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THE DYNAMIC EFFECTS OF FISCAL POLICY SHOCKS IN PAKISTAN

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Abstract

This study investigates the dynamic effects of fiscal policy shocks in Pakistan by using structural vector auto-regressive (SVAR) model for annual time series data from 1972 to 2014. To identify the effects of fiscal shocks on macro economy, four different identification approaches has been used i.e. Recursive approach, Blanchard and Perotti approach, Sign Restriction and Event Study approach for two different lags. Both sets of impulse responses gives the same results and support Mountford and Uhlig (2005) that different lag order has no effects on the whole results. While the impulse responses of all identification approaches give different results criticized Caldara and Kamps (2006) that different identification methods given the same results. The most common results provided both government expenditure and revenue shocks showed that an expansionary fiscal policy increased output only for short and medium term at the cost of high prices and have no significant effects in the long run.

Keywords: Fiscal Policy, Dynamic Effects, SVAR, Recursive, Blanchard and Perotti, Sign Restriction and Event Study approach

JEL: E12, E13, E58, E62

1. Introduction

Fiscal policy is the policy of government expenditure and taxation to attain economic growth, stable prices, resource utilization and full employment. The dynamic effects¹ of fiscal policy on economic activity is one of the most widely discussed issue of the day all over the world. The theoretical literature on the effects of government policy can be classified into two categories, i.e. Neoclassical and New Keynesians. To study effects of fiscal policy, both Neoclassical and New Keynesian expects an exogenous increase in government spending positively affect output and an

¹ Fiscal policy effects that change with respect to time.

increase in taxation negatively affect output. However, neoclassical theory argued that an increase in government spending reduce private consumption due to depressing wealth effect, while the new Keynesian theory showed an increase in government spending increase private consumption due to the Ricardian behavior.

Although, the theoretical literature on the effects of fiscal policy is well developed but currently there is strong disagreement about the sign of fiscal multiplier such as consumption. Numerous empirical studies (Fatas and Mihov (2001), Blanchard and Perotti (2002), Mountford and Uhlig (2005)) investigated the reaction of fiscal policy shocks on different macroeconomic variables, found positive response of fiscal shocks on output and consumption and support the new Keynesian theory. On the other hand, various studies (Ramey and Shapiro (1998), Burnside et al. (2003)) used some extra information about the timing of wars, tax system or elections, found that fiscal shocks affect output positively and negatively affect consumption, which supports neoclassical theory. Shaheen and Turner (2010) used the five variables structural VAR model, found that a positive government expenditure shocks have positive effects on output in the short term and negative in the long term, while Yasmin and Umaira (2009) found that consumption and output respond negatively to the innovation in government spending which is consistent with the standard neoclassic model.

This study attempts to investigate the dynamic effects of fiscal shocks in Pakistan economy by using four different approaches like; recursive approach, Blanchard and Perotti approach, sign restriction approach and event study approach. The main purpose of using different methodologies is to analyze either the lack of true responses of fiscal variables is due to different methodologies or different lags orders of VAR model. For this purpose, annual data from 1972 to 2014 has been analyzed by using reduced form VAR model. To identify fiscal shocks under the Ramey and Shapiro (1998) event study approach this study used 1965, 1971 and 1998 wars as dummy variables because government expenditure increases during wars and use the data set from 1961 to 2012.

This rest of study is organized into six chapter. The next section overviews in detail the available empirical literature in the subject area, the dynamic effects of fiscal policy shocks. Section 3 provides discussion about the theoretical background of fiscal policy. Section 4 comprise of information about data utilized and the econometric methodology for the identification of fiscal shocks. Section 5 provides in detail the empirical results and discussion. Finally, the section 6 concludes.

2. Review of Literature

A wide variety of theoretical and empirical literature is available in the subject area. three different aspects of the literature which are responsible for the absence of true effects of fiscal shocks. These are distinctions in the reduced form VAR models, distinctions in the methodology of identification shocks, and distinctions in the policy experiments.

2.1 Distinctions in the Specification of VAR models:

In the existing empirical literature distinctions in the specification of the VAR models such as; the different set of variables, different sample size, differences among deterministic and stochastic trends of variables, differences in the selection of lag length and addition of deterministic expressions such as constant, quadratic and linear time trend, and dummy variables were caused different results.

As consider the set of different variables, in case of US Blanchard and Perotti (2002) used the three variables VAR from 1947:1-1997:4, while Mountford and Uhlig (2005) used the VAR model of ten variables for the period 1955 to 2000. Ramey and Shapiro (1998), Burnside et al. (2003) and Cavallo (2003) used the large military builds ups as a dummy variable, to investigate the effects of fiscal shocks. Giordano et al. (2008) studied the effects of fiscal policy in Italy distinguished between the wage and non-wage government payments.

To study the dynamic effects of fiscal spending in Pakistan Yasmin and Umair (2009) used annual data of the fiscal variables government expenditure per capita, consumption per capita, real exchange rate, interest rate, taxes and debt to GDP ratio from 1971 to 2008, followed Favero and Giavazzi (2007) included debt to GDP ratio as a feedback to investigate the responses of fiscal shocks and used the cyclically adjusted primary deficit which was criticized by Shaheen and Turner (2010) because adjusted deficit deliver information only about current policy.

As consider the distinctions of stochastic and deterministic terms [Yasmin and Umair (2009), Giordano et al. (2008) and Favero and Giavazzi (2007)] do not report the existence of cointegration, used the unrestricted VAR models instead of VECM. There are also differences in the literature, is the addition of deterministic terms. In case of US, Blanchard and Perotti (2002) included the constant, quadratic time trends, linear time trends, and seasonal dummies while Mountford and Uhlig (2005) do not included any deterministic expressions. Ramey and Shapiro (1998), Burnside et al. (2003) and Cavallo (2003) applied fiscal dummy variable approach, used the deterministic terms i.e. the Vietnam War, Korean War, and the Reagan military build ups, to identified fiscal shocks. Giordano et al. (2008) studied the effects of fiscal policy in Italy included a constant and linear time trends.

Finally, consider the selection of the lag length the majority of the earlier literature used six and four lags Mountford and Uhlig (2005) used six lags. Mountford and Uhlig (2005) pointed that the used of high order lags do not affect the whole results.

2.2 Distinctions in the Identification Methodology:

The identification of fiscal policy shocks under the VAR methodology is one of the major problems in the empirical literature. Under the VAR methodology four different approaches are used to study the effects of fiscal shocks, which given different results. Ramey and Shapiro (1998) applied the narrative approach to evaluate the effects of unanticipated changes in government

expenditure in a two sector dynamic general equilibrium model argued that this approach provide an unambiguous indicators of unexpected shifts in defense purchases, identified three special episodes of great military builds ups in the US; the Vietnam War, the Korean War and the Carter Reagan build ups as dummy variables in a univariate auto regression. The reactions to these Ramey and Shapiro episodes indicated a significant raise in government defense spending and to a certain extent reduction in non-defense spending. As the government spending on defense increased, output and hours work also increased, while and real wages decreased. Their results were consistent with the neoclassical theory.

Edelberg et al. (1999) applied the same approach of Ramey and Shapiro (1998), found the similar results as Ramey and Shapiro (1998) and do various robustness tests concluded that small changes to the dates of the war dummies do not changed the results. Burnside et al. (2003) further extended the similar approach by allowed dissimilar fiscal responses to the different Ramey and Shapiro episodes, their results were also remaining unchanged. Eichenbaum and Fisher (2005) also used the same methodology, found that the increase in government defense spending increased hours worked and investment while decreased consumption and real wages, support the neoclassical model.

The second approach is the recursive approach introduced by Sims (1980) and used by Fatas and Mihov (2001) to observe the effects fiscal shocks in US, found that a positive government expenditure shock has strong and positive effect on consumption, output and employment; while investment does not respond significantly. On the other hand, a positive government revenue shock (increase in taxes) has negatively affect output. Their results support new Keynesian framework. Shaheen and Turner (2010) applied the same approach for Pakistan economy their results were statistically insignificant. Afonso and Sousa (2009) used the recursive approach to investigate the effects of fiscal policy shocks in OECD countries, found that government expenditure shocks have positively effects GDP and consumption, while negatively affected investment and led to depreciate the real exchange rate. On the other hand, the increase in taxes increased GDP and consumption due to fiscal consolidation and led to appreciate the real exchange rate.

The third approach is the Blanchard and Perotti (2002) structural VAR approach used to investigate effects of fiscal shocks in US, found that positive government expenditure shocks have a positive effect on output while positive tax shocks have negative effect on output. Private consumption reacts positively to government expenditure shocks as the Keynesian predicts. While both increase in government expenditure and taxes have a strong negative effect on investment.

The identification method introduced by Blanchard and Perotti (2002) has also applied by Perotti (2002) in four OECD countries, de Castro and Hernández (2006) in Spain, Giordano et al, (2008) in Italy and Shaheen and Turner (2010) in Pakistan.

The fourth approach is the sign restriction approach applied by Mountford and Uhlig (2005) to evaluate the effects of fiscal policy in US under the VAR methodology, results showed that deficit

financed spending shock positively effects consumption and output, and negatively affect both residential and nonresidential investment. On the other hand, the deficit financed tax cut significantly increase output, consumption and investment and suggests that deficit financed tax cut to be the best policy in US to stimulate the financial system.

The sign restriction approach has also applied by Fonseca et al, (2010) and Jha et al, (2010), Endegnanew (2009) for the identification of fiscal shocks. Fonseca et al, (2010) studied the effects of fiscal policy shocks in Latin American countries, found that an expansionary fiscal shock increased output and consumption, and reduced inflation and interest rate. On the other hand, positive revenue shocks have negatively affected output and consumption. Their results suggest the procyclical financial policy for developing countries. Jha et al, (2010) examined the relative efficiency of fiscal policy for ten developing Asian countries. Their results showed that government spending shocks have positively affect output in the short term, while a positive policy was the best policy to stimulate the financial system. Endegnanew (2009) studied the effects of government expenditure shocks in seventeen developing countries, used the sign restriction methodology to identified shocks, found that the positive government expenditure shocks increased output and consumption.

Finally to study the effects of fiscal policy in the VAR methodology Caldara and Kamps (2006) used all the four identifications procedures to identified shocks, found that positive government expenditure shocks increased output and consumption only in the short and medium term and have no effect on output in the long term and also found that different effects of government revenue shocks under different identification procedures; the sign restriction approach found that private consumption, output, employment and investment decreased in response to the revenue shocks, while the Blanchard and Perotti approach and the recursive approach given the puzzled outcomes that the fiscal variables do not responds to the pure government revenue shocks.

2.3 Distinctions in Policy Experiments:

The third reason of different results of fiscal shocks in the existing empirical literature is the dissimilarities in the policies experiments. In the entire empirical literature only Mountford and Uhlig (2005), Fonseca et al, (2010) and Jha et al, (2010) were mentioned the effects of pure government expenditure and revenue shocks. As considered the example of government expenditure shocks Mountford and Uhlig (2005) showed that government revenue decreased, while Blanchard and Perotti showed that government expenditure shocks led to increased government revenue in the US economy. Differences in response of government expenditure shocks were due to the differences in the policy experiments. Mountford and Uhlig (2005) used three policy experiment i.e. (1) balanced budget spending increased, (2) deficit financed tax cut, and (3) deficit financed spending increased, and argued that these policy experiments should be the linear arrangement of the pure government revenue and expenditure shocks, the result suggested that deficit financed tax to be the most effective policy to stimulate economy. Jha et al, (2010) used the two policy experiments: (1) deficit financed tax cut and (2) deficit spending, to

compare that which policy should be the best policy to stimulate the financial system. Caldara and Kamps (2006) used the four policy experiments to investigate their responses on economy. Their outcomes suggested both deficits financed spending increased, and deficit financed tax cut have spreading out effects in the short term. While in the short term the government tax financed policy saddens the economy, and neither the deficit financed tax cut, nor the deficit financed spending increased have significantly affects output in the long term.

Against this background, the present study investigates that whether differences in methodology may be responsible or not for the disagreement on the effects of fiscal policy shocks reported in the literature.

3. Theoretical Background

There is a wide-ranging theoretical literature that studied the effects of fiscal policy on economic activities. In the existing literature the effects of fiscal policy on macro economy are enlighten in different theoretical frameworks i.e. neoclassical and new Keynesian.

3.1 Neoclassical Framework:

The neoclassical approach was introduced by Hall (1980), Barro (1987), Mankiw (1987) and Baxter and King (1993) to analyze the effects of fiscal policy shocks on macro economy. In the neoclassical model the effects of an expansionary government policy depend on the process of financing government expenditure. Baxter and King (1993) analyzed the effects of discretionary fiscal policy on macro economy, assumed lump sum taxes to financed government expenditure. Their results indicated that an expansionary fiscal policy have negative wealth effect on households, they became poorer thus labor supply increased. Given the labor demand constant an increase in labor supply decreased marginal efficiency of labor and real wages, as a result production increased while consumption decreased. However, If the shock is continuing private investment would increase because of increase in marginal efficiency of capital, private expenditure would decreased than before and real wages returned to their former level.

3.2 New Keynesian framework:

The New Keynesian models introduced nominal price rigidities, non-Ricardian behavior, increasing returns and monopolistic competition, claims that an increase in government expenditure has positive impact on private consumption and production during multiplier effect. Devereux et al, (1996) introduced a model of market failing, monopolistic competition and an increasing return to scale, found that an increase in government spending enhance demand for goods which in turn enlarged labor demand and real wages. Gali et al, (2007) further broaden the New Keynesian model, introduced the non-Ricardian “rule of thumb” consumers, whose consumption increase in reaction to raise in government spending.

To study the theoretical literature on the effects of fiscal policy shocks, both neoclassical and New Keynesian models predicts that an exogenous increase in government spending positively affect output and increase in taxation negatively affect output. However, Neoclassical theory claim that an increase in government spending reduce private consumption due to negative wealth effect, while New Keynesian theory showed an increase in government spending increased private consumption due to Ricardian behavior.

4. Data and Econometric Methodology:

To investigate the dynamic effects of fiscal policy shocks in Pakistan economy this study use two sets of annual time series data; the log of real government spending, the log of real Gross Domestic Product (GDP), the log of real government tax revenue, Consumer price index (CPI), and interest rate for the period of 1972 to 2012 and from 1961 to 2012 to check the effects of increase in government expenditure during wars. All the data series are converted into base year 2005 US dollars².

To evaluate the effects of fiscal policy, the literature used two major econometrics models, i.e. the structural macroeconomic models and the VAR models. The structural macroeconomic models based on theory, inflict the Keynesian theory where government expenditure shocks respond positively to increase output and consumption and these models were mostly used in 20th century. These models were failed to make clear the ambiguous reaction of consumption to the fiscal shocks Blanchard and Perotti (2002). These models also illustrate that fiscal policy affects output through consumption and investment, but in general it does not associate the effects of fiscal policy on macroeconomy. The VAR models are needed to avoid the complexity of structural macroeconomic models. Therefore, in the recent time the VAR model is used to evaluate the effects of fiscal policy, Yasmin and Umaira (2009) the VAR model do not enforce any restrictions on financial system, do not distinguish endogenous and exogenous variables and helpful for better forecasting.

To analyze the dynamic effects of fiscal shocks in Pakistan this study uses the reduced form VAR model because this model is helpful to study the responses of variables in different time periods, and then apply the different identification procedures to identify shocks. This study follows Perotti (2005) and Shaheen and Turner (2010) by using the five variables reduced form vector autoregressive model;

$$\mathbf{X}_t = \boldsymbol{\mu}_0 + \boldsymbol{\mu}_1 t + \mathbf{A}(L)\mathbf{X}_{t-1} + \boldsymbol{\mu}_t \quad (1)$$

Where, t is a linear time trend, $\boldsymbol{\mu}_0$ is a constant term, $\mathbf{A}(L)$ is the autoregressive lag polynomial, $\mathbf{X}_t = (\mathbf{g}_t, \mathbf{y}_t, \mathbf{p}_t, \mathbf{tr}_t, \mathbf{r}_t)$ is the vector of fiscal variables, and $\boldsymbol{\mu}_t$ is a vector of reduced form error terms, with nonzero correlations.

² US dollar is used because of availability of data.

As the reduced form error terms are correlated with each other therefore, it is essential to change the reduced form model, into the structural model. We get the structural VAR by multiplying equation (1), by $(k \times k)$ vector \mathbf{A}_0

$$\mathbf{A}_0 \mathbf{X}_t = \mathbf{A}_0 \boldsymbol{\mu}_0 + \mathbf{A}_0 \boldsymbol{\mu}_1 t + \mathbf{A}_0 \mathbf{A}(L) \mathbf{X}_{t-1} + \mathbf{B} \mathbf{e}_t \quad (2)$$

Where, $\mathbf{B} \mathbf{e}_t = \mathbf{A}_0 \boldsymbol{\mu}_t$ show the relation between the structural residuals \mathbf{e}_t , and the reduced form residuals $\boldsymbol{\mu}_t$, and assumed that the structural residuals \mathbf{e}_t are not correlated with one another, i.e. is the variance-covariance matrix of structural form residuals \sum_e is diagonal. The matrix \mathbf{A}_0 shows the simultaneous relationship between the variables in matrix \mathbf{X}_t . The structural model is identified only if restrictions are imposed on the parameters in matrix \mathbf{A}_0 and \mathbf{B} .

4.1 Identifications of Fiscal Shocks:

The identification of fiscal policy shocks, under the VAR methodology is one of the major problems in the existing empirical literature. To identify fiscal shocks, four approaches are used in the previous literature i.e. (I) The recursive approach used by Fatas and Mihov (2001), (II) The Blanchard and Perotti (2002) structural VAR approach, (III) Mountford and Uhlig (2005) sign restriction approach, (IV) Ramey and Shapiro approach of event study. To investigate the dynamic effects of fiscal policy shocks in Pakistan and to find out the basic causes of differences in results this study uses all the above four approaches to identify fiscal shock.

4.1.1 Recursive Approach:

The first approach for the identification of fiscal shocks uses in this study is the recursive approach. this approach uses k -dimensional identity matrix to restrict \mathbf{B} , and the lower triangular matrix include 1 in the main diagonal, which shows the decomposition of the variance-covariance matrix $\sum_u = \mathbf{A}_0^{-1} \sum_e (\mathbf{A}_0^{-1})'$. This variance-covariance matrix is attain from Cholesky decomposition $\sum_u = \mathbf{P} \mathbf{P}'$ by identifying the diagonal matrix \mathbf{D} with the similar diagonal as \mathbf{P} and by specifying $\mathbf{A}_0^{-1} = \mathbf{P} \mathbf{D}^{-1}$ and $\sum_e = \mathbf{D} \mathbf{D}'$, i.e. the components in the main diagonal of \mathbf{P} and \mathbf{D} , are equivalent to the standard deviation of the particular structural shocks. The recursive approach shows the ordering of the variables and there are total $k!$ possible orders. This study uses government expenditure in order first, output in order second, prices in order third, government revenue in order fourth and interest rate in order fifth. In this approach relationship between the structural error's terms $\boldsymbol{\mu}_t$ and reduced form error terms \mathbf{e}_t are written in the following form;

$$\begin{bmatrix} 1 & 0 & 0 & 0 & 0 \\ \alpha_{y,g} & 1 & 0 & 0 & 0 \\ \alpha_{p,g} & \alpha_{p,y} & 1 & 0 & 0 \\ \alpha_{tr,g} & \alpha_{tr,y} & \alpha_{tr,p} & 1 & 0 \\ \alpha_{r,g} & \alpha_{r,y} & \alpha_{r,p} & \alpha_{r,r} & 1 \end{bmatrix} \begin{bmatrix} \mathbf{u}_t^g \\ \mathbf{u}_t^y \\ \mathbf{u}_t^p \\ \mathbf{u}_t^{tr} \\ \mathbf{u}_t^r \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} \mathbf{e}_t^g \\ \mathbf{e}_t^y \\ \mathbf{e}_t^p \\ \mathbf{e}_t^{tr} \\ \mathbf{e}_t^r \end{bmatrix}$$

In this study government expenditure is put in order first because it does not respond contemporaneously to the shocks in all the remaining variables in equation follow by Output because its only respond contemporaneously to shocks in government expenditure while the remaining all variables in the equation have no effect on output, then follow by prices because it does no responds contemporaneously to the shocks in tax and interest rate but responds contemporaneously to the shocks in government expenditure and output, then the tax revenue because it does not respond contemporaneously to the shock in interest rate but responds contemporaneously to shocks in all the remaining variables in system and the interest rate is in order last because it responds contemporaneously to the shocks in all variables in equation.

4.1.2 *Blanchard and Perotti Approach:*

The second approach use in this study for the identification of fiscal shocks is the Blanchard and Perotti approach. This approach depends on the institutional information about the tax and transfer system to identify the automatic reactions of government expenditure and revenue to economy. This identification approach has two steps: (a) used the institutional information in order to determine the cyclically adjusted government spending and revenue, (b) find the estimates of fiscal policy shocks. This study follows Perotti (2005) identification system as he used the five variables VAR model. In this approach relationship between the structural error's terms $\boldsymbol{\mu}_t$ and reduced form error terms \mathbf{e}_t are written in the following form;

$$\mathbf{u}_t^g = \alpha_{g,y}\mathbf{u}_t^y + \alpha_{g,p}\mathbf{u}_t^p + \alpha_{g,r}\mathbf{u}_t^r + \beta_{g,tr}\mathbf{e}_t^{tr} + \mathbf{e}_t^g \quad (1)$$

$$\mathbf{u}_t^{tr} = \alpha_{tr,y}\mathbf{u}_t^y + \alpha_{tr,p}\mathbf{u}_t^p + \alpha_{tr,r}\mathbf{u}_t^r + \beta_{tr,g}\mathbf{e}_t^g + \mathbf{e}_t^{tr} \quad (2)$$

$$\mathbf{u}_t^y = \alpha_{y,g}\mathbf{u}_t^g + \alpha_{y,tr}\mathbf{u}_t^{tr} + \mathbf{e}_t^y \quad (3)$$

$$\mathbf{u}_t^p = \alpha_{p,g}\mathbf{u}_t^g + \alpha_{p,y}\mathbf{u}_t^y + \alpha_{p,tr}\mathbf{u}_t^{tr} + \mathbf{e}_t^p \quad (4)$$

$$\mathbf{u}_t^r = \alpha_{r,g}\mathbf{u}_t^g + \alpha_{r,y}\mathbf{u}_t^y + \alpha_{r,p}\mathbf{u}_t^p + \alpha_{r,tr}\mathbf{u}_t^{tr} + \mathbf{e}_t^r \quad (5)$$

The above scheme of equations is not identified because it has seventeen (17) unidentified parameters, while the variance covariance vector of the reduced form error terms has ten (10) different parameters. Blanchard and Perotti approach imposed some restrictions on these seven

extra parameters to identify fiscal shocks. Assume that interest fees on govt debt are omitted from the definitions of govt spending and revenue, the semi elasticities of these two factors to the variations in interest were equal to zero i.e. $\mathbf{a}_{g,r}$ and $\mathbf{a}_{tr,r} = 0$, and following Shaheen and Turner (2010) place the output elasticity of taxes $\mathbf{a}_{tr,y} = \mathbf{0.96}$ and price elasticity of taxes $\mathbf{a}_{tr,p} = \mathbf{0.71}$. We follow Perotti(2005) place the output elasticity of govt expenditure i.e. $\mathbf{a}_{g,y} = 0$, because govt spending consists of investment and consumption which is independent to the automatic changes in economy; and also place the inflation elasticity $\mathbf{a}_{g,p} = -\mathbf{0.5}$, because govt spending on nominal wages do not response contemporary to changes in inflation shows that in real terms govt wages falls if inflation rises. Finally, we follow Perotti (2005) and Shaheen and Turner (2010) by placing $\mathbf{\beta}_{g,tr} = \mathbf{0}$, because govt decisions on expenditures are taken earlier than taxes. By imposing these limitations on parameters, the relationship among structural and reduced form error term are as follows;

$$\begin{bmatrix} 1 & 0 & 0.5 & 0 & 0 \\ \alpha_{y,g} & 1 & 0 & \alpha_{y,tr} & 0 \\ \alpha_{p,g} & \alpha_{p,y} & 1 & \alpha_{p,tr} & 0 \\ \alpha_{nt,g} & 0.96 & 0.71 & 1 & 0 \\ \alpha_{r,g} & \alpha_{r,y} & \alpha_{r,p} & \alpha_{r,r} & 1 \end{bmatrix} \begin{bmatrix} \mathbf{u}_t^g \\ \mathbf{u}_t^y \\ \mathbf{u}_t^p \\ \mathbf{u}_t^{tr} \\ \mathbf{u}_t^r \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 \\ \beta_{tr,g} & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} \mathbf{e}_t^g \\ \mathbf{e}_t^y \\ \mathbf{e}_t^p \\ \mathbf{e}_t^{tr} \\ \mathbf{e}_t^r \end{bmatrix}$$

In the above system the reduced-form error terms are linear combinations of the orthogonal structural shocks.

4.1.3 The Sign Restrictions Approach:

The third approach use in the analysis for the identification of shocks is the sign restriction approach of Mountford and Uhlig (2005). In contrast to the above two approaches, this approach does not impose any restriction on the reaction fiscal variables. In this approach Mountford and Uhlig (2005) identified four different shocks i.e. Monetary policy shocks, Business cycle shocks, govt expenditure and revenue shocks. This study only identifies business cycle and fiscal policy shocks and ignores monetary policy shocks. To identify business cycle, government expenditure and revenue shocks, this study inflict the sign restrictions on impulse responses of variables in the below table.

In the below table 1 it is assumed that the business cycle shock is as a shock that shifts the output and govt revenue in the same way for four quarters after the shock. This is the fundamental assumption for identify fiscal shocks, when govt revenue and GDP shifts in the same way, it means that this is due to the improvement in business cycle. This shows that a rise (fall) in govt revenue lead to rise (fall) in GDP, such an observable fact is known as “expansionary fiscal contractions”.

The fiscal policy shocks are identified only the impulse responses of fiscal variables is restrict; and assume that they are orthogonal to the business cycle shocks.

Table1: Identifying Sign Restrictions.

	Real GDP	Govt Expenditure	Govt Revenue	Real interest rate	Prices
Business cycle shock	+	?	+	?	?
Govt revenue shock	?	?	+	?	?
Govt expenditure shock	?	+	?	?	?

Note; in this table (+) sign indicated the positive reaction of impulse response for four quarters after shock, (-) sign indicated the negative reaction, while (?) sign indicated no response.

To identify fiscal shocks Mountford and Uhlig (2005), write the relationship among reduced form error terms \mathbf{u}_t and structural form error terms \mathbf{e}_t as, $\mathbf{u}_t = \mathbf{B}\mathbf{e}_t$, where $\Sigma_u = \mathbf{E}(\mathbf{u}_t\mathbf{u}_t')$ and identity matrix, $\mathbf{I} = \mathbf{E}(\mathbf{e}_t\mathbf{e}_t')$. This study identified three basic shocks using the sign restrictions approach for the five variables VAR model. Mountford and Uhlig (2005) decompose the vector \mathbf{B} into two parts \mathbf{p} and \mathbf{q} , i.e. $\mathbf{B}=\mathbf{p}\mathbf{q}$, where \mathbf{p} is the lower triangular matrix of Σ_u and \mathbf{q} are the identifying weights to be determined. The impulse matrix \mathbf{B} to the n dimensional IRF at period k can be written as;

$$r_B = \sum_{i=0}^m q_i r_i(k)$$

To impose the sign restriction on impulse responses and compute the individual weights \mathbf{q} , use the following penalty function by minimizing the criterion function.

$$\mathbf{q} = \mathit{argmin} \bar{m}(\mathbf{pq})$$

Where the criterions function $\bar{m}(\mathbf{pq})$ is given as;

$$\bar{m}(\mathbf{pq}) = \sum_{j \in JS^+} \sum_{k=0}^K f\left(-\frac{r_{ja}(k)}{s_j}\right) + \sum_{j \in JS^-} \sum_{k=0}^K f\left(-\frac{r_{ja}(k)}{s_j}\right)$$

The criterion function thus sums the penalties over the period of $k = 0, 1, 2, \dots, K$, following the shock and shows positive and negative restrictions of variables Mountford and Uhlig (2005).

4.1.4 The Event Study Approach:

The event study approach of Ramey and Shapiro (1998) is the fourth approach use in this analysis for the identification of fiscal shocks. Ramey and Shapiro (1998) argued the exogenous events such as wars increased the military spending. In Pakistan government spending on defense increases during war times, therefore this study follows Ramey and Shapiro (1998) for the identification of fiscal shocks by introducing dummy variable \mathbf{D}_t . The dummy variable \mathbf{D}_t takes

the 1 for 1965 war, 1971 war and 1998 war and zero for all other years. Including the War dummy in equation 1, the reduced form model as written as under;

$$X_t = \mu_0 + \mu_1 t + A(L)X_{t-1} + \phi(L)D_t + \mu_t \quad (A)$$

Where, $\phi(L)$ is the lag polynomial of the fiscal dummy variable D_t .

5. Results and Interpretations

5.1 Stationarity Tests:

To test the stationarity of variables the Augmented Dickey Fuller (ADF) is applied on log of government expenditure, log of government tax revenue, log of CPI, log of GDP and long-term interest rate. The null hypothesis (H0) of ADF test stated that unit root present means the data is non-stationary while the alternative hypothesis stated that the data is stationary. The results of ADF test in table 2, indicated that the order of integration is not same; series of government expenditure (G), output (Y), inflation (CPI), and tax revenue (TR) are non-stationary at level and became stationary at first difference at 5% significance level, while the interest rate is stationary at level. For further analysis this study takes only stationary variables.

Table 2: ADF test Results

Variables	P values at Level	P values at 1 st difference
Log of G	0.4154*	0.0003*
Log of Y	0.1132*	0.0008*
Log of P	0.0654*	0.0213*
Log TR	0.5732*	0.0000*
Interest rate	0.0429*	—

Note: * shows significance at 5%, the null hypothesis of ADF test is existence of unit root. G is the government expenditure, Y is GDP, P is CPI, tr is the tax revenue and interest rate.

5.2 Lag Selection Criteria:

The second step of estimation procedure is the selection of optimum lags for VAR model. The Akaike Information Criterion (AIC) suggested the optimum lags 4, while Hannan and Quinn Information criterion (HQ) and Schwartz Information Criterion (SIC) suggested lag 1 of endogenous variables. Mountford and Uhlig (2005) argued that different lags order has no effects on whole results. This study used both lag order one and four to compare their results.

Table 3: VAR lag order selection criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	10.37754	NA	5.15e-07	-0.290678	-0.072986	-0.213932

1	247.3337	397.0616	5.52e-12	-11.74777	-10.44162*	-11.28729*
2	266.2337	26.56226	8.30e-12	-11.41804	-9.023431	-10.57383
3	294.7456	32.36484	8.48e-12	-11.60787	-8.124805	-10.37993
4	340.0703	39.19975*	4.48e-12*	-12.70650*	-8.134980	-11.09483

* 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

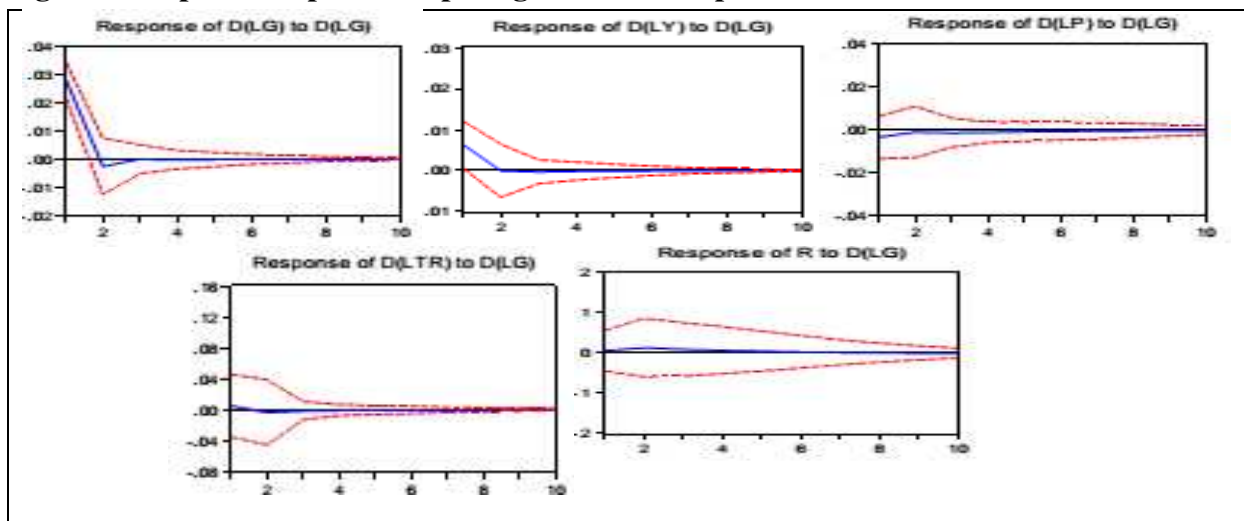
Note: Lag selection at 5% level of significance.

5.3 Recursive Approach:

5.3.1 Effects of Pure Government Expenditure Shocks:

The impulse responses for government expenditure shocks are shown in figure 1. The responses of positive government expenditure shocks to its own shock have positive for next two years following the shock, and after two years its impact become negligible. The impulse responses of output to government expenditure shocks indicated that positive government expenditure shocks have positively affect output Fatas and Mihov (2001). The impulse responses of prices and interest to government expenditure shocks showed increases in government expenditure have negative effects on prices and positive effect on interest rate Fonseca et al, (2010) found the same results. The impulse responses of tax revenue to government expenditure shock showed that a positive government expenditure shock has no significant effect on tax revenue.

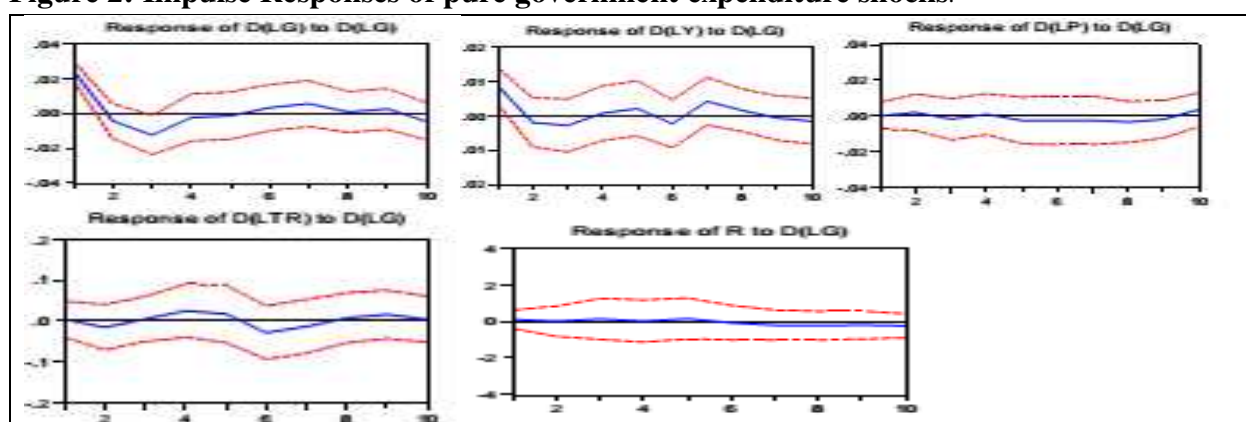
Figure 1: Impulse Responses of pure government expenditure shocks.



Note: The impulse responses of lag one for the recursive identification approach. The responses are shown for 10 periods.

However, the impulse response functions of government expenditure shocks for lag order four were reported in figure 2 indicated that the response of government expenditure to its own shock reacts positively for two years after the shock and after two years declined up to next three years and then became positive gradually. The impulse responses of output to government expenditure shocks showed a humped shaped pattern of output Burnside et al (2003). The impulse responses of prices and interest rate to government expenditure shock showed that the positive government expenditure shock have negative effects on effect on prices and positive effect on real interest rate the lag order one found the same responses. The impulse responses of government revenue to expenditure shock also showed a humped shaped pattern of government revenue to positive government expenditure shock.

Figure 2: Impulse Responses of pure government expenditure shocks.



Note: The impulse responses of lag four for the recursive identification approach. The responses are shown for 10 periods.

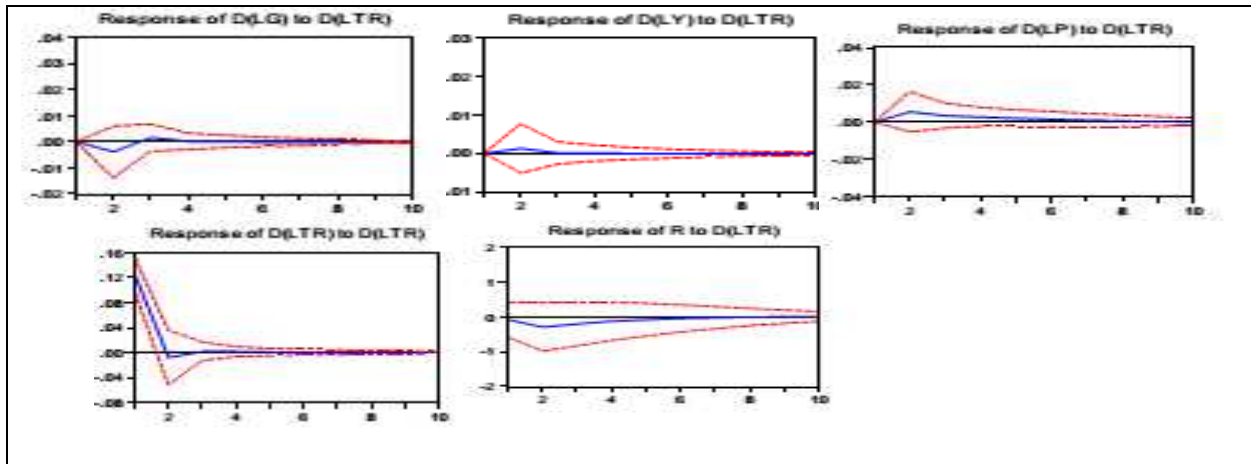
The impulse responses of both lag order showed that an increased in government expenditure increased output in the short term and reduced prices and interest rate.

5.3.2 Effects of Pure Government Revenue Shocks:

The impulse response functions of government revenue shocks are shown in figure 3. The responses of government expenditure to government tax revenue indicated that positive government tax revenue shocks have negligible effects on government expenditure. The impulse responses of output, prices, and interest rate to government revenue shock reported that increased in government revenue increased output for the short term after the shock due to fiscal consolidation and then became constant because of low persistence of shock, Afonso and Sousa (2009) used the recursive approach found the same results. The impulse responses of prices to government revenue shocks indicated that prices increased in the next five periods due to increase in government revenue. The impulse responses of tax revenue to its own shock showed positive response for short term. While the impulse responses of interest rate to government revenue shock indicated that the positive increased of tax revenue have negative effects on interest rate.

On the other hand, the impulse responses of government revenue at lag order four are reported in figure 4 showed that the impulse responses of government expenditure to tax revenue indicated

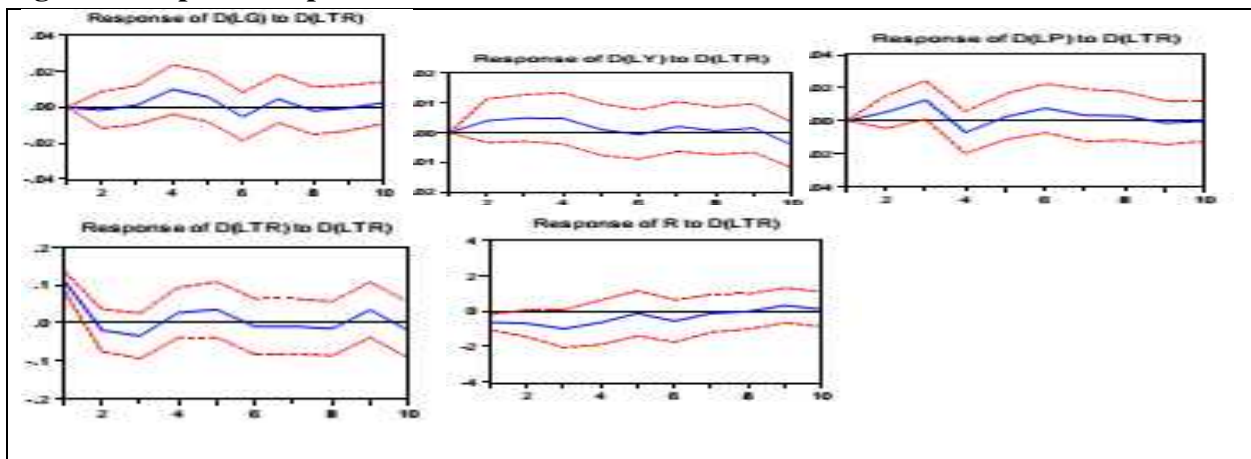
Figure 3: Impulse Responses of Government Tax Revenue Shocks.



Note: The impulse responses of lag one for the recursive identification approach. The responses are shown for 10 periods.

that government expenditure responds positively after the second period of government tax revenue shock. The responses of output to government revenue indicated that output increased persistently following the positive government revenue shock. The impulse responses of prices to government revenue indicated that prices respond positively to government revenue shock. The impulse responses of tax revenue to its own shock have shown a humped shaped pattern of government revenue. Finally, the impulse responses of government interest rate to government revenue shock reported that the real interest rate decreased for short term after the positive government revenue shock.

Figure 4: Impulse Responses of Government Tax Revenue Shocks



Note: The impulse responses of lag four for the recursive identification approach. The responses are shown for 10 periods.

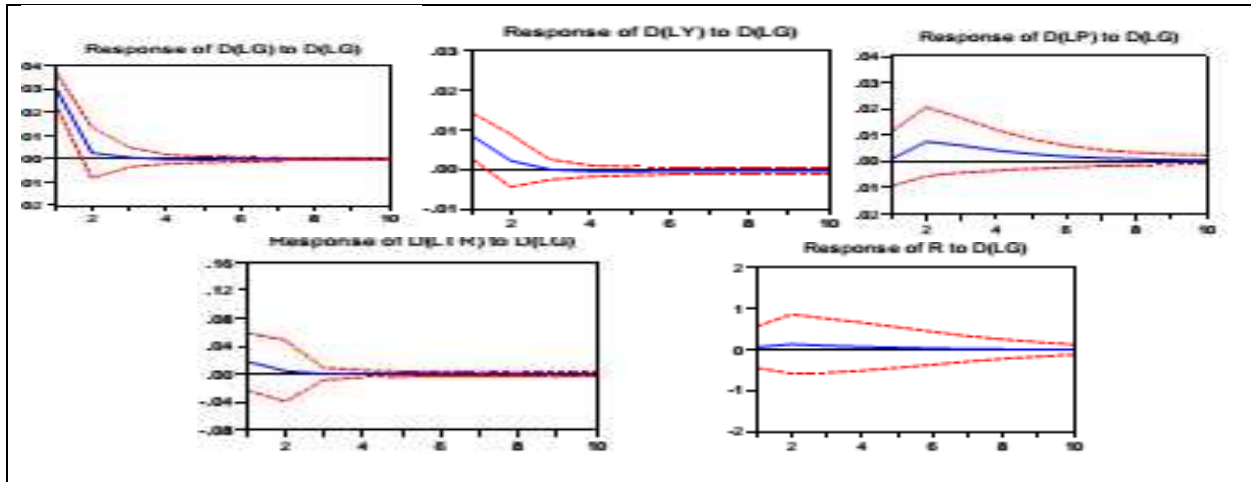
Both impulse responses of government revenue shock indicated that the positive government revenue shock increased output and prices while the interest rate responds negatively support new Keynesian Fatas and Mihov (2001) and, Afonso and Sousa (2009) found the same results.

5.4 Blanchard and Perotti Approach:

5.4.1 Effects of Pure Government Expenditure Shocks:

The impulse responses of government expenditure for lag order one is reported in figure 5. The responses of government expenditure shock to its own shock indicated that government revenue response positively to its own shock. The responses of output, government expenditure, prices and interest rate response positively to government expenditure shocks Fatas and Mihov (2001).

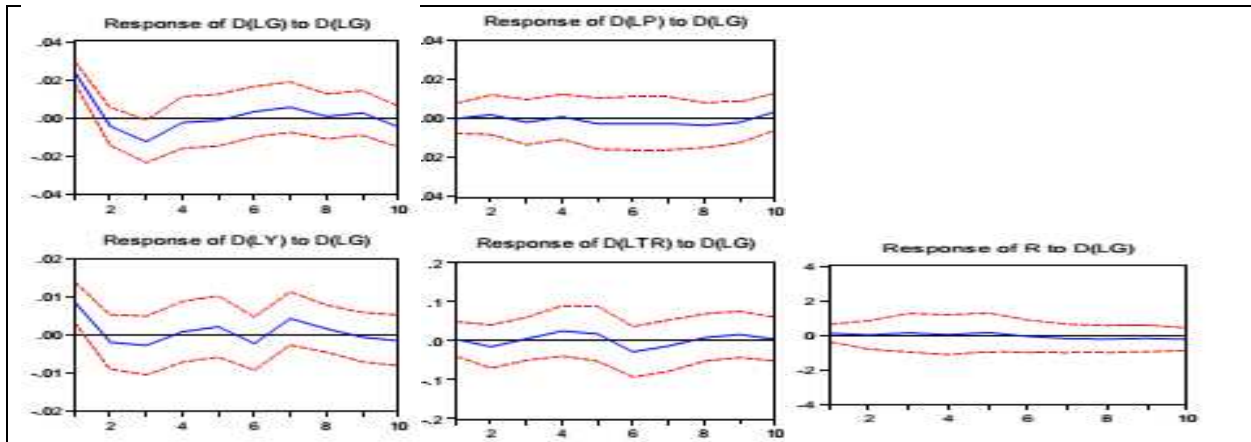
Figure 5: Impulse Responses of pure government expenditure shocks.



Note: impulse responses of government revenue for lag order one of Blanchard and Perotti approach based on Cholesky order. The responses are shown for 10 periods.

The impulses responses of government expenditures for lag order four are reported in figure 6. The impulse responses of government expenditure to its own shock showed that government

Figure 6: Impulse Responses of government Expenditure shocks.



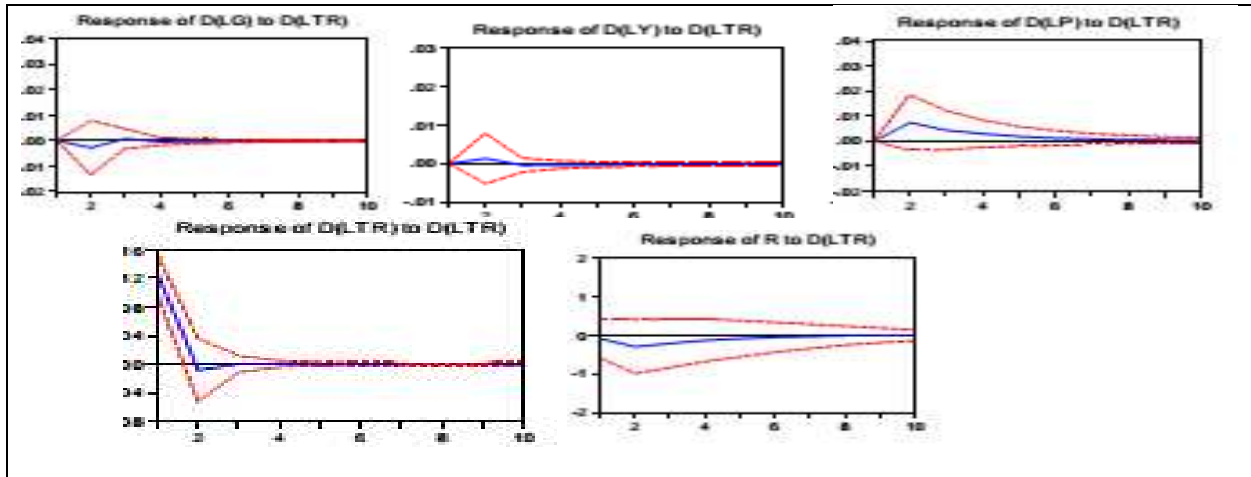
Note: The impulse responses of lag four. The responses are shown for 10 periods.

expenditure respond positively to its own shock. The impulse responses of output to government expenditure showed insignificant result, while the impulse responses of government tax revenue and interest responds positively to government expenditure shocks.

5.4.2 Effects of Pure Government Revenue Shocks:

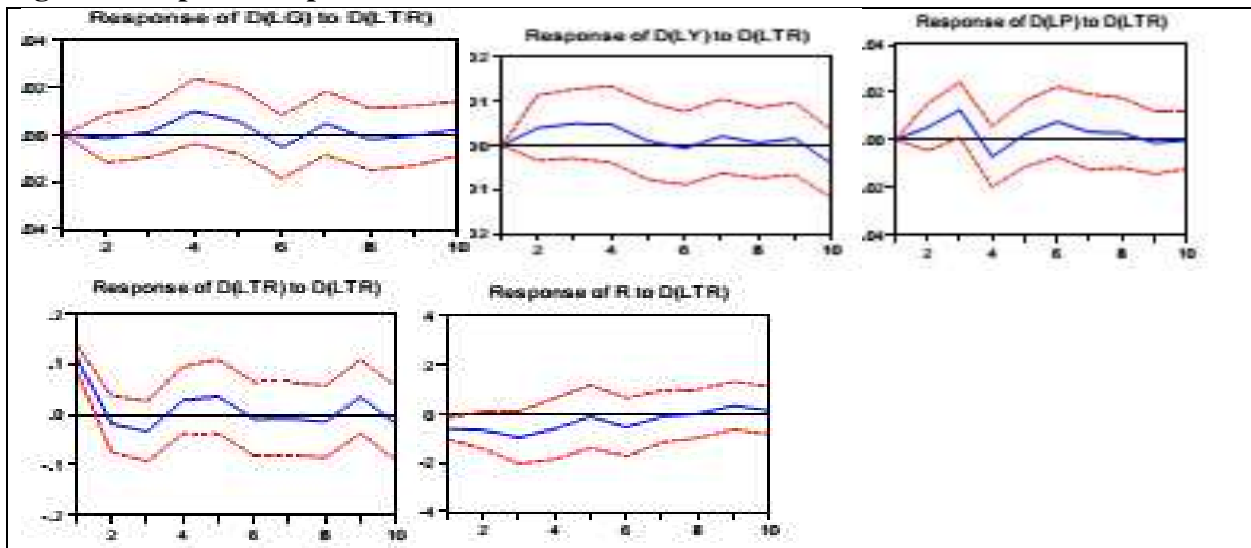
The impulse responses of pure government tax revenue shocks for lag one is shown in figure 7. The impulse responses of government expenditure to tax revenue respond negative for two years after the shock. The impulse responses of output and prices and interest rate showed that prices respond positively for four years and government tax revenue also responds positively for two years following the shock, while the interest rate decreased results are like Afonso and Sousa (2009) results.

Figure 7: Impulse Responses of Government Revenue Shocks.



Note: Impulse responses of government revenue for lag order one Blanchard and Perotti approach.

Figure 8: Impulse Responses of Government Revenue shocks.



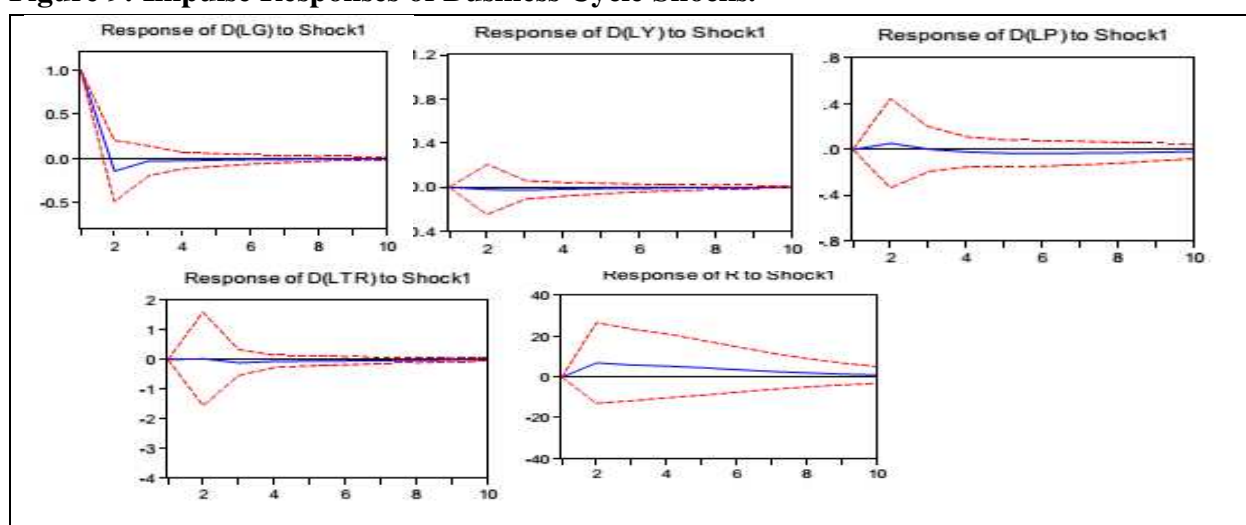
Note: The impulse responses of lag four. The responses are shown for 10 periods.

While the impulse responses of government tax revenue shocks for lag order four are reported in figure 8. The impulse response of government expenditure to tax revenue shock indicated that positive one percent positive shock to government revenue increased expenditure. The impulse responses of output, prices, tax revenue and interest rate to revenue shock indicated output and prices react positively to government revenue shock, tax revenue also responds positively while interest rate reacts negatively, the impulses of lag one found the same outcomes.

5.5 The Sign Restriction Approach:

The impulse responses of business cycle shocks are reported in figure 9. The impulse responses of government expenditure, output, prices, tax revenue and interest rate to business cycle shock

Figure 9: Impulse Responses of Business Cycle Shocks.

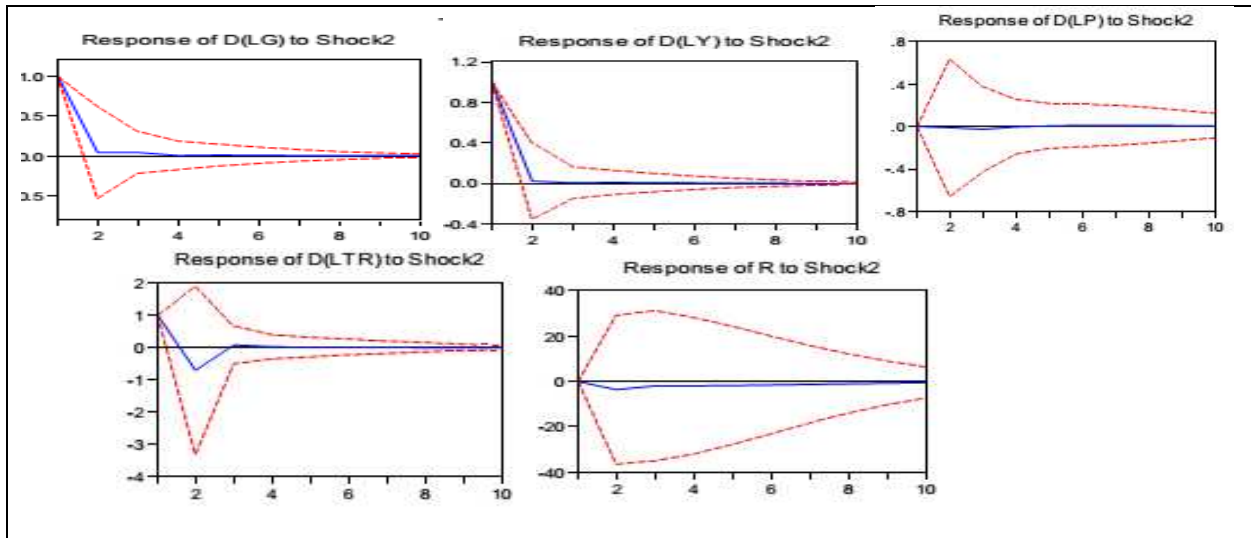


Note: Impulse responses of business cycle shock for lag one of sign restriction approach. The responses are shown for 10 periods.

showed that government expenditure responds positively for one year after the shock, have no effect on output, prices respond positively for one year after the shock and then became negative, no effect on revenue and positively affect interest rate. The impulse responses of business cycle shock for lag order four reported in figure 12 in appendix given the same results, i.e. the business cycle shock positively affect prices and interest rate for one year after the shock Mountford and Uhlig (2005) used the sign restriction approach found the same result and have no significant effects on output, expenditure and revenue.

The impulse responses of government revenue shocks for lag one reported in figure 10 indicated that government expenditure responds positively for four years after the shock. The impulses of expenditure, output, prices and interest rate to revenue shock indicated that output and expenditure responds positively for short term after the shock while the response of prices and interest rate has insignificant.

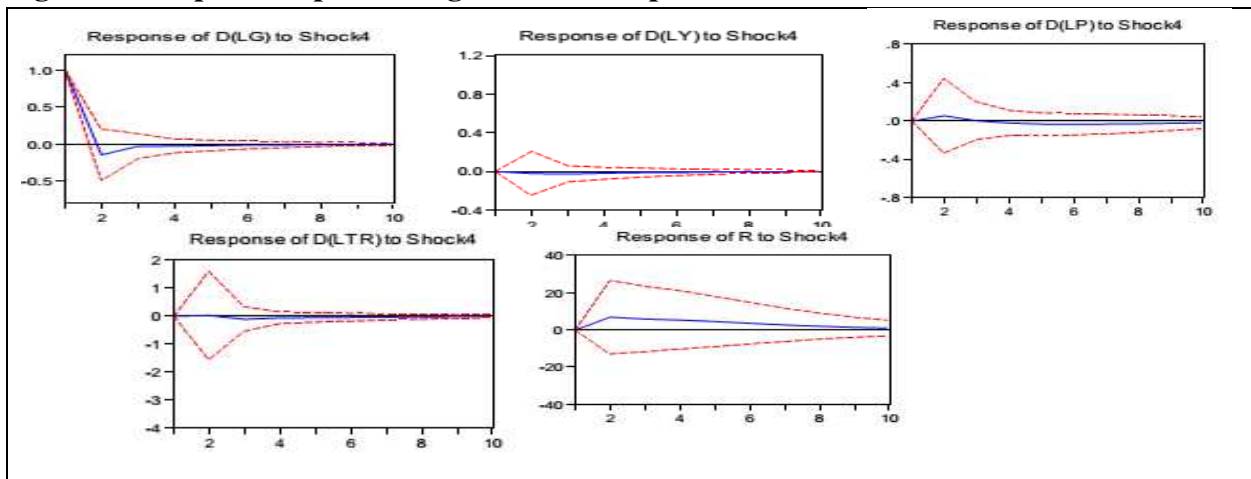
Figure 10: Impulse Responses of Government Revenue Shocks.



Note: Impulse responses of government revenue for sign restriction approach of identification for lag order one. The responses are shown for 10 periods.

The impulse responses of government expenditure shown in figure 11 indicated that government expenditure responds positively to its own shock, have no significant effects on output and revenue. While positively affect prices and interest rate Mountford and Uhlig (2005) found the similar results.

Figure 11: Impulse responses of government expenditure shock.



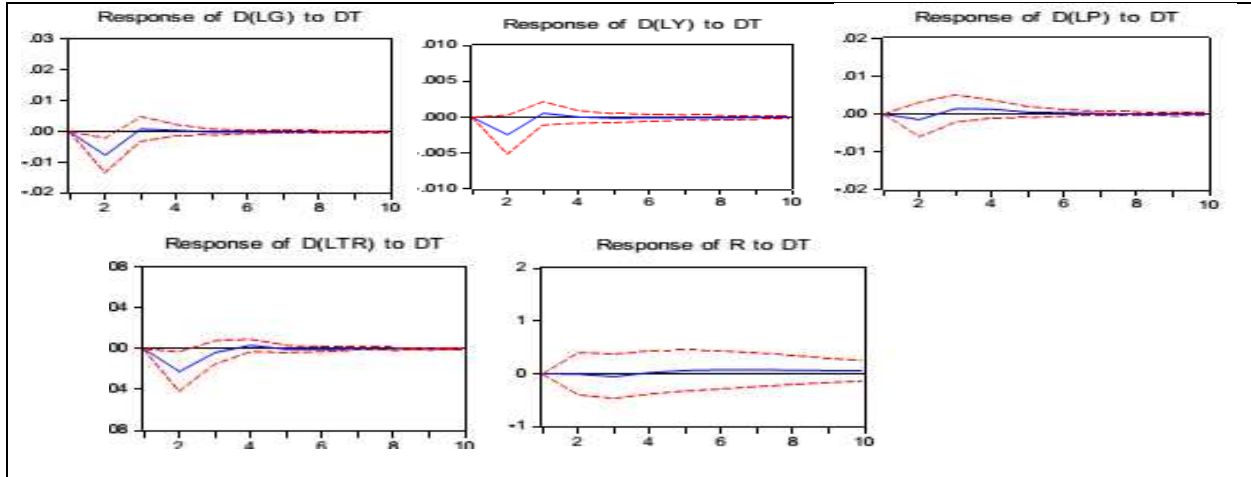
Note: Impulse responses of government expenditure Lag 1 of sign restriction approach. The responses are shown for 10 periods.

5.6 The Event Study Approach:

To identify the effects of government expenditure on fiscal variables under the Ramey and Shapiro (1998) event study approach, this study used three different episodes of war i.e. 1965 war, 1971 war, and 1998 war as dummy variable and take the data set from 1961 to 2012. The SC and HC

suggested lag one is the optimum lag for the new VAR model included dummy variable. The impulse responses of exogenous shocks of large military build ups to fiscal variables for lag order one is reported in figure 12.

Figure 12: Impulse Responses of Military Build Ups:



Note: *Impulse Responses of military build ups on g, y, p, tr, r.*

The impulse responses of government expenditure, output, prices, revenue and interest to military buildups showed that output and revenue responds negatively and then became insignificant after two years of the shock. While interest rate responds positively after four years of increase in military buildups.

6. Conclusion

This study investigated the dynamic effects fiscal policy shocks in Pakistan by using SVAR model for annual time series data of government expenditure, GDP, CPI, government tax revenue and interest rate from 1972 to 2012. To identify the effects of fiscal shocks on macro economy this study used four different identification approaches i.e. recursive approach, Blanchard and Perotti approach, sign restriction and event study approach and two sets of impulse responses for lag order one and four to compare their results. The outcomes of impulse responses and variance of all four approaches gives the same results support Mountford and Uhlig (2005) that different lag orders have no effect on the whole results. The impulses responses of all the four identification approaches given different results criticized Caldara and Kamps (2006) that different identification methods given the same results.

As regards the pure government expenditure shock the recursive approach that showed increases in government expenditure have positive effect on output and negative effects on prices Fonseca et al, (2010) found the same results; the Blanchard and Perotti approach showed that that an increase in government expenditure increase output and interest rate and prices, Perotti (2002) found the same results support new Keynesian theory of fiscal policy. The results of sign restriction approach showed that increase in expenditure have no effect on output and increased prices and

interest rate. While the dummy variable approach showed that output and prices respond negatively. However, consider the positive government revenue shock both the recursive approach and Blanchard and Perotti (2002) showed that the positive government revenue shock increased output and prices while the interest rate decreased support new Keynesian Fatas and Mihov (2001) and, Afonso and Sousa (2009) found the same results. The sign restriction approach showed that output and government expenditure respond positively for short term while the response of prices and interest rate were insignificant.

The results provided both government expenditure and revenue shocks in Pakistan showed that an expansionary fiscal policy can stimulate economic activity in the short term, but such a policy might down economic activity in the long term. Although VAR is a useful forecasting tool in the short term, but their use is limited because their accuracy declines at longer horizons. Therefore, the conclusions obtained regarding the long-term responses to fiscal policy shocks, in general, must be interpreted with caution.

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