THE EFFECTIVENESS OF MONETARY POLICY FOR MACROECONOMIC STABILITY: 
A STRUCTURAL VECTOR AUTO REGRESSION (SVAR) APPROACH

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ABSTRACT
Monetary policy is very important to steer the economy to control higher inflation, boost the economic growth and stabilize the other macroeconomic activities. This study investigated the effectiveness of monetary policy for Macroeconomic stability by structural vector-auto-regressive model. For this purpose, impulse responses and variance decomposition techniques were applied to examine the shocks and dynamic behavior of the variables. The results indicate that the role of monetary policy has a gradual and significant impact on Macroeconomic stability of Pakistan. The aim of restriction method SVAR has been used to describe the impact of highlighted variables i.e., money market rate, money supply and exchange rate. It is institute that exchange rate is more effective in long run, while interest rate and money supply are contemporaneous effects in short run. Further, there is the evidence of price puzzle because the level of prices increased rather than decreased in the short run and is against what generally policy perceives.

Keywords: Macroeconomic Stability, Impulse Responses, Structural VAR

INTRODUCTION
Every country struggle to improve its economy; they use various policies as a tool such as monetary policy and fiscal policy. This study clarifies the structural stability of Pakistan by using the monetary policy approach. In modern era the contribution of monetary policy is usually to the stability of gross domestic product, to achieve and sustain low inflation rates. There is much importance of monetary policy in both the developing and developed countries. Pakistan is classified in the developing countries1. Developing countries are inconsistent economically and have low circulation of money in market and have small investment market and the banking system. The circulation of money is sluggish in the economy, the monetary policy cannot be significantly successful in these conditions. Furthermore, developing countries make most transactions in the terms of currency, while the usage of cheques, drafts and other types of currency instruments are too little amount or unavailable. People are bound to keep their savings at home in the terms of jewelry and reservoirs because there are no attractive saving schemes from government and private sectors. Developing countries have traditional banking system where commercial banks provide loan only for those who belongs high business sector and limited loan facilities for industrial and agriculture sectors. As a results instability conditions emerged in the economy (see Shahid., 2006). So, the effectiveness of monetary policy depends on policy makers, to ensure accurate review of price stability and monetary policy impact on economic activities. Moreover, accurate evaluation of monetary policy is very crucial for policy makers. There are various models adopted in different periods of time for the accurate evaluation of monetary policy. The most important model is called VAR model, which is broadly used by the researchers to find the relationship between monetary policy and macroeconomics variables.

1 A developing country is a country with a less developed industrial base and a low Human development index (HDI) relative to other countries. (Human Development Report 2018)
The large body of experimental literature, most of which, using the VAR analysis of the open and closed economy, investigates monetary policy and its transmission mechanisms, VAR has identified many experimental problems. For example, two major key problems can be arising during the identification of monetary policy such as, the price puzzle and parameters stability. Prices puzzle means that prices increase rather than prices decrease in short run due to interest rate innovation.

Second, in econometrics, a structural change is an unexpected shift in a time series data that can lead to huge forecasting errors and unreliability of the model in general then we need the test of parameters stability (see Farhani, S. 2012). Sims (1992) shows that the innovations in interest rates reflect partial inflationary pressure. This causes rise in the price level in short run. Therefore, in the previous experimental studies some researchers used VAR model approach with the include of proxy variables to solve the problem of any puzzle (e.g., Javid and Munir 2011, and Vinayathasan., 2013).

Brischetto and Voss using the Structural Vector Autoregressive (SVAR) model with economic restrictions and proxy variables are to solve the puzzles. The structural-VAR model is the best way to capture the movement of monetary policy actions and the impact of domestic and additional macroeconomic variables shocks. To captures these shocks with the help of impulse responses faction, imposition of additional restrictions and variance decomposition.

We included the following sections in this study. The first section consists of the introduction of monetary policy. In 2nd section, we have discussed the existing literature review which is considered as the importance of exogenous variables in monetary policy shocks. In 3rd section, we discussed Structural-VAR model and its procedure in details. In 4th chapter we provided the empirical results and its interpretation in details. In 5th chapter hold study implication and conclusion.

LITERATURE REVIEW
This chapter examines the recent literature, and it discusses considering the objectives of this study. All literatures review conducted below are about monetary policy shocks. It also explains the role of monetary policy in any economy.

Andrea and Graham (1999) examined the impact of monetary policy in Australia using a small dimension the Structural Vector Autoregression Model. Also use the Kim and Roubini (1999) model as a benchmark for the modification of small open economy. According to the results the monetary policy shocks have an awaited and gradual effect on the level of price and little temporary impact on output level. They investigated that the role of monetary policy is important in the response of these shocks. Monetary policy must moisten (boost) both the level of prices and output. Most important the model provides sensible predictions about the effect of shock on output, price of the interest rate and exchange rate which are used as variables.

Thanabalasingam (2013) researched the movements of Sri Lankan economic activities with the help of SVAR model as a base. He studied many articles for the extension of Sri Lankan economic activities one of them Kim and Roubini (2000) article. He explained monetary policy with the help of seven domestic and international variables; it’s divided into two parts policy variables (Domestic) and non-policy variables (Foreign). Particularly, he investigated the effect of foreign and domestic monetary policy shocks and world oil price shocks on domestic economic activities. According to the result interest rate shocks play a key role in the monetary policy than Exchange rate. Foreign monetary policy and world price shocks have not direct effects on domestic economic activates, but domestic monetary policy shocks successful effects on output, prices, and other economic activities.

Bagliano and Favero (1997) elaborated the measurement of the monetary policy shocks in United State using benchmark VAR model and three other alternative measures. Also analyzed the system of monetary policy and describes six variables. They used the Bernanke and Mihov (1995) model as a benchmark. They specially focus on three issues: specification, identification, and the impact of the elimination of long-term interest rate. According to the arguments that the policy variables have does not contemporaneous effect on macroeconomics activities. All variables are affecting by monetary policy action, but they specially focus on the bank reserves which directly affect by monetary policy shocks. They suggested measures of monetary policy with VAR model, but they found strong evidence of mis specification and parameters instability for all equations.

Kozlik and Mehrotra (2009) found the effects of the Chinese monetary policy on Asian countries which trade with China, by using Structural-VAR model. They found that the Chinese monetary policy leads to temporary increase in GDP of Hong Kong and Philippines and permanent
increase in prices level in both countries. Chinese monetary policy is significant and positive effects on output in Hong Kong, Philippine, and Singapore. The forecast error and variance decomposition results show that the Chinese monetary were not only one tool which effects on Asian economy.

Javed and Munir (2011) investigated the effects of monetary policy shocks in Pakistan in the absence of price puzzle and with the assist of SVAR model. They identified the role and the importance of monetary policy in Pakistan. The main view of this paper is to discuss the following economic instruments such as inflation, discount rate and the stability of price level. According to the interpretation, sometimes monetary policy shocks are contrary to the expectations which causes rise in the price level rather than reduce this is known as price puzzle. They suggest that the inclusion of commodity price in model resolve the problem of price puzzle. They also suggest that in the current condition of Pakistan, an increase in the interest rate shows a good performance in the monetary policy.

Olmo and Pilbeam (2007) explained the forward discount puzzle and its effects on foreign exchange market by using the Taylor expansion method and other tests. They argued that the forward discount puzzle is purely statistical phenomenon and the behavior of Uncovered Interest rate Parity (UIP). Market efficiency checked with the help of two alternative tests (Conventional regression and Taylor expansion). They also argued on the evidence of forward discount puzzle. According to the arguments, the unbalance nature directly creates largely spurious of economic instability in market efficiency. In the presence of forward discount puzzle, evidence about inefficiency in foreign exchange market was not found. The results clarifying that the forward discount puzzle is little bit unfavorable in the concept of foreign exchange market. Authors suggested that there is no fear about forward discount rate puzzle because it is the statistical phenomenon.

Kim and Roubini (2000) investigated the impacts of exchange rate anomalies on open economy. They found the evidence about the existence of several anomalies, such as the price puzzle and exchange rate puzzle. The problems of price puzzle and exchange rate anomalies mostly related with developed countries like G-7. The empirical findings in this study are that G-7 monetary policy shocks on open economy (Exchange rate) and macroeconomic variables are constant with the set of theoretical models. They suggested that the SVAR model is useful to capture the numbers of anomalies and the effects of monetary policy in trade economies. The gap in resent literature, we have estimated the role of economy in domestic structure, this role of the economy is estimated through sequence of SVAR model. So that the monetary policy can be applied better in domestic. In addition, we can improve our understanding about monetary policy, which is related to resent literature.

**METHODODOLOGY OF RESEARCH**

**Model**

In line with the objectives, we can now define the methodology of this study. To estimates the macroeconomic model for structural stability. In the model, we use six variables in structural VAR model as like the model used by Brischesto and Voss (1999), Javid and Munir (2010), Christiano (2012), Nizamani et al (2016) and Orfaig (2017). They have put light on the effects of monetary policy. Let us illustrate the variables in the form of equation.

\[ X_t = [IMPI, CPI, WOP, NEER, M2, MMR] \]

\( X_t \) is a vector with the value of six variables at time \( t \). All these variables are set in logarithmic form, except the domestic interest rate. WOP is the world oil prices in current US dollars (Converted in Rupees), Industrial Manufacture Product (IMPI), CPI the domestic consumer price index, MMR the money market rate or domestic interest rate, Money supply (M2) is a monetary policy aggregate, and NEER nominal effective exchange rate chose in rupees/US dollars. To analyze the monetary policy system, is to observe the relationship between the forecast errors \( (e_t) \) and structural shocks \( (\mu_t) \) in a six variable VAR model. We consider the economy has the following system of open economy SVAR model as:

\[ BX_t = Y_0 + Y(L)X_{t-1} + \mu_t \]

(1)

Where \( B \) is an \( (n \times n) \) matrix of coefficients and reflects the contemporaneous interaction between the variables. \( X_t \) is \( (n \times 1) \) vectors of variables in data, and \( Y_0 \) is an \( (n \times 1) \) vector of constant term or vector of disturbance. The \( Y(L) \) is an \( (n \times n) \) matrix polynomial in the lag operator \( L \) \((t-1)\), which capture the dynamics of the model. The \( (n \times 1) \) vector of disturbance, \( \mu_t \), represents the structural
shocks which are serially uncorrelated that fulfill the condition of \( E(\mu_t) = 0 \) zero mean and has co-
variance matrix \( E(\mu_t\mu'_t) = I \) \( \Omega \) if \( t = \tau \) or \( ut \sim N(0, \Omega) \).

The \( \Omega \) is the diagonal matrix representing the variances. The matrices \( B \) and \( \Omega \) are primary to
the specification and estimation of Structural-VAR models. Further multiply \( B^{-1} \) with equation (7) to
obtain the equation (8) known as reduce-from VAR:
\[
X_t = B^{-1}Y_0 + B^{-1}Y(L)X_{t-1} + B^{-1}\mu_t
\]  
(2)

We got:
\[
X_t = G_o + G_1X_{t-1} + e_t
\]  
(3)

Where \( X_t \) is the vector of variables which included in the system multiplied with identity matrix
\( (B \, B^1 = 1) \) and it \( (X_i) \) depends on lag (t-1). Identifying \( G_0 = B^1 \gamma_0 \), \( G_i = B^1 \gamma_i \), and \( et = B^1ut \) defers the
simplification of six variables system. The matrix \( B \) also relates the forecast errors of the reduced-from
VAR \( (e_t) \) and the structural shocks \( (\mu) \): \( e_t = Bu_t \) \( (e_t \text{ = forecast error}) \) shows the relationship between
forecast error and structural shocks. There are many ways to estimate the parameters of the structural-
VAR model. However, the estimation of parameter in equation required for the impositions of
restriction on matrix \( B \) with the economic intuition to recover the structural shocks and structural
parameters, using the reduce-from equation. We know from the past empirical studies \( (\text{e.g., Sims 1980}) \)
to identify recursive ordering through exactly identifying restrictions before the explanation of variance
decomposition and impulse responses. So, impositions of restriction on our economic variables make
structural-VAR system. For the identification of the monetary policy system, we impose 15 numbers of
restrictions on coefficients of matrix \( B \). Bernanke (1986), Kim and Roubini (2000), proposed the
innovations modeling using economic analysis. The equation \( (e_t = Bu_t) \) satisfies the zero mean and
variance co-variance condition, co-variance matrix as:
\[
E(e_t, \, e'_t) = \sum e \text{ to get } E(B^{-1}ut, u_tB^{-1}) = \sum e. \text{ Assuming that, } ut, ut = \sum ut = I.
\]

Hence:
\[
\sum \, = \, B^{-1}\sum \, (B^{-1})
\]  
(4)

Where \( \sum \) \((n x n)\) is symmetric, it includes only \((n^2+n)/2\) known elements. Known elements allow
us to get \((n^2+n)/2\) as distinct elements to summaries the variance co-variance matrix of errors. There is
“n” unknown variance of structural shock total is \(n^2 - n + n = n^2 \). The problem of identification is to
solve \(n^2\)-unknowns from known independent elements of variance covariance matrix to impose an
additional restriction on the system. To identify the structural model from an estimated VAR model, we
impose restrictions on the model for this purpose, using the Kim and Roubini (2000) method. The
identification restrictions are used for the changing of monetary policy reaction function. Thus, the
system becomes over-identified (see Kim and Roubini 2000). There are six-variable in recursive order as
shown in (5):

\[
\begin{bmatrix}
e_{IMPI} \\
e_{CPI} \\
e_{WOP} \\
e_{NEER} \\
e_{M2} \\
e_{MMR}
\end{bmatrix} =
\begin{bmatrix}
1 & 0 & 0 & 0 & 0 & 0 \\
a_{21} & 1 & 0 & 0 & 0 & 0 \\
a_{31} & 0 & 1 & a_{34} & 0 & 0 \\
a_{41} & a_{42} & 0 & 1 & 0 & a_{46} \\
a_{51} & a_{52} & a_{53} & a_{54} & 1 & 0 \\
a_{61} & a_{62} & a_{63} & a_{64} & a_{65} & 1
\end{bmatrix}\begin{bmatrix}
u_{IMPI} \\
u_{CPI} \\
u_{WOP} \\
u_{NEER} \\
u_{M2} \\
u_{MMR}
\end{bmatrix}
\]  
(5)

Where \( e_{WOP} \), \( e_{IMPI} \), \( e_{CPI} \), \( e_{NEER} \), \( e_{M2} \), \( e_{MMR} \), are forecast errors and \( \mu_{CPI} \), \( \mu_{WOP} \), \( \mu_{IMPI} \),
\( \mu_{NEER} \), \( \mu_{M2} \), \( \mu_{MMR} \) are structural shocks, which represent six variables inside the method. In the above
equation (11), we applied fifteen restrictions on the coefficients of matrix \( B \) to transform the equation
into the monetary policy reaction functions. The restrictions are also intended to find the movements of
variables inside the monetary system. We assume that the exchange rates, M2 and MMR are the conditional effects of own-lagged values on IMPI and CPI, given that IMPI lag is provided. It means that if we impose the zero restrictions on coefficients of money supply and money market rate, then the IMPI does not depend on money market and money supply. So, the model implies that IMPI only depends on its lag (see Ruey S. Tsay, 2010, page 399).

**Description of Variables and Data**

Monthly data are used for study analysis from 1999M01 to 2018M04 and 324 observations in the context of Pakistan. The data which represents the following indicators in detail. Manufacturing is the third largest sector in Pakistan. The industrial sector of Pakistan makes 22% share of Gross Domestic Product (GDP). There are many large- and small-scale industry works in country such as textile and apparel, food, Beverage and Tobacco, Petroleum Group, and Leather products. The consumer price index (CPI) is the aggregate price level based on a basket of consumer goods and services. Generally monetary authority targets inflation or price level in its policy framework. The change in it is accepted as a measure of inflation. The world oil price is referred to the international oil prices which are set by international oil companies in the specific amounts of barrel crude oil. All oil buyers and sellers agree with these prices and trade accordingly. The addition of the world oil price is to prevent the expected price puzzle. Exchange rate is the value of one currency in terms of another currency. Changes in the NEER can have powerful effects on open economy variables such as the demand for export and imports, economic growth, inflation, and unemployment. M2 is a type of money which consists of these determinants, currency in circulation, demand deposit of bank, time deposit of bank and foreign currency remittances. In the present era, money is the main requirement for any market or country to continue the exchange of goods and services in its economic setup. Money is the basic need for to continue trade, business, and people’s needs. Monetary policy authorities use money supply as a tool for two objectives, to increase economic growth and to control inflation rate. Interest rate is the cost of money; with respect to the price paid by indebted and other assets. The empirical evidence for these variables provides in next section.

**EMPIRICAL RESULTS AND ESTIMATION**

In this Section, we have discussed different techniques for the model to estimate 232 observations of monthly data from 1999M01 to 2018M04. Before using Structural Vector Autoregressive model, we apply various techniques for the preliminary analysis.

**Results from Unit Root test**

<table>
<thead>
<tr>
<th>Variables</th>
<th>Coefficient</th>
<th>Critical Value at 5%</th>
<th>Test Statistic</th>
<th>Intercept/Trend</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>LnIMPI</td>
<td>-0.9702</td>
<td>-3.4294</td>
<td>-14.4885</td>
<td>Both</td>
<td>1st Difference</td>
</tr>
<tr>
<td>LnCPI</td>
<td>-0.4582</td>
<td>-2.5750</td>
<td>-8.1684</td>
<td>None</td>
<td>1st Difference</td>
</tr>
<tr>
<td>LnWOP</td>
<td>-0.7165</td>
<td>-2.8739</td>
<td>-11.2838</td>
<td>Both</td>
<td>1st Difference</td>
</tr>
<tr>
<td>LnNEER</td>
<td>-0.6103</td>
<td>-1.9422</td>
<td>-9.9909</td>
<td>Both</td>
<td>1st Difference</td>
</tr>
<tr>
<td>LnM2</td>
<td>-1.1753</td>
<td>-2.8739</td>
<td>-18.1525</td>
<td>Both</td>
<td>1st Difference</td>
</tr>
<tr>
<td>MMR</td>
<td>-1.2214</td>
<td>-2.8374</td>
<td>-4.12334</td>
<td>Both</td>
<td>Level I(0)</td>
</tr>
</tbody>
</table>

The test results indicate that all variables are stationary at 1st difference except MMR (MMR is stationarity at level) and thus the results dragged us towards VAR approach, because data has mixed order, we are interested in the study of dynamic responses of the variables in a method, so we pursue the assumption of Kim and Roubini (1998) as well as Brischetto and Voss (1999). Nizamani et al (2017), the SVAR models depends on economic theory. It is also based on the theoretical relationships of economic variables. In this way, we selected the variables in their levels for analysis.
Residual Diagnostic LM Tests

Table 2: Residual Serial Correlation Lagrange Multiplier (LM) test

<table>
<thead>
<tr>
<th>Lags</th>
<th>LM-Stat</th>
<th>Probability Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>49.8605*</td>
<td>0.0621*</td>
</tr>
<tr>
<td>2</td>
<td>50.6275*</td>
<td>0.0537*</td>
</tr>
<tr>
<td>3</td>
<td>99.4158</td>
<td>0.0000</td>
</tr>
<tr>
<td>4</td>
<td>53.9124</td>
<td>0.0279</td>
</tr>
<tr>
<td>5</td>
<td>39.7784*</td>
<td>0.3055*</td>
</tr>
</tbody>
</table>

Note: The Null Hypothesis for LM tests Zero serial correlation.

The table 2, shows the problems of serial correlation in lag length of 03 and 04, whereas lag 01, 02, and 05 is to be clean from serial correlation problems. When taking lags more than 02 the data face the problem of serial correlation, because the LM test is extremely sensitive with the numbers of extra lags. As a result, 1 is selected its free from Autocorrelation, if we chose more than one lag which might cause the degree of freedom and violate the assumption of serial independence of residual. Furthermore, the literature on monthly data as they suggest, 01 lag values are enough for monthly data analysis (see Nizamini at all 2016).

Estimated Results and Coefficients of Structural-VARs

The estimated findings of the contemporaneous Structural-VAR model are displayed in the table 3. The SR analysis for the detection of restriction observes that our further restriction accurate with the likelihood estimation. The estimated Parameters of the matrix B in below equation (12) are 15, with restrictions; approximately all Parameters or coefficients are found significant in S.R.

\[
\begin{bmatrix}
1 & 0 & 0 & 0 & 0 & 0 \\
0 & 1 & 0 & 0 & 0 & 0 \\
0 & 0 & 1 & 0 & 0 & 0 \\
0 & 0 & 0 & 1 & 0 & 0 \\
0 & 0 & 0 & 0 & 1 & 0 \\
0 & 0 & 0 & 0 & 0 & 1 \\
\end{bmatrix}
\]

(6)

Table 3: Estimated Contemporaneous Restriction Matrix (B)

<table>
<thead>
<tr>
<th>lnIMPI</th>
<th>lnCPI</th>
<th>lnWOP</th>
<th>lnNEER</th>
<th>LnM2</th>
<th>MMR</th>
</tr>
</thead>
<tbody>
<tr>
<td>lnIMPI</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>lnCPI</td>
<td>-0.025</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>lnWOP</td>
<td>0.035</td>
<td>0</td>
<td>1</td>
<td>-0.043</td>
<td>0</td>
</tr>
<tr>
<td>lnNEER</td>
<td>0.012</td>
<td>-0.264</td>
<td>0</td>
<td>1</td>
<td>0.090</td>
</tr>
<tr>
<td>LnM2</td>
<td>-0.003</td>
<td>-0.359</td>
<td>0.014</td>
<td>-0.000</td>
<td>1</td>
</tr>
<tr>
<td>MMR</td>
<td>-3.164</td>
<td>15.767</td>
<td>1.408</td>
<td>-5.080</td>
<td>-14.439</td>
</tr>
</tbody>
</table>

Notes: Model: \(e_t = B u_t\) Where \(E(\mu_t u_t') = I\) (See Equation 11)

Coefficients of the matrix B and its identification restrictions are estimated using the SVAR system; the estimated outcomes are shown in the table 3. According to the results, a part of the estimated main contemporaneous parameters supports their individual conditions significantly. Especially, the parameters of the monetary policy such as MMR and M2 statistically more efficient than the other selected variables (see Z score in table 4).
Table 4: Estimated Contemporaneous Coefficients of SVARs

<table>
<thead>
<tr>
<th>Restriction</th>
<th>Estimate</th>
<th>Restriction</th>
<th>Estimate</th>
<th>Restriction</th>
<th>Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>$a_{21}$</td>
<td>-0.025</td>
<td>$a_{46}$</td>
<td>0.090</td>
<td>$a_{61}$</td>
<td>-3.164</td>
</tr>
<tr>
<td></td>
<td>(-0.030)</td>
<td></td>
<td>(2.449)</td>
<td></td>
<td>(-0.174)</td>
</tr>
<tr>
<td>$a_{31}$</td>
<td>0.035</td>
<td>$a_{51}$</td>
<td>-0.003</td>
<td>$a_{62}$</td>
<td>15.767</td>
</tr>
<tr>
<td></td>
<td>(0.043)</td>
<td></td>
<td>(-0.004)</td>
<td></td>
<td>(0.102)</td>
</tr>
<tr>
<td>$a_{34}$</td>
<td>-0.043</td>
<td>$a_{52}$</td>
<td>-0.359</td>
<td>$a_{63}$</td>
<td>1.408</td>
</tr>
<tr>
<td></td>
<td>(-2.900)</td>
<td></td>
<td>(-0.035)</td>
<td></td>
<td>(0.123)</td>
</tr>
<tr>
<td>$a_{41}$</td>
<td>0.012</td>
<td>$a_{53}$</td>
<td>0.014</td>
<td>$a_{64}$</td>
<td>-5.080</td>
</tr>
<tr>
<td></td>
<td>(0.014)</td>
<td></td>
<td>(0.018)</td>
<td></td>
<td>(-0.043)</td>
</tr>
<tr>
<td>$a_{42}$</td>
<td>-0.264</td>
<td>$a_{54}$</td>
<td>-0.000</td>
<td>$a_{65}$</td>
<td>-14.439</td>
</tr>
<tr>
<td></td>
<td>(-0.026)</td>
<td></td>
<td>(-0.000)</td>
<td></td>
<td>(-1.613)</td>
</tr>
</tbody>
</table>

Notes: Numbers in brackets are z-score.

Table 4: The negative signs of estimated coefficient of IMPI ($a_{21}$) with lnCPI reveal to us the inflation rate negatively related with output. The Oil prices have positive value of estimated coefficient ($a_{31}$) with output and money market rate ($a_{34}$). So, the monetary authority will rise the rate of interest if they detect an unexpected rise in the Oil prices and in this problem, SBP regulate the contractionary monetary policy for SR to control inflation rate a result the output will increase. The other reason of the positive value of estimated coefficient of Oil can be, when the oil prices increase the firms profit decline in S.R. Firm can increase his profit only one case when they will increase output for S.R. The negative value of estimated coefficient ($a_{42}$) is related with the supply of money, whenever, the supply of money increase leads to increase in inflation rate. The SBP increase the rate in money market, for the reduction of M2. The estimated value of coefficient ($a_{41}$) is NEER with positive shock in MMR; the trade of country related with NEER, in the responses of currency depreciated the monetary authority rapidly increases MMR to decline the purchasing of import goods. The estimated value of the coefficient ($a_{42}$) is negative between NEER and CPI. According to these findings, the relationship between M2 and NEER is weak because the values are not statistically significant and have lower impact on other variables. However, it is concluded that the policy variables such as MMR and M2 are more significant and have a S.R impact on the economy of Pakistan.

**Estimation Results of Impulse Response Function**

In this section, we understand the dynamic responses to monetary policy shocks of selected variables by using the estimated impulse responses function within the structural-VAR system. For the estimation of impulse response functions, use 24-month period, Cholesky decomposition method doff adjusted and to structure one standard deviation are explained the monetary policy shocks.

**Response to a World Oil Price shocks**

Figure 1: A positive shock in Oil prices will clearly lead the output to go up by the shock amount- so the initial value of one from starting point of plot. The decay in the plot shows that as the time lapses, the effects of the shock in output reaches to zero, after fifteen months. After 15 months, output becomes negative below the zero from 15 to 24 periods of month. There is one impertinent reason for increasing production in S.R, the increases of oil prices effects on firm’s profits (Decline), thus firm increase output in S.R for stability of profits. If the firm is continuously facing to increase in the oil prices, firm will reduce output in compulsion. Pakistan’s industrial sector produces agriculture related products, in which Oil shock significant impact through imports. The oil prices also have valuable effects on inflation rate, thus in responses of increase in Oil prices leads to increase in domestic prices. So, the monetary authority will rise the rate of interest if they detect an unexpected go up in the oil prices, in these problems, SBP regulate the contractionary monetary policy for SR to control inflation rate as a result output will increase in S.R.

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2 Similarly, Vinayagathasan, T., (2013), Interest Rate increases due to increase in oil prices.
The Effectiveness of Monetary Policy for Macroeconomic Stability: A Structural Vector Auto Regression (SVAR) Approach

Figure No.1: Response to a World Oil Price shocks

Response of LNWOP to LNWOP

Response of LNIMPI to LNWOP

Response of LNCPI to LNWOP

Response of LNNEER to LNWOP

Response of LNM2 to LNWOP

Response of MMR to LNWOP

Response to Industrial Manufacture Products (IMPI) shocks

Figure 2: The positive lnIMPI shock causes high fluctuations in Oil prices, whenever firm increase his output for profit as a result the demand of oil increase. The higher demand negatively impacts on its price; thus, the prices of oil will increase for two quarters. Furthermore, the rise in Oil prices will also lead to increase in the prices of other commodities, which will cause a rise in the inflation rate. In the responses of higher prices, the central bank increases the rate of interest for 6 months to decline inflation. The response of lnNEER to lnIMPI, lnNEER will gradually increase from initial to 5 months, because domestic output increases which lead to higher fluctuation in exchange rate.
Response to a Consumer Price index (CPI) shocks

Figure 3: The impulse responses of inflation on other economic variables are negative except money market rate. Whenever the rate of inflation is increase at domestically, then the overall price level in an economy increases. People will have more money to spend on commodities and services. This increases the effects on consumer products and as a result, the demand of products increases. In addition, the response of lnNEER to lnCPI, the currency will depreciate with small amount from initial to 8 months, this effect on debt positively. After 8 months, the currency will appreciate continuously, because central bank control inflation rate through increase in money market rate. The response of MMR to lnCPI, the policy authority wants to increase output in the responses of higher demand, so that the inflation can reduce. The lower interest rate leads to increase in investment, which significant impact on the level of output.
Response to an Exchange Rate (NEER) shocks

Figure 4: The exchange rate is a crucial parameter in the open economy. In the past 20 years, the Pakistani rupee is constantly in the state of devaluation. In our selected period, the Oil prices have decreased in the international market, but the benefit of this reduction could not be found in Pakistan because the value of rupee has been also reducing. Due to this situation, the production is not increased significantly and so, the price level of all goods is going to rise in the country. Positive shocks in lnNEER reaction of lnWOP will negatively decreases with small amount because the fluctuation between Oil prices and exchange rate is higher. In Pakistan, most of the economic output depends on imported machinery, when the value of currency depreciated. As a result, the prices of machinery are going to expensive. The exchange rate has no impact on money supply, statistically or significantly.
Response to a Money supply (M2) shocks

Figure 5 shows the positive lnM2 money growth shocks. It means that lnM2 will increase and the reaction of lnWOP will stable but eventually increases after 3 months. The increase in oil prices may have two reasons in Pakistan. Firstly, the increase in money supply is larger than the increase in international oil prices, so the oil demand has increased by high supply of money. Secondly, the oil prices have reduced during the specific periods in international market, but the supply of money has been continually increasing, against the reduction in oil prices. The response of lnIMPI to lnM2, lnIMPI will increase positively from initial to 9 months; it is obviously, when the supply of money increases, the output will also increase. If increases in the money supply continually leads to increase in inflation.
Response to an Interest Rate (MMR) shocks
Figure 6: The interest rate plays a contemporaneous and key role in any monetary policy. If central bank feels that whether a certain policy is better for country or not, the central bank’s first view will be on the interest rate. The positive shock of interest rate is significant in the level of prices, output, and the exchange rate. When there is one S.D shock in MMR, then output will increase for four-month period, and so it gradually declines to its baseline point. The domestic currency appreciates after three months because output and investment increase at the domestic level. The Oil prices rise continuously; this rise could increase in all levels of prices and could reduce the level of output, although the money market rate also increases. In addition, the level of output decrease after few months periods rather than increase, which lead to the evidences of expected prices puzzle. The impact of money market rate is immediate on inflation, domestic currency output. So, that is the reason to emphasize on the money market rate in Structural-VAR system.
is section, we will explain the relationships between different economic variables which can create fluctuations in macroeconomic activities. For the analysis purpose, we included 24-month period. Also, a 4-month decision period for short run analysis and 24-month decision period for long run are considered.

Table 5 describes the influence of world Oil prices on other economic variables. The influence of shock to lnIMPI can cause 2.682 percent fluctuation in Oil prices after four months. This proves that both output and Oil are important for each other. The influence of world Oil prices in output is more and gradual then other economic variables.

Table 6: The output is more important in the demand of Oil, inflation, and money supply. The output can cause 0.55 percent fluctuation in the demand of Oil. The output also makes positive movements in money supply and inflation. The output can cause 10.48 fluctuation in money supply and 13.49 in inflation rate.

Table 7: The shock of lnCPI can creates 60.42 percent of influence in Oil prices. When the inflation rate increase in country as a result the demand of output increase, so the industrial sector produce more output for higher demand. The oil prices affect by more use of oil in industrial sector.

Table 8: The shock of lnNEER lower impact on oil prices is around 17.45 % fluctuation in oil prices as the depreciation rate of currency is higher in all the selected periods. After 24-month period, the effects of exchange rate gradually increase and reach at peak point of 60 %. This higher fluctuation is not dominant for the economy of Pakistan.

Table 9: The shock of money supply leads to 6.23 % fluctuation in inflation rate. Of course, this is true whenever money supply increases in the country, then it leads to an increase in inflation. The money market rate has a greater role in maintaining the low inflation rates. In addition, the

Estimation Results of Variance Decomposition
The variance decomposition is another useful technique that is helpful in investigating the influences of economic variables. In this section, we will explain the relationships between different economic variables which can create fluctuations in macroeconomic activities. For the analysis purpose, we included 24-month period. Also, a 4-month decision period for short run analysis and 24-month decision period for long run are considered.

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highlighted figures such as 6.2368 % and 86.3250% represent the higher fluctuations in other economic variables.

Table 10: The shock of money market rate leads to 34.38 % fluctuation in oil prices through the investment channels and the demand of industrial output. We can conclude that the 34 % of oil fluctuation boosts due to the demand of output and positive exchange rate shock. We can assume that around 68 % of money market rate fluctuations are due to inflation rates.

Table 5: Variance Decomposition of LNWOP

<table>
<thead>
<tr>
<th>Period</th>
<th>S.E.</th>
<th>LNWOP</th>
<th>LNIMPI</th>
<th>LNCPI</th>
<th>LNNEER</th>
<th>LNM2</th>
<th>MMR</th>
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Table 6: Variance Decomposition of LNIMPI

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Table 7: Variance Decomposition of LNCPI

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Table 8: Variance Decomposition of LNNEER

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Table 9: Variance Decomposition of LNM2

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Table 10: Variance Decomposition of MMR

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Cholesky Ordering: LNWOP LNIMPI LNCPI LNNEER LNM2 MMR

CONCLUSION

In this study, we examined the contemporaneous causal relationship of monetary policy with macroeconomics variables in Pakistan, using a structural-VAR approach. Moreover, we investigated the existence of expected price puzzle with the help of exogenous international variable (WOP) and the impact of monetary policy shocks. We did the investigation of monetary policy shocks which have gradual impacts on the output, prices, and other additional monetary activities in Pakistan. Furthermore, we considered various policy variables to understand which policy variable will be the most effective in Pakistan. For this principle, we used monthly data from period 1999M01 to 2018M04 and the total observations are 232. Overall empirical results are based on impulse responses, variance decomposition and other useful techniques like economic restrictions.

The shock of IR/MMR policy variable provides significant results, contrast to the shock of NEER. Meanwhile, the positive shock of money supply formulates significant fluctuations in the economy of Pakistan. The world oil price shock mainly affects the domestic prices more than its effects on the other variables. Particularly, the oil prices have a greater fluctuation in industrial sector because Pakistan is least oil productive country. The shocks of NEER had not constructive impact on output, prices, and other economic activities in Pakistan. The positive IR/MMR shocks have significant impacts on price levels, while price levels increased rather than decreased. This indicates the evidence of a price puzzle.

In this study, we examined the ups and downs of Pakistan economy, using a structural-VAR approach. Moreover, we investigated the existence of expected price puzzle with the help of exogenous international variable (WOP) and the impact of monetary policy shocks. We are successful in the investigation of monetary policy shocks which have delayed impacts on the output, inflationary pressure, and additional monetary activities in Pakistan. Furthermore, we did consideration of various
economic activities to understand which activity will be most effective in Pakistan, so the monetary policy channels have strong approaching tools. For this principle, we used monthly data from period 1999M01 to 2018M04 and total observations are 232. Overall empirical results are based on impulse responses, variance decomposition and other useful techniques like economic restrictions.

The shocks of IR/MMR (policy tool) provide significant results better than the shock of NEER. There are also the results of money supply shock which make a significant fluctuation in the economy of Pakistan. The shocks of WOP represent significant fluctuation in IMPI because Pakistan is least oil productive country, so the monetary policy variables are strongly affecting from WOP. The positive IR/MMR shocks significant impacts on price level, price level increased rather than decreased this evidence is the signal of estimated price puzzle. The model Structural-VAR provided some useful participation about the economic theory of Pakistan’s and the monetary policy function.

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