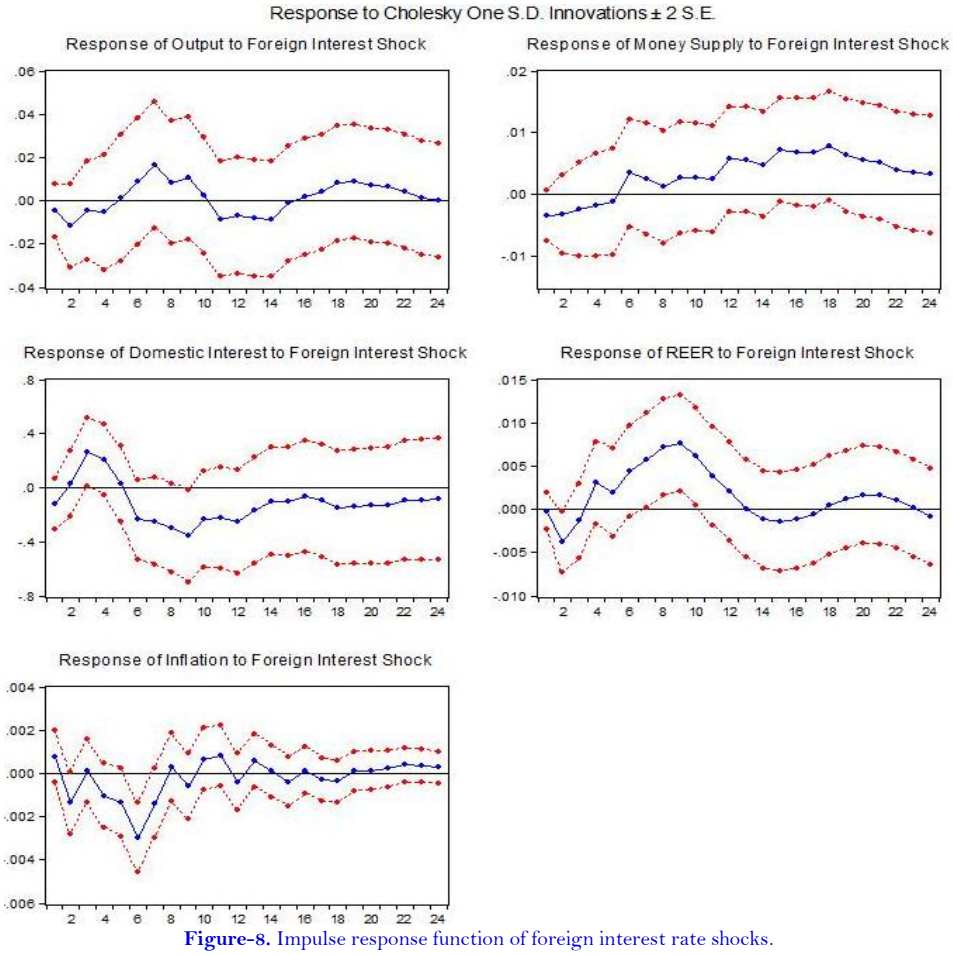

Figure-8. Impulse response function of foreign interest rate shocks.

Above five charts are showing the impacts of external shock impact on major macro variables of Pakistan over the period of 24 months where external shock is one unit positive standard deviation to foreign monetary policy changes of a developed country while macro variables of Pakistan includes output, money balances, inflation, exchange rate and domestic interest rate. We are starting our interpretations with the output graph. When a positive innovation in the Federal Reserve's interest rate takes place, which is the central bank of the United States, it affects the real Gross Domestic Output of Pakistan. In simple words, the increase in US interest rate makes the Foreign Assets i.e. American Assets more attractive for the Investors all over the world including Pakistan. So investor shifts their investment decisions towards US economy which significantly affect the output of Pakistan. This economic theory empirically observed in the first graph where output initially decreases due to foreign interest rate shock but starts die out this impact after 3 months completely finished over two years.

The second graph showing the response of money supply by State bank of Pakistan in response to one standard deviation innovation to the foreign interest rate. According to the Liquidity Preferences Theory, there is a negative relationship between the money supply and interest rate. A positive impulse to the foreign interest rate means that the money supply is reduced by the American central bank which appreciates the US dollar. In other words, the value of the US dollar will increase as compared to other currencies including Pakistan rupees due to a reduction in the money supply of US dollars. In order to respond to this foreign monetary policy shock, there is no serious attempt is made by the SBP during the understudy period which can be confirmed from the second graph. However, at somehow decrease the money supply by SBP for the purpose of strengthening the Pakistani rupees which increase the interest rate of Pakistan. This increase in interest rate will attract the foreign investors because domestic assets may provide a higher return but the overall impact is very minor and based on three months. After that interest rate starts decreasing and money supply increasing (Chen *et al.*, 2017).

Initially, the real effective exchange rate is highly affected by the foreign monetary policy shocks in the fourth graph. The positive US interest rate shock increases the value of US dollar which, on the other hand, lower down the value of Pakistani currency. So, up to the 10th period, the real effective exchange rate increases due to the positive foreign interest rate shock and start declining after that which die out in two years. Similar types of swings can be observed in the inflation rate due to foreign interest rate shock which is explained in the 5th graph. Overall, we can conclude that the positive foreign interest rate shock has minor impacts on the major macro variables of Pakistan except for the exchange rate and domestic inflation rates which is imposing an external constraint on the monetary policymaking process of the central bank of Pakistan.

4.11. Forecast Error Variance Decomposition Analysis of Foreign Interest Rate

Table 5 is providing the generalized Forecast Error Variance Decomposition Analysis of foreign interest rate shocks. It explains the 24 months horizon movements via using Cholesky ordering of variables.

Table-5. Generalized forecast error variance decomposition of foreign interest rate.

Period	LOILP	LWFPI	FFR	LRGDP	LM2	CMR	LEX	Inflation
1	3.714245	0.017608	96.26815	0.000000	0.000000	0.000000	0.000000	3.714245
4	9.218673	0.290754	83.00217	5.496219	0.066316	0.198815	1.716799	9.218673
8	11.45194	5.037029	57.45222	18.96878	0.115693	0.067840	6.772019	11.45194
12	10.95617	12.09927	43.90855	22.89640	0.361077	0.056306	9.630375	10.95617
16	10.19115	18.65326	36.42254	22.90444	0.574687	0.114333	11.02260	10.19115
20	9.470246	24.10261	31.70106	21.83643	0.713074	0.233397	11.70257	9.470246
24	8.840326	28.46174	28.51281	20.61069	0.785290	0.389628	12.01902	8.840326

Above table presents the spillover impacts of foreign interest rate shocks on major macro variables including real GDP, Inflation, Money supply, Domestic Interest Rate and Real Effective Exchange Rate. The Generalized Forecast Error Variance Decomposition Analysis stating that third column is showing the spillover impact of

foreign interest rate due to its own shock which started with 97 percent in the 1st month and ends up with 29 percent in the 24th month. The output responds to foreign interest rate shocks starts with 5.49 to 20.61 percent, the money supply 0.066 to 0.785 percent, the call money rate from 0.19 to 0.38, the real effective exchange rate from 1.71 to 12.01 percent and inflation starts with 3.71 percent in the first month which ends with 8.84 percent in the 24th month.Overall we can conclude that the generalized Forecast Error Variance Decomposition Analysis of foreign interest rate shocks supporting the impulse response function claim of "the positive foreign interest rate shock have minor impacts on the major macro variables of Pakistan except the exchange rate and domestic inflation rates which is imposing an external constraint on the monetary policymaking process of central bank of Pakistan". In simple words, the impulse response function and variance decomposition analysis claiming the almost similar results about the major macro variables of Pakistan.

5. CONCLUSION AND POLICY RECOMMENDATION

There is a plethora of studies existing that deals with the monetary policy and central bank independence but there is no serious attempt has yet been made that incorporating the external monetary constraints impact on developing countries. The study in hand is filling this research gap and provide a comprehensive analysis of the external shocks and constraints impacts on Pakistan economy. The problem with the most of the developing economies is that their monetary policy is constrained by the developed economies central banks especially Federal Reserve's Bank USA and ECB. Numerous other reasons like exchange rate stability, the International Monetary Fund's restrictions due to external debt, and interest rate linkages etc. also restricting the developing countries central banks to work independently. In this research study, we examine the impacts of major external shocks like global oil price shocks, foreign interest rate shocks and global food price shocks on the major macro variables of Pakistan which creating hurdles for the central bank of Pakistan to achieve its monetary objectives independently. For empirical analysis, we used a Structural Vector Autoregressive (SVAR) model along with its extensions of Impulse Response Functions and Generalized Forecast Error Variance Decomposition Analysis. The results stating that the global oil price shocks and global food price shocks have direct impacts on the major macro variables of Pakistan and put inflationary pressure on the Pakistan which making difficult for the central bank to achieve its predetermined dual objective of monetary policy i.e. full employment and stable inflation. Additionally, we examine how the changes in US monetary policy effects Pakistan economy and find that positive foreign interest rate shock has minor impacts on the major macro variables of Pakistan except for the exchange rate and domestic inflation rates which is imposing an external constraint on the monetary policymaking process of Pakistan central bank. In a nutshell, all these external shocks are creating hurdles and imposing monetary constraints on the Pakistan which making difficulties for Pakistani central bank to achieve its monetary policy objectives.

The external shocks like oil price increase and global food price increase put inflationary pressures on Pakistan economy which ultimately causing the stagflation. In order to cope up with these problems, apolitical and independent monetary authority is indispensable for the countries like Pakistan. As oil is used in the industrial sector of Pakistan so the industrial goods prices increases whenever oil price hikes. Subsequently, we need to find the substitutes of oil based electricity for examples solar panels to eliminate or lower down the shock intensity. Additionally, the industrial sector should transform its electricity products to energy saving technologies like LED lights for the purpose of saving the oil uses in electricity generation. On the other hand, international monetary policy coordination invigorated after the financial crisis of 2007-08 which means changes in foreign monetary policy i.e. Fed Monetary policy will affect the Pakistan economy. So central of Pakistan should incorporate the foreign monetary policy coordination in its constraints while formulating policies.

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