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An Analysis of Macroeconomic Impacts of Fiscal Policy in Pakistan: A Structural Vector Auto-Regressive Approach

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Abstract

Fiscal policy is important for the economy through spending, taxes, and debt. For this purpose, the government of Pakistan uses different fiscal policy tools to achieve the targets of output, inflation, and unemployment. In this context, the present study analyzes the macroeconomic impacts of fiscal policy tools by using the annual time series data from 1975 to 2020 of Pakistan. The Structural Vector Auto-Regression methodology is used to estimate the effects through shocks produced by government spending and taxes. The results show that a spending shock has a positive effect on variations in output while a negative on unemployment whereas a positive tax shock has a negative impact on output, spending, and inflation. From the policy perspective, the government should use prudent fiscal policy by not increasing the tax rate but widening the tax base. This higher spending can be used to curtail unemployment and increase output.

Keywords: Fiscal policy, Unemployment, Inflation, Tax, Spending, SVAR

JEL Classifications: H20, H50, H53, H60, E10, E31

1. Introduction

Fiscal policy is vital for a macroeconomic situation of a country as government spending and revenues influence the economy. Through fiscal policy, the government tries to reduce unemployment, inflation, poverty and inequality to achieve welfare objectives. Fiscal incentives are used to boost economic activity by improvement in spending, decrease in tax revenue, or a combination of both spending and taxes. A boost in government expenditures or reduction in taxes serves as fuel for the economy of a country, directly or indirectly. It enhances the individuals' disposable income, which resultantly increases consumption. Such policy is important for developing countries to reduce inequality and improvement in other welfare indicators (Khan and Padda, 2021a).

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The effectiveness of government is important for growth, employment, and poverty reduction. The revenue generated from raising taxes affects economic behavior negatively by the change in prices. While generating revenue for running the government and financing ongoing and new projects is necessary. However, the main issue is to generating money in the least distortionary manner is the major issue as it has large implications for welfare (Padda, 2014; Khan and Padda, 2021b). The controlled fiscal policy is better but with a lack of stability and credibility, it remains no more effective (Restrepo and Rincon, 2005). Taxes and expenditures are the main tools, however, there are different views on the subject of the impacts of fiscal policy on macroeconomic factors. Engen and Skinner (1996) found taxes have a direct effect of taxes on growth. The positive tax shocks have a negative impact on output as an escalation in taxes causes to decrease the output and investment expenditure. Padda and Akram (2009) found that taxes have a negative impact on output per capita, but a transitory effect on its growth. Taxes do have not a constant effect, but expenditures have a consistent effect on economic growth (Padda and Akram, 2010).

Blanchard and Perrotti (2002) described the impacts of expenditures and taxes on output for the American economy. The findings show that spending shocks have a positive impact whereas the direct tax shocks harm output depicting that increase in taxes affects output negatively. Giordano *et al.* (2005) examined the effects of spending, specifically wage and non-wage spending and net revenues on key macro-economic variables. The analysis reveals that shocks to government spending on goods and services have a positive impact on economic activity. Ravnik and Zilic (2010) show that in the short-run increase in tax shocks increases the short-term inflation rate and decrease the interest rate, but shocks of government spending decrease the production level, and government revenues increase the production level. Krusec (2003) examines the effects of government spending and taxation on the gross domestic product. The findings show that in all countries increases in spending have a positive effect on the level of output and increases in taxes have a negative impact on it.

There are many studies on the role of fiscal policy on macroeconomic variables of Pakistan, however, the present study is unique as it uses Structural Vector Auto-Regression methodology to estimate the effects through shocks produced from government spending and taxes on inflation, unemployment and output. There are underutilized economic resources, depressed private investment, an increased level of debt services, high inflation, and low employment (Khan and Padda, 2021a, Khan and Padda, 2021b). This study has estimated the impacts of fiscal policy instruments i.e. taxes and government spending on unemployment, inflation and output. The reason for the selection of these variables is because mainly the welfare of peoples depend on these macroeconomic indicators. In Pakistan there seems ineffectiveness of long-run fiscal policy in generating employment, reducing inflation, and stimulating growth. Therefore, the main objective of the present study is to analyze the dynamic effects of the shocks in the spending and tax revenue on inflation, output, and unemployment in Pakistan by using the Blanchard and Perotti Approach and Recursive Approach.

There is extensive literature available on the macroeconomic impacts of fiscal policy in Pakistan but the analysis with the combination of these macroeconomic variables is rare. As in most of the previous studies VAR model is used but we employed the SVAR model because SVAR modeling has a number of advantages over competing methodologies. To begin with, the SVAR model is simple, which is beneficial in a low-dimensional system while estimating values (Yegorov, 2004). Second, there are a few constraints associated with implementing an SVAR model. Third, the SVAR simulations' estimates are based on a small set of economic assumptions. Fourth, SVAR is capable of accurately simulating structural shocks.

After this introductory section, section 2 narrates the analytical framework. Section 3 gives estimated results whereas the last section presents the conclusion and proposes policy implications,

2. Analytical Framework

The structural VAR is used to find out the impacts of taxes and government spending on unemployment, inflation, and output in Pakistan. The study is using the SVAR approach and the following number of studies that have used similar ordering of the variables. The studies include Blanchard and Perotti (2002), Perotti (2004), Fatas and Mihov (2001), Caldara and Campus (2008), and De Castro (2010). These all studies have used both taxes and government spending and taxes in the SVAR, simultaneously. The estimation is based on the method of Lozano and Rodriguez (2009). This study uses two approaches to estimate the structural shocks, i.e. recursive approach (1980) and Blanchard and Perotti (2002) SVAR approaches. For this purpose, the reduced form model is presented below.

$$Y_t = A_0 + D(L)Y_{t-1} + \varepsilon_t \qquad (1)$$

Where $A_0 = \beta^{-1}A_0$, $D(L) = \beta^{-1}A(L)$, $\varepsilon_t = \beta^{-1}\epsilon_t$

Where Y_t is a vector of endogenous variables i.e. output, inflation, and unemployment, A_0 is the fixed constant, Y_{t-1} is a vector of lagged values of Y_t, ε_t

is the vector of random error of the disturbance term for every variable which captures any exogenous shock in the model.

a) Data and Estimation Method

This study uses data from Pakistan for the period 1975-2020. The data are collected from the World Development Indicators and various issues of the Pakistan Economic Survey. The main variables of the model are the following, government spending (gx), tax revenues (τ), unemployment rate (up), real GDP (y), and inflation (π).

b) Identification of Fiscal Shocks

There are different methods available in the literature to identify the SVAR to examine the fiscal policy shocks on macroeconomic variables. One of these is the recursive approach presented by Sim (1980), the other is the SVAR approach by Blanchard and Perotti (2002), and the third is the sign restriction approach introduced by Uhlig (2005) while another one is the event study approach presented by Remsey and Shapiro (1989). All these approaches can be used. However, the present study uses the recursive approach by Sim (1980) and the SVAR approach presented by Blanchard and Perotti (2002).

c) Recursive Approach

In the Recursive approach, parameters are not imposed exogenously. It means this approach restricts matrix B to a k-dimensional identity matrix and matrix A is restricted to a lower triangular matrix with a percent diagonal. This approach involves the causal ordering of the model variables. This ordering is suggested by Shaheen, Ravlik, and Zilik (2010) and Caldara and Kampos (2008) particularly in the five variable SVAR models these authors projected ordering as g, y, π, τ and up.

Based on previous studies the ordering of our variables is as follows: government spending is ordered first because it does not react contemporaneously to shocks to other variables of the model, in second-order output is placed because it only contemporaneously reacts to the public spending and does not react to other variables of the model, in third-order inflation is placed because inflation contemporaneously reacts to public spending and output but it does not contemporaneously react to taxes and unemployment, in fourth-order taxes are placed that suggest taxes contemporaneously reacts to public spending, output and inflation it does not react to unemployment. In fifth, we placed unemployment which reacts contemporaneously to all variables of the model. The specification is as below:

$$\begin{bmatrix} 1 & 0 & 0 & 0 & 0 \\ -\alpha_{gx}^{y} & 1 & 0 & 0 & 0 \\ -\alpha_{gx}^{\pi} & -\alpha_{y}^{\pi} & 1 & 0 & 0 \\ -\alpha_{gx}^{\tau} & -\alpha_{y}^{\tau} & -\alpha_{\pi}^{\tau} & 1 & 0 \\ -\alpha_{gx}^{up} & -\alpha_{y}^{up} & -\alpha_{\pi}^{up} & -\alpha_{\tau}^{up} & 1 \end{bmatrix} \begin{bmatrix} \mu_t^{gx} \\ \mu_t^{y} \\ \mu_t^{\pi} \\ \mu_t^{\tau} \\ \mu_t^{up} \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} \epsilon_t^{gx} \\ \epsilon_t^{y} \\ \epsilon_t^{\pi} \\ \epsilon_t^{\tau} \\ \epsilon_t^{up} \end{bmatrix} \quad (2)$$

d) The Blanchard and Perotti Approach

The Blanchard and Perotti (2002) method is used for the identification. This method can be used by imposing different restrictions, which include restrictions on institutional features of taxes and government spending and the timing of taxes and spending on the economic activity. These restrictions are imposed to identify the automatic response of taxes and government spending towards output, inflation, and unemployment. In this approach, parameters are exogenously imposed. The relations between reduced form disturbances μ_t and the structural disturbances e_t can be written as

$$\mu_t{}^{gx} = \alpha^{gx}{}_{y}\mu_t^{y} + \alpha^{gx}{}_{\pi}\mu_t^{\pi} + \alpha^{gx}{}_{up}\mu_t^{up} + \beta^{gx}{}_{\tau}e_t^{\tau} + \beta^{gx}_{gx}e_t^{gx} \quad (3)$$

$$\mu_t{}^{\tau} = \alpha_{y}^{\tau}\mu_t^{y} + \alpha_{\pi}^{\tau}\mu_t^{\pi} + \alpha_{up}{}^{\tau}\mu_t^{up} + \beta_{gx}^{\tau}e_t^{gx} + \beta_{\tau}^{\tau}e_t^{\tau} \quad (4)$$

Furthermore, the connection between government spending and taxes can be presented as follows

$$\mu_t{}^{gx} = \mu_t{}^{gx} - \left(\alpha^{gx}{}_{y}\mu_t^{y} + \alpha^{gx}{}_{\pi}\mu_t^{\pi} + \alpha^{gx}_{up}\mu_t^{up}\right) = \beta^{gx}{}_{\tau}e_t^{\tau} + \beta^{gx}_{gx}e_t^{gx} \quad (5)$$

$$\mu_t{}^{\tau} = \mu_t{}^{\tau} - \left(\alpha_{y}^{\tau}\mu_t^{y} + \alpha_{\pi}^{\tau}\mu_t^{\pi} + \alpha_{up}{}^{\tau}\mu_t^{up}\right) = \beta_{gx}^{\tau}e_t^{gx} + \beta_{\tau}^{\tau}e_t^{\tau} \quad (6)$$

A decision requires whether tax revenues should be placed first or government spending in the model. Perotti (2002) argues that neither empirically nor theoretically base put one first. It is reasonable to suppose that decisions about taxes are carried out after spending decisions, for example, $\beta_{\tau}^{gx} = 0$. The opposite assumption is also tested by Caldar and Kamps (2008). Under the assumption of $\beta_{\tau}^{gx} = 0$ cyclically adjusted residuals of spending and taxes are as follows:

$$\mu_t{}^{gx} = \beta^{gx}_{gx}e_t^{gx} \quad (7)$$

$$\mu_t{}^{\tau} = \beta_{gx}^{\tau}e_t^{gx} + \beta_{\tau}^{\tau}e_t^{\tau} \quad (8)$$

These are the reduced form innovations that are estimated using the instruments. Therefore, other reduced forms of innovations can be written as follows:

$$\mu_t{}^{y} = \gamma_{gx}^{\ y}\mu_t^{gx} + \gamma_{\tau}^{y}\mu_t^{\tau} + \beta_y^y e_t^y \quad (9)$$

$$\mu_t{}^{\pi} = \alpha_{gx}^{\ \pi}\mu_t^{gx} + \alpha_{\tau}^{\pi}\mu_t^{\tau} + \alpha_y^{\pi}\mu_t^{y} + \beta_{\pi}^{\pi} e_t^{\pi} \quad (10)$$

$$\mu_t{}^{up} = \alpha_{gx}^{up}\mu_t^{gx} + \beta^{up}{}_{\tau}\mu_t^{\tau} + \alpha^{up}{}_{y}\mu_t^{y} + \alpha^{up}{}_{\pi}e_t^{\pi} + \beta_{up}^{up}e_t^{up} \quad (11)$$

Where α corresponds to elasticity, the term corresponds to the cross-reaction of the variables of the policy.

e) The Elasticity of Spending and Tax Revenue

To achieve the full identification of SVAR, the elasticity of government spending and total tax revenues to change in macroeconomic variables are estimated by using Blanchared and Perotti (1999) and Lozano and Rodriquez (2011) procedure. These elasticities measure the contemporaneous effects of taxes and spending on output, inflation, and unemployment.

The elasticity of government spending to price

$$a_{\pi}^{gx} = \sum \frac{d^{gx}/_{gx}}{dp/_{p}} = 0.5 \quad (12)$$

The elasticity of tax revenues to price

$$a_{\pi}^{\tau} = \sum \frac{d^{\tau}/_{\tau}}{dp/_{p}} = 0.97 \quad (13)$$

The elasticity of tax revenues in relation to output

$$a_{y}^{\tau} = \sum \frac{d^{\tau}/_{\tau}}{dy/_{y}} = 0.74 \quad (14)$$

The AB model is used to estimate the fiscal shocks. The A and B matrices are as follows:

$$A\mu_t \ = \ Be_t \quad (15)$$

$$A\mu_t \begin{bmatrix} 1 & 0 & n_{\pi}^{g\tau} & 0 & 0 \\ -\alpha_{gx}^{y} & 1 & 0 & -\alpha_{\tau}^{y} & 0 \\ -\alpha_{gx}^{\pi} & -\alpha_{y}^{\pi} & 1 & -\alpha_{\tau}^{\pi} & 0 \\ 0 & n_{y}^{gx} & n_{y}^{\tau} & 1 & 0 \\ -\alpha_{gx}^{up} & -\alpha_{y}^{up} & -\alpha_{\pi}^{up} & -\alpha_{\tau}^{up} & 1 \end{bmatrix} \begin{bmatrix} \mu_t^{gx} \\ \mu_t^{y} \\ \mu_t^{\pi} \\ \mu_t^{\tau} \\ \mu_t^{up} \end{bmatrix} =$$

$$Be_t \begin{bmatrix} 1 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 \\ \beta_{gx}^{\tau} & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} \epsilon_t^{gx} \\ \epsilon_t^{y} \\ \epsilon_t^{\pi} \\ \epsilon_t^{\tau} \\ \epsilon_t^{up} \end{bmatrix} \quad (16)$$

The variance-covariance matrix of the above equation of the reduced form disturbance has ten different elements with seventeen (17) unknown parameters. These parameters and elements cannot be estimated here because these parameters are not identified. Blanchard and Perotti (2002) proposed a few extra restrictions on these unknown parameters.

In the first stage, we have not fixed the diagonal coefficient of the matrix A and B due to economic theory constraints. If we suppose that the innovation does not influence the other side then we attribute a zero value to the coefficient. On the other hand, if the innovation does influence another side then attribute the value. The values of the coefficient are determined by estimating the elasticity between two innovations based on institutional information.

This study applies the following restrictions to identify the structural shocks. The spending is decided by the government exogenously and thus cannot react in the same period. The price elasticity of government spending is assumed to be 0.05, following Caldara and Kamps (2008) and Stikova (2006).

$$\begin{bmatrix} 1 & 0 & 0.5 & 0 & 0 \\ -\alpha_{gx}^{y} & 1 & 0 & -\alpha_{\tau}^{y} & 0 \\ -\alpha_{gx}^{\pi} & -\alpha_{y}^{\pi} & 1 & -\alpha_{\tau}^{\pi} & 0 \\ 0 & -0.74 & -0.97 & 1 & 0 \\ -\alpha_{gx}^{up} & -\alpha_{y}^{up} & -\alpha_{\pi}^{up} & -\alpha_{\tau}^{up} & 1 \end{bmatrix} \begin{bmatrix} \mu_t^{gx} \\ \mu_t^{y} \\ \mu_t^{\pi} \\ \mu_t^{\tau} \\ \mu_t^{up} \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 \\ \beta_{gx}^{\tau} & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} \epsilon_t^{gx} \\ \epsilon_t^{y} \\ \epsilon_t^{\pi} \\ \epsilon_t^{\tau} \\ \epsilon_t^{up} \end{bmatrix} \quad (18)$$

Where $A\mu_t = Be_t$ and $\mu_t = A^{-1}Be_t$.

3. Estimation

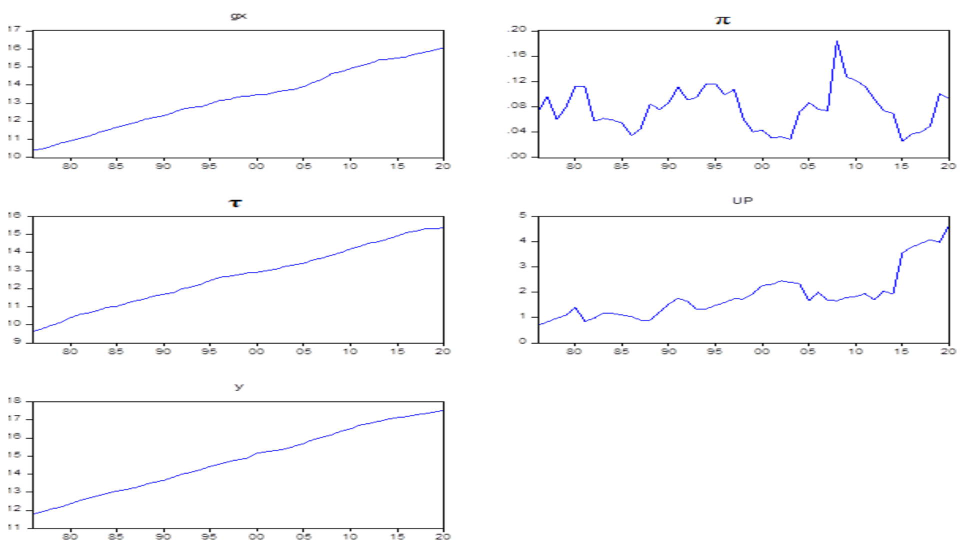
This section presents the results of the unit root test, descriptive statistics, selection of lag length, impulse response functions (IRF), and variance decomposition.

3.1 Unit Root Test

When performing empirical analysis in econometric models, Lee and Strazicich (2001) and Harvey et al. (2001) recommended that all variables be kept constant. As a result, the purpose of this subsection is to look at the stationarity properties of the outlined variables. According to Carrion-i-Silvestre et al. (2001), the augmented Dickey-Fuller test (ADF-test) is utilized to conduct the unit root test in this research. The break-point unit root test is also used to augment the results of the ADF test since the investigated variables reveal structural breaks.

Thus to check the order of integration of the variables the Augmented Dicky-Fuller (ADF) unit root test and Zivot and Andrews unit root test with structural breaks are used. The results show that all variables are integrated of order one except inflation according to the ADF test and Zivot and Andrews unit root test also concludes that all variables are stationary at first difference except inflation which is stationary at a level due to the presence of structural break. The results are also confirmed by the graphs of variables given in Figure 1 below.

Figure 1: Graphs of variables



The results confirm that the SVAR model can be used for the analysis, as a requirement of the SVAR model is that at least one variable in the model should be integrated into order one. Table 1 shows the results of the unit root test.

Table 1: Results of ADF Unit Root Test

ADF Unit Root Test							
Variables	**Level**			**First Diff.**			**Decision**
	Const.	**Const. and Trend**		**Const.**	**Const. and Trend**		
y	-2.87	-3.07		-2.49*	-3.25*		I(1)
π	-3.12*	-3.07*		-7.57*	-7.47*		I(0)
gx	-0.77	-1.90		-5.98*	-5.95*		I(1)
up	-1.89	-1.88		-5.56*	-5.50*		I(1)
τ	-1.77	-2.54		-5.87*	-6.06*		I(1)
Zivot and Andrews Unit Root Tests with Structural Breaks							
	Const.	**Const. and Trend**	**Break**	**Const.**	**Const. and Trend**	**Break**	
y	-4.86	-4.97	1993	-5.83*	-6.04*	1998	I(1)
π	-4.95*	-5.34*	2008	-7.88*	-8.16*	2009	I(0)
gx	-5.12	-5.41	1999	-7.79*	-8.35*	2005	I(1)
up	-4.43	-7.62	2006	-8.75*	-8.94*	2009	I(1)
τ	-3.48	-3.29	2000	-7.23*	-7.72*	2006	I(1)

3.2 Descriptive statistics

Table 2: Descriptive statistics

	GX	P	UP	Y	T
Mean	13.280	0.0778	1.8773	14.797	12.679
Median	13.359	0.0755	1.6900	14.800	12.779
Maximum	16.082	0.1847	4.6500	17.542	15.373
Minimum	10.383	0.0249	0.7000	11.778	9.6514
Std. Dev.	1.6921	0.0330	0.9628	1.7716	1.6881
Skewness	-0.0098	0.5846	1.3402	-0.0391	-0.0479
Jarque-Bera	2.3627	3.4069	15.732	2.9343	2.2201
Probability	0.3068	0.1820	0.2573	0.2305	0.3295
Sum Sq. Dev.	125.98	0.0481	40.787	138.10	125.40

Note: Author calculated based on Economic Surveys of Pakistan data and World Development Indicators

The analysis, synthesis, and presentation of findings relating to a data set produced from a sample or complete population are referred to as "descriptive statistics." Frequency Distribution, Measures of Central Tendency, and Measures of Variability are the three primary categories of descriptive statistics.

The descriptive statistics of all the variables including the mean, minimum and maximum values, standard deviation and Jarque-Bera are summarized below in Table 2. It shows that on average GDP growth rate was 14.79 while inflation, public spending, total tax revenues, and unemployment remained at 0.077 percent, 13.28 percent, 12.67, and 1.87 percent, respectively during the period 1975-2020.

We can see that the standard deviation of the public spending is higher than other variables, which indicates that the public spending is more volatile in comparison to other variables. Jarque-Bera's statistics and P-values are used to test the null hypothesis for normal distribution (H_o: Normal distribution). Since all P-values are greater than 0.05, which demonstrates that the null hypothesis is accepted for all variables, and they are normally distributed.

3.3 Pairwise Correlation

To investigate the correlation between variables we used a correlation matrix. The results are given in the table below and show that increasing government expenditure stimulates economic activities, which in turn increase government revenues. It is important to note that when government expenditures rise, government revenues should also follow that trend, which implies an increase in tax rates. From Table 3 there is an almost perfect correlation between government spending and tax revenue. This implies that these two variables move in the same direction at the same time.

Table 3: Correlation Matrix

	y	**up**	**π**	**gx**	**T**
y	1	0.265	-0.009	-0.971	-0.675
up	0.265	1	-0.519	-0.310	-0.283
π	-0.009	-0.519	1	0.004	-0.020
gx	-0.971	-0.310	0.004	1	0.998
τ	-0.675	-0.283	-0.020	0.998	1

3.4 Selection of Lag Length

Economic theory can occasionally drive the choice of lag lengths in models. There are, however, statistical approaches for determining how many lags should be used as regressors. In general, too many lags inflate the standard errors of coefficient estimates, implying a rise in forecast error, whereas omitting lags that should be included in the model might lead to estimation bias. In order to check the optimal lag length of the model, we use AIC, SC and HQ criteria and decided on the basics of AIC and HQ that the optimal lag length of the model is 2.

Table 4: Lag Length Creteria

Lag	AIC	SC	HQ
0	-12.953	-12.737*	-12.87
1	-14.764*	-12.471	-13.304*
2	-14.015	-11.645	-13.172
3	-13.754	-10.306	-12.527
4	-13.991	-9.466	-12.381
5	-14.012	-9.310	-12.919

* Indicates lag order selected by the criterion.

3.5 Results of Estimated Coefficients

Recursive and Blanchard and Perotti (2002) approaches are used to estimate the coefficients with the SVAR model. These show that the significance level and the signs of the variables vary. Government spending has a positive and significant impact on taxes. It has a negative and significant impact on output and unemployment, while taxes have an insignificant impact on unemployment. Output has a significant and negative impact on inflation and unemployment but a positive and significant impact on taxes. Inflation has a significant impact on taxes and unemployment. These results are shown in Appendix A.

Results of the coefficients estimated through the Blanchard and Perotti (2002) approach show that government spending has a positive effect on output. It has a negative and significant impact on inflation and taxes. Taxes have an insignificant impact on unemployment. Output has a significant impact on taxes and inflation. The high value of the coefficients shows that taxes are more responsive to government spending and the high value of the coefficient shows that inflation is more responsive to output. Thus the significance of the variables shows that the estimation of IRF is meaningful. These results are shown in Appendix B.

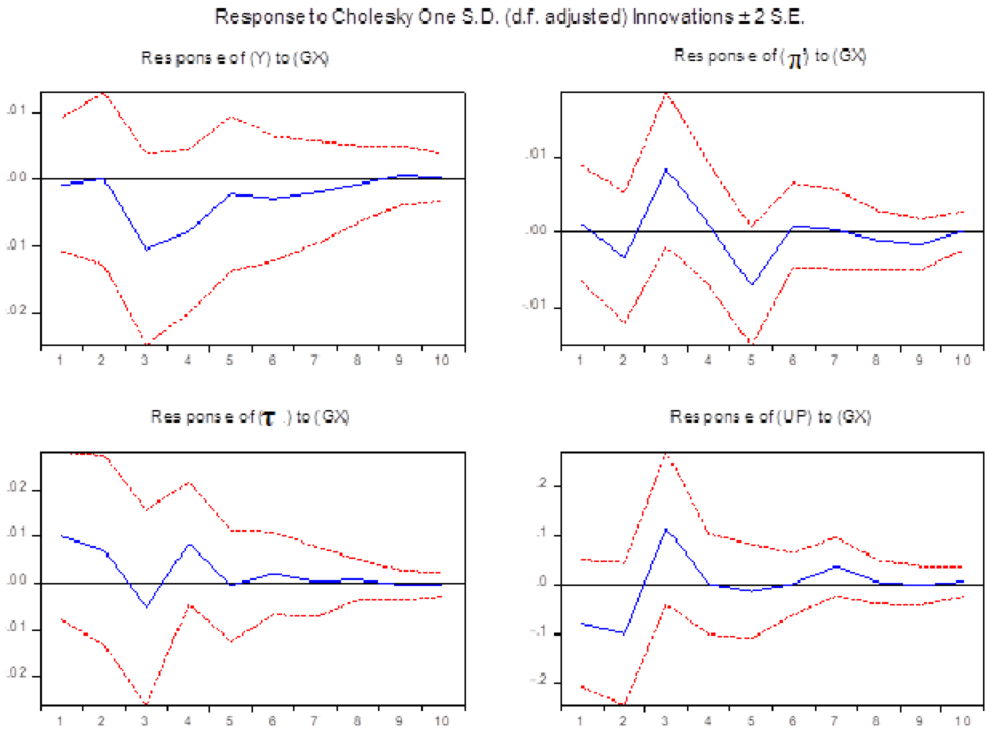
3.6 Impulse Response Function Analysis

The IRF helps us to find out the innovations in one of the variables on the other variables in the system. This section presents the IRFs for the SVAR model recognized by Cholesky decomposition. The solid line in each figure represents the estimate; the horizontal axis is the time axis, measured in years. The units on the vertical axis are percent, which shows the responses of the variables. The model presents estimates of responses of spending, tax, unemployment, inflation, and output for one standard deviation shock.

3.6.1 Real Government Spending Shock

The following figures show the impulse response of macro-variables to a positive government spending shock by Recursive and Blanchard and Perotti (2002) approach separately. The responses from both techniques seem similar as shown in Figure 2. It shows that IRFs of government spending and tax revenue respectively. First, we discuss the spending shocks on other variables. Real GDP responds constantly in the first year to a shock in government spending. After that, it responds negatively after the second period but then it responds up and becomes positive till the end period. The significant response of output to government spending shows that economy of the country is not saturated thus increase in government spending can be a stimulus for the economy.

Figure 2: Responses to government spending shock



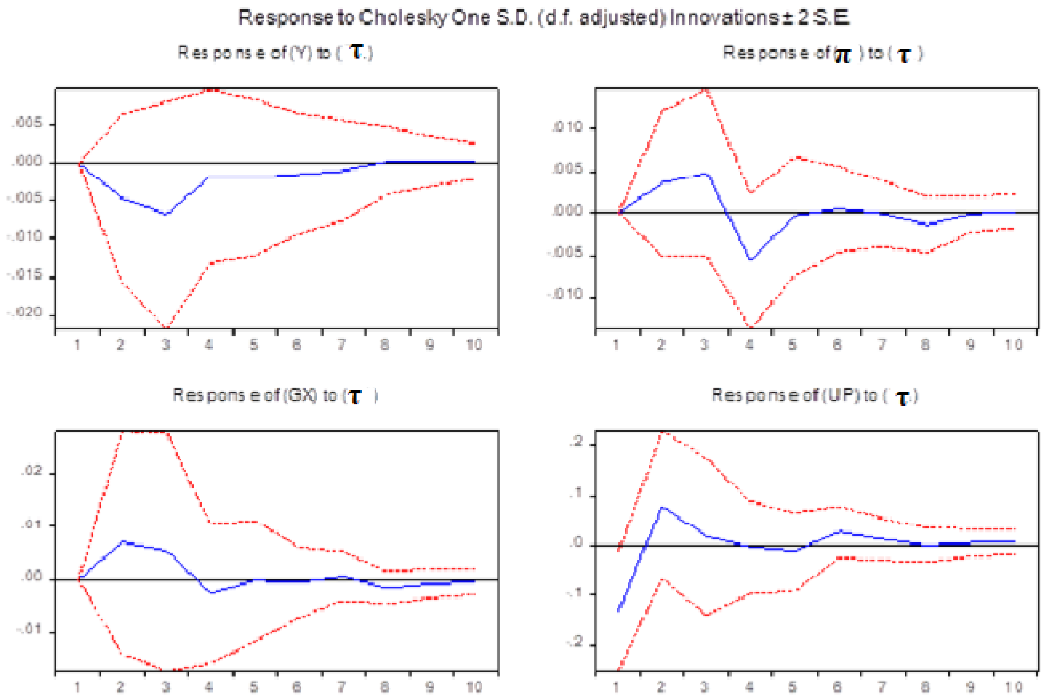
The response of tax revenue is negative in the initial period and after a second period, it dies till the third period but shows positive response till the fourth period and then has consistent response throughout next period which implies tax revenues totally finance government spending. This result is similar to Padda (2009, 2013) who finds the spend-tax hypothesis in Pakistan.

Response of inflation to government spending shock is positive from the second year then it becomes negative in the third year but after a fifth period, it tends to rise again consistently and shows convergence towards equilibrium in the tenth period. Response of unemployment to government spending shock is first slightly negative and then becomes positive in the second period but starts declining after the third period and shows convergence in the eighth period. Consistently. So government spending has mix impact on unemployment. Such a result may be due to misallocation and misuse of public spending.

3.6.2 Real Tax Revenue Shock

The following figure shows the impulse response of macro-variables to a positive real tax revenue shock. Response of real output to tax revenues is negative till the third period and it starts convergence after the third period and reaches equilibrium in the eighth period. It follows the increasing trend after the third year.

Figure 3: Response to real tax revenue shock



The response of government spending to tax revenue is initially positive and a sharp decline after the third period. The spending decreased for two years but after two years it converges due to the real tax revenue shocks. It shows the government uses the contractionary fiscal policy i.e. when the government increase taxes the GDP decreases and hence negative impact on government spending.

Response of inflation to taxes is positive in the initial years but became negative after the second period; it shows tax revenues have a strong effect on reducing inflation, this shows the price effect of real tax shocks dominates eventually. It shows the responsiveness of tax to price i.e. increase in taxes will reduce inflation.

The response of unemployment to shock in taxes is positive at the start but shows a declining trend after the second period and shows convergence in the eighth period. As tax shock has a negative impact on the output which transmits to unemployment. The coefficient shows that this result is significant. Response of real output to tax revenues is negative till the third period and it starts convergence after the third period and reaches equilibrium in the eighth period. It follows the increasing trend after the third year.

3.7 Variance Decomposition Results

The results of variance decomposition are shown in Appendix C. This analysis is used to present more detailed information about the causes of the variance of selected macroeconomic variables. The forecast error variance (FEV) decomposition is created in order to decide the variability proportion of the errors in forecasting the variables at time t+s based on the current time period information i.e. at time t which occurs due to the variability of the structural shocks during the times t and t+s.

A variance decomposition for government spending shows that 100% variation in spending is explained by itself in the first year but the portion of forecast error declines throughout ten years and reached 78.4% but still this confirms that spending i independent from the shocks of other variables. Perhaps as time increases variation due to other variables also increases, little variation due to output occurs in the fifth year which increases little till the tenth year to 3.80%. Tax revenue also explains the variation of 1.86% and 12.73% in unemployment respectively.

The variance decomposition for output demonstrates that in the first year 99.95% of the (FEV) in output is explained by the shock in itself and even after the 10th year it remains quite a large amount at 73.34%. It is also confirmed from the analysis that the output shocks are independent of other shocks. The inflation shocks explain only a 2.95% variation in output. The results also show that the shocks arising from government spending, tax revenue, and unemployment explain the 6.65%, 2.86%, and 14.1% variation in output respectively.

Output explains 62.76% of the FEV in inflation after the first year. Its portion decreases to 39.68% after ten years. This result indicates that output is not (economic growth) causing inflation. Inflation caused 36% variation by itself after one year but the portion decreased to 26.8% after ten years. After the first year, 83% of the FEV of tax revenue is explained by itself. This portion declines as the time increased after three years it declined to 66.4% in the tenth year. While in first-year government spending explains 3.0% of the FEV of tax revenue the portion increases to 5.97% after ten years. Inflation, output, and unemployment shocks explain, respectively, 14.6%, 8.20%, and 4.73% of the FEV in tax revenue after ten years.

This shows the significance of fiscal policy for clarifying the forecast error of tax revenue and also confirms that revenue depends on economic activity. Unemployment shock explains almost 78% of their errors after one year. This portion declines every year quickly and after ten years it reduces to 58.1%. The output explains 0.21% in the first year while it increases to 6.82% in the tenth year. Inflation, tax revenue, and government spending also explain 8.19%, 9.87%, and 3.1% in the first year of the FEV of unemployment, respectively. In tenth-year Inflation, tax revenue and government spending portions slightly increase to 12.53%, 10.02%, and 12.4%, respectively. The results of variance decomposition of government spending and output series are similar to Lozano and Rodriguez (2011), and Romer and Romer (2007).

4. Conclusion

The analysis finds out the dynamic impacts of spending and taxes on unemployment, inflation, and the output of Pakistan. The IRFs and variance decomposition are estimated by using the SVAR methodology. The structural innovations are identified by the Blanchard and Perotti (2002) approach, as well as, the Recursive approach. Along with benchmark identification, exogenous elasticities are used to attain complete identification. The estimation through the Blanchard and Perotti (2002) approach suggests a statistically significant impact of government spending shocks in explaining variation in output, inflation, and taxes but an insignificant impact on unemployment. Shocks in taxes have an insignificant impact on unemployment. Whereas the results from the recursive approach reveal a statistically significant impact of government spending shocks on output, taxes, and unemployment while the insignificant impact on inflation. The shocks in taxes have an insignificant impact on unemployment.

The variance decomposition for government spending suggests that a major part of FEV in government spending is explained by the shock in itself, perhaps shocks arising from unemployment to some extent. It shows that spending shocks are exogenous and independent from other shocks. Whereas variance decomposition for taxes suggests that a major part of the FEV in taxes is explained by the shock in government spending. On the other hand, unemployment explains a minor part of the forecast error, while after one year its part increases which confirm the dependence of taxes on unemployment. It can be concluded here that government should use prudent fiscal policy by increasing not increasing the tax rate but widening the tax base. On the spending side, it should enhance the share of development spending.

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Appendices

Appendix A

Estimated coefficients of the Recursive approach			
	Coefficients	Standard error	Prob.
α^{τ}_{gx}	0.311	0.082	0.046
α^{y}_{gx}	-0.213	0.039	0.027
α^{π}_{gx}	-0.185	0.138	0.180
α^{up}_{gx}	-0.706	0.981	0.031
$5\alpha^{\pi}_{y}$	-0.613	0.073	0.000
α^{τ}_{y}	1.033	0.427	0.015
α^{up}_{y}	-1.821	3.173	0.031
α^{τ}_{π}	1.396	0.552	0.011
α^{up}_{π}	-4.039	4.125	0.005
α^{up}_{τ}	-2.465	1.084	0.023

Appendix B

Estimated coefficients of the Blanchard approach			
	Coefficients	**Standard error**	**Prob.**
αygx	2.086	0.086	0.018
απgx	-1.063	0.038	0.006
ατgx	-0.706	0.981	0.071
αupgx	-0.634	0.073	0.953
απy	-6.821	3.173	0.031
αupy	-11.39	4.125	0.005
αup π	0.076	0.089	0.395
ατy	-0.152	0.040	0.000
α τπ	-2.465	1.084	0.023
αupτ	-0.061	0.006	0.000
βτgx	-10.03	0.003	0.000

Appendix C

Variance Decomposition of (Y):						
Period	**S.E.**	**(GX)**	**(Y)**	**(π)**	**(τ)**	**(UP)**
1	0.059751	0.050001	99.95000	0.000000	0.000000	0.000000
2	0.061125	0.035037	96.46098	1.789119	1.436891	0.277971
3	0.066819	5.293310	83.08183	1.368003	3.364012	6.892845
4	0.067414	7.136926	79.31463	1.311696	3.083343	9.153402
5	0.068345	6.657704	76.92499	2.191813	2.944100	11.28140
6	0.068372	6.692984	75.27769	2.343279	2.909154	12.77690
7	0.068547	6.692137	73.99435	2.608095	2.886577	13.81884
8	0.068635	6.662018	73.53128	2.819907	2.870257	14.11653
9	0.068733	6.661742	73.35491	2.930729	2.865403	14.18722
10	0.068798	6.657774	73.34088	2.952445	2.863863	14.18503
Variance Decomposition of (INF):						
Period	**S.E.**	**(GX)**	**(Y)**	**(π)**	**(τ)**	**(UP)**
1	0.031700	0.258197	62.76181	36.97999	0.000000	0.000000
2	0.039245	1.863383	56.49151	39.67478	1.859669	0.110659
3	0.045066	8.258719	42.80267	28.25542	3.577943	17.10525
4	0.048103	8.058806	41.14860	27.52948	6.444823	16.81829
5	0.050441	11.97740	38.77109	27.44179	6.040613	15.76910
6	0.051445	11.84344	39.26678	27.45009	5.952160	15.48753
7	0.051960	11.71800	39.96923	27.12571	5.882069	15.30499
8	0.052136	11.72994	39.76430	26.96880	6.008954	15.52800
9	0.052201	11.89481	39.64024	26.85950	5.983084	15.62236
10	0.052239	11.87382	39.68380	26.85753	5.972303	15.61254
Variance Decomposition of (GX):						
Period	**S.E.**	**(GX)**	**(Y)**	**(π)**	**(τ)**	**(UP)**
1	0.024551	100.0000	0.000000	0.000000	0.000000	0.000000
2	0.026045	96.21164	1.096645	0.351713	1.327321	1.012679
3	0.031545	82.58790	2.558830	1.624732	1.752234	11.47630
4	0.032175	81.39281	2.712682	1.730252	1.857491	12.30676
5	0.033254	79.38013	3.080037	3.081355	1.807670	12.65080
6	0.033562	79.31956	3.113840	3.080235	1.812906	12.67346
7	0.033762	78.91708	3.428841	3.121414	1.811770	12.72089
8	0.033869	78.71504	3.598404	3.120738	1.859170	12.70665
9	0.033945	78.60595	3.691555	3.120864	1.864828	12.71681
10	0.033984	78.46773	3.809511	3.123662	1.864026	12.73507

Variance Decomposition of (UP):						
Period	**S.E.**	**(GX)**	**(Y)**	**(π)**	**(τ)**	**(UP)**
1	0.057947	3.392591	0.214105	8.195785	9.873759	78.32376
2	0.061128	7.960520	0.605702	7.558635	12.00830	71.86684
3	0.063636	12.56679	3.104856	13.08301	10.26115	60.98419
4	0.064642	12.51512	3.380489	13.13153	10.22492	60.74795
5	0.065059	12.21364	5.765552	12.75265	9.995547	59.27260
6	0.065303	12.10304	6.137325	12.71577	10.18974	58.85413
7	0.065383	12.58945	6.214216	12.58103	10.12451	58.49079
8	0.065433	12.53682	6.571656	12.57165	10.06821	58.25167
9	0.065443	12.48463	6.812966	12.55895	10.03217	58.11129
10	0.065451	12.48814	6.823481	12.53942	10.02706	58.12190
Variance Decomposition of (LTR):						
Period	S.E.	(GX)	(Y)	(π)	(τ)	(UP)
1	0.414574	3.008242	0.932778	12.94068	83.11830	0.000000
2	0.440189	4.041718	4.676708	14.57524	75.71859	0.987746
3	0.479102	4.398341	6.858457	15.02048	70.13537	3.587353
4	0.480156	5.995454	7.540529	14.66450	67.96977	3.829740
5	0.487282	5.925622	7.963287	14.71450	67.17394	4.222656
6	0.489587	5.986225	8.212376	14.65389	66.67602	4.471482
7	0.492489	5.973844	8.210798	14.65137	66.52216	4.641834
8	0.493878	5.977551	8.201279	14.67280	66.42064	4.727734
9	0.494909	5.979202	8.200175	14.68336	66.40259	4.734670
10	0.495343	5.981014	8.209499	14.68736	66.38505	4.737077