Impact of fiscal policy shocks on the Indian economy

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Abstract

In this paper, we analyse the impact of fiscal shocks on the Indian economy using structural vector autoregression (SVAR) methodology. The study uses quarterly data for the period 1997Q1 to 2009Q2. Two different identification schemes have been used to assess the effects of shocks to government spending and tax revenues on output. The recursive scheme is based on the Cholesky decomposition and the second identification scheme Blanchard & Perrotti (1999) technique of using information on tax system to identify the SVAR model. We find that the impulse responses obtained from both identification schemes behave in a similar fashion but the value of multipliers differs. Also the shock to tax variable has a bigger impact on GDP than the government spending shock. In the extended four variable VAR model the effects of fiscal shocks on private consumption has been assessed using the recursive identification scheme. Findings indicate that the tax variable has larger impact on private consumption as compared to the government spending variable. In the short run the impact of expansionary fiscal shocks follow Keynesian tradition but the long run response is mixed.

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Impact of Fiscal Policy Shocks on the Indian Economy[4]

"Contrary to what the policy discussion seems to take for granted, there is clearly no consensus even on the basic effects of government spending on output and its components".
Perotti (2002)

1. Introduction

In the standard Keynesian model of demand an increase in government expenditure would lead to higher levels of output and employment in an economy operating below full employment level. It is this aspect of fiscal policy that according to Keynes general theory (1936) makes it a suitable stabilization tool. Increased number of articles can be found on the stabilization aspect of fiscal policy in the current decade whereas the focus of empirical research during eighties and nineties was primarily on monetary policy. The reason behind this increase in research on fiscal policy lies in a) the aggressive use of discretionary fiscal policy in USA as a stabilization tool in the post 9/11 attacks recession in contrast to the 1990 recession and b) the application of new econometrics methods (vector auto regressions) to analysis of fiscal policy which were earlier being used for monetary policy. Blanchard and Perotti (1999; 2002), Perotti (2002; 2005), Fatás and Mihov (2001), Fatas (2003) and Mountford and Ulhig (2002) were among the first to analyze fiscal policy using VAR methodology. The global slowdown of 2008 has only added fuel to the fire with the revival of Keynesian policies. The response has been in form of fiscal stimulus packages though there is still no consensus on the effects of discretionary fiscal policy on the level of economic activity. In such a scenario it would be interesting to examine the macroeconomic effects of fiscal policy in an emerging economy like India.

We find that the effects of spending and tax shock on output are in line with the Keynesian model for both recursive and Blanchard & Perrotti's identification scheme. The impact of tax revenues on private consumption is larger and significant than the effect of a shock to government spending. The results are also sensitive to the way data has been detrended.

The paper is an attempt to empirically analyze the effectiveness of fiscal policy in India using structural vector auto regressions (SVARs). In the next section, we discuss the theoretical debate on the effectiveness of fiscal policy followed by a section on empirical research using

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VAR methodology to study the effects of fiscal policies. Then in the fourth section we describe the data and different approaches used. In the next two sections, we present our results and check the robustness of the results under alternative trend specifications.

2. Theoretical Background

Prior to Keynesian general theory of demand (1936) classical view emphasized that in a model with fully flexible prices and vertical supply curve, there is no role for fiscal policy. Economy will automatically revert back to full employment equilibrium and supply will create its own demand (Say's law). Demand side of the problem was emphasized in the Keynesian model with sticky prices and consumption as a function of current income. In this world, an expansionary fiscal policy can stimulate the economy with multiplier effects. In the simplest Keynesian model with price rigidity and excess capacity, output is determined by aggregate demand. Extending Keynesian model for crowding out through induced changes in interest rates and exchange rate would reduce the size of fiscal multiplier but does not alter their sign. Final impact of increase in government spending will be increase in output, total investment and consumption level. A fiscal expansion in form of a tax cut will also boost private consumption leading to an increase in aggregate demand and output. Neoclassical and classical school of thought argued that deficit financed expansionary fiscal policy would lead to fall in private consumption and investment in the economy. Private agents perceive higher current deficits leading to higher taxes in future. The households will react less than proportionally to current increases in disposable income as a result of tax cut. Firms will chose to invest less expecting lower profits for the future. Thus a deficit financed fiscal expansion would result in the contraction of the economy. This Ricardian Equivalence behaviour resulting in non Keynesian effects of fiscal expansion has been observed in case of Japan and is also important in the countries of euro area (IMF World Economic Outlook, 2001). Several empirical studies have shown that contractionary fiscal policy may turn out to be expansionary[5] (non-Keynesian effect) and vice versa. The fiscal stabilization policies of Denmark and Ireland in the 1980's had

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5 See Hemming, Kell & Mahfouz (2002) The effectiveness of fiscal policy in stimulating economic activity – A review of literature.

resulted in non-Keynesian effects on their economies (Giavazzi& Pagano, 1990). Table 1 summarises the theoretical debate.

Table 1

Theoretical overview of the Response of Key macroeconomic Variables to fiscal expansion

	Output	Private Consumption	Real Wage	Interest Rate	private investment	trade balance	real exchange rate
Keynesian:Closed Economy	↑	↑	↓	↑	↓		
Keynesian:Flexible Exchange Rate	↔	↑	↔	↔	↔	↓	↑
Keynesian:Fixed Exchange Rate	↑	↑	↓	↔	↔	↔	↔
Classical	↓/↑	↓			↓		
New Keynesian	↑	↓ / ↑	↑	↑	↓	↓	↑
Real business cycle	↑	↓	↓	↑	↑	↓	↑

The sign "↑" indicates a positive effect and in case of real exchange rate an appreciation whereas the sign "↓ " indicates a negative effect and in case of real exchange rate a depreciation. The sign "↔" indicates no effects.

To address the issue of lack of microeconomic foundation in the earlier models theoretical research in macroeconomic theory is increasingly trying to derive microfounded intertemporal aggregate relations that explain the factors behind economic fluctuations. Such class of models is known as Dynamic General Stochastic Economic (DGSE) models. These models incorporate forward looking agents and rational expectations and can broadly be divided into two categories: Real business cycle (RBC) models and Neo Keynesian models.

Real business cycle (RBC) models can be seen as an extension of the new classical approach. RBC model with assumption of flexible prices and perfect competition in all markets predict a negative effect of fiscal expansion on consumption and a positive effect on output. In a model where Ricardian Equivalence holds the forward looking consumer knows that an

expansionary fiscal policy leading to increase in deficit and debt will have to be financed by higher taxes in future. The mode of financing –debt financed or tax financed – is immaterial. The origin of cyclical fluctuations in the economy are explained in RBC models from sources such as oil price changes, technical progress and changes in taste. The Neo Keynesian macroeconomic models assume that prices and wages are sticky, firms are monopolistic competitors and households and firms have rational expectations. The assumptions of the New Keynesian models imply that the economy may fail to attain full employment requiring macroeconomic stabilization. Use of fiscal and monetary stabilization policies in these models leads to a more efficient macroeconomic outcome than a no intervention policy would (Rotemberg and Woodford, 1997; Campbell& Mankiw, 1989; Mankiw, 2000).

To summarise, the theoretical macroeconomic models- Classical, Keynesians, DGSE- generally agree on positive effect of expansionary fiscal policy on output but there is no unanimity about the responses of other variables- consumption, real wages, real exchange rate, interest rate and investment. The responses are model dependent. For example, an expansionary fiscal policy will have a negative effect on consumption in a standard DGSE model in contrast to the predictions of standard Keynesian model. Within the DGSE models the assumption about the behaviour of households, type of utility function all lead to varying results. Thus, the debate about the effectiveness of fiscal policy is not just about the magnitude of the effect, there is considerable disagreement regarding the basic direction of the effects. The empirical scenario is no different.

3. Empirical Overview

Most of the empirical research on the macroeconomic effects of fiscal policy has originated in the developed countries mainly USA, EU, NZ and Australia. Blanchard and Perotti (2002), Fatás and Mihov (2001), Fatas (2003) Ramey & Shapiro (1998) and Mountford and Ulhig (2002) used VARs to identify fiscal policy shocks and quantify their consequences.

A VAR is a n equation, n variable linear model in which each variable is explained by its own lagged value plus current and past values of the remaining n-1 variables. The structural form of a n variable VAR model is

$$A_0 X_t = \sum_{i=1}^{k} A_i X_{t-i} + B e_t$$

e_t's are white noise.

Reduced form of the VAR can be written as

$$X_t = A(L) X_{t-1} + U_t$$

U_t is the corresponding vector of reduced form residuals with non zero cross correlations.

$$U_t = (u_{1t}\ u_{2t}\ \ldots\ldots u_{nt})'$$

The relationship between the reduced form residuals and structural form residuals can be expressed as:

$$e_t = B^{-1} A_0 U_t$$

Where, the matrix A_0 describes the contemporaneous relationship among the variables in vector X_t. The residuals of structural shock are uncorrelated with the variance and covariance matrix being diagonal. To identify the system – A matrix, matrix B and the diagonal elements of var-covariance matrix, restrictions needs to be imposed.

For a two variable VAR (Enders, 1995)

Structural form: (1)

$$x_{1t} + b_{12}\ x_{2t} = b_{10} + \gamma_{11}\ x_{1t-1} + \gamma_{12}\ x_{2t-1} + e_{1t}$$

$$x_{2t} + b_{21}\ x_{1t} = b_{20} + \gamma_{21}\ x_{1t-1} + \gamma_{22}\ x_{2t-1} + e_{2t}$$

Reduced form: (2)

$$x_{1t} = a_{10} + a_{11}\ x_{1t-1} + a_{12}\ x_{2t-1} + u_{1t}$$

$$x_{2t} = a_{20} + a_{21}\ x_{1t-1} + a_{22}\ x_{2t-1} + u_{2t}$$

From (1) and (2) the reduced form error terms can be expressed as:

$$u_{1t} = (e_{1t} - b_{12}\ e_{2t}\ )/\ (_{1-}\ b_{12}\ b_{21}\ )$$

$$u_{2t} = (e_{2t} - b_{21}\ e_{1t}\ )/\ (_{1-}\ b_{12}\ b_{21}\ )$$

In a two variable VAR model reduced form of the model yields only nine parameter values: six coefficients estimates ($a_{10}\ a_{20}\ a_{11}\ a_{12}\ a_{21}\ a_{22}$) and the estimates of variance (u_{1t}) variance (u_{2t}) and covariance ($u_{1t,}\ u_{2t}$) whereas the structural form requires estimation of ten parameters (b_{10}, b_{20}, $\gamma_{11}\ \gamma_{12}\ \gamma_{21}\ \gamma_{22}\ \sigma_1$, σ_2 and the two feedback coefficients b_{12} and b13). Therefore, to estimate the structural form of the model from the reduced form requires certain identification restrictions.

The vector moving average representation of the model can be expressed as:

$$x_t = \mu + \sum \varphi_i \, e_{t-i} \qquad i = 0 \ldots \text{infinity}$$

The matrix (φ_i) can be used to generate the effects (or more popularly called the impulse responses) of structural shocks e_t's on the time paths of the variables X_t's. The within period response coefficients of (φ_i) matrix are the impact multipliers. For example $\varphi_{12}(0)$ is the instantaneous impact of one unit change in variable X_2 on the variable X_1. The element $\varphi_{12}(1)$ is the one period response effect of X_1 to a unit change in X_2. These effects can be accumulated to obtain the cumulative multipliers.

Blanchard & Perrotti (1999) showed that in a three variable fiscal VAR **t**he reduced form residuals (u_t) consist of a linear combination of three components:

  (i)   Automatic response of fiscal variables to shocks in other variables.

 (ii)   Systematic discretionary response of policymakers of innovation in variables.

(iii)   Random discretionary shocks to fiscal policy.

The third type of shocks (structural shocks) are the one on which the analysis is centered when impulse responses to fiscal shocks are estimated. The impulse responses of the variables summarize the responses of all other variables to structural shock in the current value of the selected variable. But to compute the impulse responses system has to be identified. The identifying assumptions used in the literature to identify fiscal shocks form the basis of the four approaches:

3.1 Blanchard & Perrotti Approach

For a three variable fiscal VAR model ordered as **[G T Y]**, the reduced form residuals are linear combinations of the underlying structural shocks in the three variables and can be expressed as

$$u_t^g = \quad \boldsymbol{\alpha}_{gy}\, u_t^y + \boldsymbol{\beta}_{gt}\, e_t^t + e_t^g \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(1)$$

$$u_t^t = \quad \boldsymbol{\alpha}_{ty}\, u_t^y + \boldsymbol{\beta}_{tg}\, e_t^g + e_t^t \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(2)$$

$$u_t^y = \quad \boldsymbol{\alpha}_{yg}\, u_t^g + \boldsymbol{\alpha}_{yt}\, u_t^t + e_t^y \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(3)$$

The equation 1 states that the unexpected movement in government spending variable within a quarter is due to the unexpected movements in output $(\boldsymbol{\alpha}_{gy})$ or due to the response to structural shock to taxes $(\boldsymbol{\beta}_{gt})$ or as the response to its own structural shock (e_t^g). Similar interpretation can be applied to equation 2. For the equation 3 the unexpected movements in output (u_t^y) is as a response to unexpected movement in spending $(\boldsymbol{\alpha}_{yg})$ or as a response to unexpected movements in taxes $(\boldsymbol{\alpha}_{yt})$ or due to the other unexpected shocks (e_t^y). Blanchard & Perrotti(1999) noted that

when quarterly data is used α_{gy} and α_{ty} variables consists only of the automatic responses (component (i) as explained above) as it takes larger than a quarter for systematic discretionary response of policymakers (ii) to a output shock . When quarterly data is used the second component (ii) is absent. They used institutional information on taxes and government spending to construct the parameters α_{gy} and α_{ty}, the elasticity of spending and taxes to GDP respectively. Using the elasticity values the cyclically adjusted fiscal shocks can be determined as:

$t_{t'} = t_t - \alpha_{ty}\, y_t$

$g_{t'} = g_t - \alpha_{gy}\, y_t = g_t$ taking $\alpha_{gy} = 0$

B&P took value of α_{gy} as zero because they could not find any automatic feedback from economic activity to government spending. Given the values of α_{gy} and $\alpha_{ty;}$ $t_{t'}$ and $g_{t'}$ can then be used as instruments to capture α_{yg} and α_{yt} in a regression of y_t on g_t and t_t. Now the identification of fiscal shocks requires estimation of only two coefficients β_{gt} and β_{tg}. Using agnostic approach they identify the model under two alternative assumptions:

i. $\beta_{gt} = 0$ estimate β_{tg}

ii. $\beta_{tg} = 0$ estimate β_{gt}

When the correlation between g_t' and t_t' is very low, the actual ordering does not matter for calculating the impulse responses of output. In matrix form:

$$
\begin{pmatrix} 1 & 0 & 0 \\ \alpha_{yg} & 1 & \alpha_{yt} \\ 0 & \alpha_{ty} & 1 \end{pmatrix}
\begin{pmatrix} u^{spending} \\ u^{output} \\ u^{taxes} \end{pmatrix}
=
\begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ \beta_{tg} & 0 & 1 \end{pmatrix}
\begin{pmatrix} e^{spending} \\ e^{output} \\ e^{taxes} \end{pmatrix}
$$

<div align="center">Reduced form errors   Structural errors</div>

3.2 Recursive approach

Sims (1980) suggested use of Cholesky decomposition (recursive ordering) to identify the VAR model. Fatas & Mihov (2001) applied Sims method to a fiscal VAR model **[G Y T]** to identify fiscal shocks. According to this approach the first variable ordered in the system (government spending in the three variables VAR) responds only to its own exogenous shock. The next variable (output) responds to government spending contemporaneously and to its own shock.

The third variable, taxes, ordered last will respond contemporaneously to both the variables (government spending and output) and to its own shock. In matrix form:

Recursive approach (matrix form):

$$
\begin{pmatrix} 1 & 0 & 0 \\ \alpha_{yg} & 1 & 0 \\ \alpha_{yt} & \alpha_{ty} & 1 \end{pmatrix}
\begin{pmatrix} u^{spending} \\ u^{output} \\ u^{taxes} \end{pmatrix}
=
\begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix}
\begin{pmatrix} e^{spending} \\ e^{output} \\ e^{taxes} \end{pmatrix}
$$

The restrictions in this identification scheme are imposed on the contemporaneous responses of the variables but the variables are free to respond in all other periods. In this identification scheme ordering of variables is extremely crucial for the results as outcome can change with the change in the ordering of the variable. So precaution should be taken and some theoretical justification is needed to decide the ordering of the variables as it also defines the direction of causal relationship.

3.3 Sign Restriction Approach

The third approach is the sign restriction approach developed by Mountford & Uhlig (2002). They applied this approach by using sign restriction to identify fiscal shocks while controlling for the monetary and business cycle shocks. The identification method of imposing sign restrictions on impulse response functions helps in addressing three main difficulties in using vector autoregression: firstly the distinction between systematic discretionary shocks and automatic responses of fiscal variables to business and monetary shocks, secondly the definition of fiscal shock and thirdly the issue of lag between the announcement and the implementation of fiscal policy since the announcement may result in changes in macroeconomic variables before there are movements in the fiscal variables. This approach in contrast to the other three approaches relies on macroeconomic time series data alone for shock identification and does not require assumptions about the sluggish reaction of some variables to macroeconomic shocks (Mountford & Uhlig;2002).

3.4 Narrative Approach

The last approach is the narrative approach/the dummy variable or the event study approach developed by Ramey and Shapiro (1998), Eichenbaum, Edelberg and Fisher(1999) to

identify the periods of military buildups for the US economy- Vietnam war, Korean war and the Carter – Raegan buildup. They tried to capture the dynamic effects of a shock in government spending by constituting dummy variables for the increase in government defense spending. Assumption is that these buildups are exogenous to GDP and unanticipated by the private sector. The fiscal shock is identified by tracing the impulse response of the date dummies. The response of private consumption to a fiscal policy shock was found to be negative.

The empirical results of the four approaches to test the effectiveness of fiscal policy using VAR are presented in table 2.

Table 2

Four Approaches to Empirically Test the Effectiveness of Fiscal Policy

Approach	Study	Identification scheme	Output	Consumption	Employment	Interest rate
1) The Blanchard-Perotti approach	Blanchard & Perrotti (1999) [Quarterly 1960-97]	The institutional information is used to estimate cyclically adjusted taxes and government expenditures, then estimates of fiscal policy shocks are obtained.	0.84 (positive shock to spending)	↑		
			-0.69 Tax shock (increase)	↓		
2) The Recursive approach	Fatas & Mihov (2001) [Quarterly 1960-1996]	A causal ordering of the model variables following the Cholesky decomposition	0.3	↑	↑	↑
3) The Sign-Restrictions approach	Mountford & Uhlig (2002) [Quarterly 1960-96]	Identifies fiscal policy shocks via theory-motivated signs on the responses to these shocks impose restrictions directly on the shape of the impulse responses	0.4	↔	↔	
			0.19 Tax shock	↑		↓

			(decrease)			
4) The Narrative approach **	Ramey & Shapiro (1998) [Quarterly 1947-1996]	Use of dummy variables for exogenous fiscal episodes with respect to the state of the economy.	1(C)	↓	↔	↓

**The Event-Study approach/ The Dummy Variable Approach. *If the study does not consider a certain variable, the consequent field is kept empty. The sign ↑ indicates a positive effect; ↓ sign indicates a negative effect and ↔ indicates no effect. C stands for cumulative impact. Otherwise mentioned multiplier value is on impact. All four studies are for USA.

Since then there has been a lot of research on effectiveness of fiscal policy using vector autoregressions. Findings indicate that macroeconomic effects of fiscal policy vary considerably for different countries. While the fiscal policy had a significant influence on cyclical conditions in New Zealand according to Hargreaves, Karagedikli & Ozer (2007); Rahman (2005) indicates insignificant impact of fiscal policy on real output growth for Bangladesh. Rezk, Avramovich & Basso (2007) analysis, using Perotti (2004) VAR method on Argentina's logarithmic real variables, casts doubt upon some of the traditionally acceptable Keynes macroeconomic policy prescriptions. Castro(2002) empirically found evidence for small, though significant, effects of fiscal shocks on GDP, private consumption, private investment, interest rates and prices for Spain whereas Tenhofen & Wolff (2006) for Germany indicate significant effects for government expenditure and direct income tax but little effect of small indirect tax revenue shocks. Lendvai(2007) found mixed macroeconomic impact of unexpected changes in the government expenditure using the SVAR model for Hungary. For Finland Kuismanen and Kämppi (2007) results indicate that a positive tax shock has a positive effect on investment and GDP but the response of private consumption is mixed. Pereira& Sagales (2006) VAR model estimation for the Portugual economy show that whereas the effect of public investment and public wages on output are Keynesian in nature, non-Keynesian effects dominate public transfers.

The effects of fiscal policy vary considerably for different countries from significant to insignificant to even adverse impact. Similar results were obtained by using panel data for mainly developed countries. Fatas and Mihov (2003) showed that the discretionary fiscal policy

induces macro-economic instability which may affect growth negatively. Perotti (2005) estimate the effects of fiscal policy on GDP, inflation and interest rates in five OECD countries, using a structural Vector Auto regression approach. Findings indicate that the effects of fiscal policy on GDP tend to be small and there is no evidence that tax cuts work faster or more effectively than spending increases. Only in the post-1980 period is there evidence of positive effects of government spending on long run interest rates.

In developing countries very few attempts have been made to apply this methodology to study the effects of a fiscal shock. A crucial element for the analysis is the availability of quarterly data and estimates of automatic response of fiscal variables to other endogenous variables. Even if quarterly data is available it is interpolated from the annual data and the available time series are shorter. Availability of reliable quarterly data and proper understanding of the theoretical justification of the identification scheme is absolutely necessary. In India related recent studies have focused on variety of issues : cyclicality (Chakraborty & Chakraborty,2006) ; fiscal consolidation (Pattnaik, Raj and Chander ,2006) ; political budget cycles (Srivastava,2007 ; I.Rajaraman,2004); impact of business cycle on the fiscal deficit (M. Rao, 2004) and debt sustainability (Rangarajan & Srivastava, 2005) but none has focused on macroeconomic effects of fiscal policy shocks using SVAR models with quarterly data. This study hopes to fill the gap by estimating the effect of fiscal shocks on output and private consumption using SVAR model.

4. Data and Methodology

The data consists of quarterly observations for the Indian economy covering the period 1997 Q1 to 2009 Q2. Study uses Controller General of Accounts (CGA) data for fiscal variables – government spending and tax revenue. Quarterly data on output and private consumption is obtained from Central Statistical Organisation (CSO) and RBI's Handbook of Statistics is used for procuring data on the other macroeconomic variable used in this study- wholesale price index (WPI). All the variables are expressed in logarithmic terms. Fiscal variables and GDP have been deflated using the WPI to obtain their values in real terms.

The baseline recursive VAR model consists of the three variables – government spending, output and taxes. In the recursive approach matrix A is lower triangular and matrix B is an identity matrix. The recursive approach used in this paper follows Fatas & Mihov (2001) and Caldara & Kamps (2008) by ordering tax variable last. In recursive ordering the variable

ordered lower cannot affect the variable ordered higher in the same period. They are free to respond in other periods. The government expenditure is largely exogenous in nature and unrelated to business cycle. Government does implement countercyclical fiscal policy in response to business cycle fluctuations but there are considerable lags involved. It is assumed that it would take atleast more than a quarter for the government to take systematic discretionary action to a shock in the private sector. In contrast the tax variable is endogenous in nature. It would be difficult to assume no within period response of taxes to output if taxes are ordered before output in a recursive model as there are significant automatic stabilizers inbuilt in the tax system. Thus it is better to assume that output responds to a tax shock with a lag. Results of the recursive model have been compared with those obtained using Blanchard and Perrotti's (1999) identification scheme (BP). For the BP method value of automatic tax stabilizer has been calculated as the weighted sum of elasticity's[6] for different tax categories, the weights are given by the share of the tax variable in total tax revenue. The elasticity value based on annual data is 1.50 (BP2). Since the elasticity value differs for annual and quarterly data the impulse responses will also be estimated using the elasticity value +0.25(BP3) and -0.25(BP1). In the extended VAR, to study the effect of fiscal shock on private consumption, the ordering is G, GDP, PFCE and T as it would be less realistic to assume that tax revenues do not respond contemporaneously to change in consumption expenditure (indirect taxes) than assuming private consumption respond with a lag to a tax shock.

A common problem in using quarterly data is seasonality. The data has therefore been seasonally adjusted[7] using Census X12 method. For all the VAR models the lag length has been taken as suggested by the information criteria (AIC, SC) searching between zero to six lags. Given the small number of observations taking more than six lags will not be feasible. Two different trend specifications have been used to check the robustness of the results. In the first case, first difference of the series (FD approach) is included in the model for all the variables to detrend the series. In the second specification (HP approach) the series have been detrended using the Hodrick and Presscott filter with a lambda parameter of 1600.

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6 The value of corporate profit tax and personal income tax has been taken from the eleventh plan draft document and the elasticity of indirect taxes has been taken as one following the approach of Van de Noord (2000).
7 We have not taken into account the problem of quarter dependence which we hope to take care in our future research.

5. Results

This section presents the main findings of our research based upon the analysis of impulse response functions (IRFs) and multipliers derived from fiscal shocks. In all cases impulse responses are reported atleast for five years (20 quarters) and the one standard deviation Hall's confidence bands have been obtained with 500 replications.

5.1 FEVD

Table (3) reports the forecast error variance decomposition of the three variables baseline model. As can be seen from the table both fiscal variables play small role in explaining each other. The forecast error of government expenditure twelve quarters ahead is mainly explained by own shock (85%), whereas tax revenues explain 11% and GDP shocks account only for 4 % of total variations. The movements in this fiscal variable are largely governed by policy objectives which are largely exogenous in nature and not entirely dependent on macroeconomic conditions. In 2008-09 as a percentage of GDP out of total 15.1% of revenue expenditure interest payment amounted to 3.62% followed by subsidies (2.43%), defence (2.15%), wages and salaries (1.33%) and pensions (0.66%). Around 54 % of government expenditure is on items (interest payments, defense and subsidies) that can be together termed as committed expenditure, rest of the discretionary government expenditure decisions are governed to a certain extent by political factors.

Table 3

Forecast Error Variance Decomposition (FEVD) in percentage

Percentage of the Forecast Error of	Quarters	Explained by shocks in		
		GEXP	GDP	TAX
	1	100	0	0
	2	88	3	9
	4	87	3	10
	8	86	4	10
Government Spending (GEXP)	12	85	4	11
Output (GDP)	1	0	100	0

	2	1	98	1
	4	2	92	6
	8	4	87	9
	12	4	86	10
	1	0	1	99
	2	2	17	81
	4	2	30	68
	8	2	41	56
Tax Revenue (TAX)	12	3	46	51

Tax revenues in contrast are more endogenous in nature. The variance decomposition of revenue variable show that twelve quarters ahead 51% of variance is explained by own shock , 3% by expenditure shocks and 46% by output shocks. The large variance responses of taxes to business cycle or output shocks make them good automatic stabilizers. With respect to the decomposition of GDP, even after twelve quarters 86% of variations are explained by own shock. Together both fiscal variables explain around fifteen percent of variance decomposition of output after twelve quarters. Thus the movement in exogenous fiscal policy is not the main source of business cycle fluctuations in Indian economy. It plays a very small role in explaining the movements in GDP. The data covers the period 1997Q1 to 2009Q2 during which the economy became more open and market oriented.

5.2 The Impact of a Tax Shock

Figure 1 present the impulse responses of fiscal shocks for the baseline three variable VAR model. A fiscal shock that increases government revenues by one rupee would lead to a decrease in real GDP by 0.53 paise using the recursive LT approach. The multipliers reported are greater in absolute terms for the Blanchard & Perrotti approaches: BP (1), BP (2), BP(3). The tax shock impact multipliers are -0.84, -1.05 and -1.37 for BP1, BP2 and BP3 approaches respectively (table 4). The impulse responses behave similarly in terms of direction of the effect on output but the value of multipliers differs. The impact of a tax shock on GDP increases with the value of tax elasticity.

Table 4

Multipliers for Impact of Tax Shock on Output

	Impact	Q2	Q4	Q8	Q12
Recursive	0	-0.53	-2.0	-1.58	-1.26
Bp1	-0.84	-1.26	-2.53	-2.0	-1.68
Bp2	-1.05	-1.47	-2.74	-2.11	-1.79
Bp3	-1.37	-1.68	-2.95	-2.32	-1.89

Multiplier values from baseline specification.

The impact on government spending does not show any significant movement for any of the specifications. Tax shock adversely affects components of GDP other than government expenditure like private consumption, investment and net exports that result in adverse impact on output.

5.3 Shock to Government Spending

Figure 1 gives the impulse responses to government spending shock. The impact of the government spending shock on output is positive with the peak output multiplier value of (1.14; Q4) and an impact value of 0.09. The cumulative output multipliers are presented in the table 5. The cumulative output multiplier is defined as the cumulative change in output over the cumulative change in fiscal variable. The cumulative multipliers under LT approach show that it takes around three years for GDP to increase by more than the cumulative fiscal shock. The cumulative output multiplier for the fourth quarter points to crowding out in the economy. Increase in government spending crowds out some of the other components of GDP in the initial quarters.

Table 5

Multipliers for Impact of Spending Shock on Output

	Multiplier			Cumulative Multiplier		
	Impact	Q8	Q12	Q4	Q8	Q12
Output	0.09	0.88	0.70	0.51	1.01	1.38

Multiplier values from baseline specification.

The impact effect on tax variable of a shock in government spending variable is negative but it becomes positive by the second quarter and then fluctuates along the base value.

5.4 The Impact of Non Fiscal Shock

The response of fiscal variables to non fiscal shock is captured by responses to output shock. The tax revenue variable exhibits a hump shape response for recursive and BP approaches. This actually captures the dynamics of automatic stabilizers for the Indian economy. The expenditure variable also responds in a similar fashion for the recursive and BP approaches. Given the assumption of zero within period expenditure elasticity with respect to output, the expenditure moves positively after one period though the result is not significant as can be seen from the large confidence intervals. There is a need to work out the output elasticity of government spending to check the sensitivity of results. With unemployment programmes like NREGA the possibility of within period response of government spending to fluctuations in economic activity has increased.

5.5 The Impact of Fiscal Shock on Private Consumption

As far as the impact of tax shock on private consumption is concerned the results follow Keynesian tradition. The response of private consumption to fiscal shock is captured from a four variable Recursive VAR model with six lags. A tax shock resulting in increase in tax revenues adversely affects private consumption. To obtain the value of impulse responses as a share of GDP the log responses are multiplied by the average of consumption to GDP ratio. For quarter one the effect as a percentage share of GDP is -0.08 and by end of the fourth quarter private consumption decrease by -0.11 percent of GDP. The impulse response of the tax shock on private consumption show that the effect is significant and negative in the initial quarters but become positive by the sixth quarter and after the tenth quarter the value keeps fluctuating around the base value. A similar result was obtained by Perrotti (2005) for UK.

Table 6

Cumulative Consumption Multipliers

	Cumulative Consumption Multiplier	
	Q8	Q12
Spending	0.25	0.34
Tax	-1.09	-0.74

Multiplier values from the extended four variables VAR with six lags.

A positive shock in government spending on impact affects private consumption in Keynesian manner. Increased government expenditure on wages and salaries can easily translate

into increased consumption by the households, but certain items of government spending takes time to influence private consumption. For the four variable model, private consumption increases on impact by 0.14 percent of GDP after the spending shock. Private consumption in turn affects output positively till the third quarter after which GDP starts declining. On the whole the response of private consumption to fiscal shocks generally mimics the response of output. The cumulative consumption multipliers after two and three years are reported in table 6.The tax shocks have larger impact on private consumption than the shock to government spending.

6. Robustness of the Result

To check the sensitivity of the results, we examine whether changing the trends significantly affects our result or not by comparing three alternative specifications:1)as earlier linear time trend (LT approach), 2) by taking first differences of the series(FD appproach) and 3) using HP filter approach with a lambda of 1600(HP approach). When the series are detrended by taking first differences the Augmented Dickey Fuller (ADF) test results indicate that all series are stationary including the output series, whereas in case of a linear trend output series still contained unit root. For the HP specification the variables are stationary with a confidence interval of 99 percent except the government spending variable which is stationary at 95 percent confidence level. If the series are not detrended the estimated shock is a linear combination of temporary and permanent shocks. Blanchard and Perrotti (1999) detrended the series by incorporating a deterministic time trend for all the variables. The unit root test (ADF) results when series are detrended by including a linear trend show that the output series is non stationary and private consumption is stationary. Figure 3 compares the impulse responses of the four variable recursive VAR specification with six lags, the impulses are obtained using the alternative detrending approaches. The analysis of the effect of shock to fiscal variables (spending and tax shock) on private consumption show similar positive impact for spending shock and negative impact for the tax shock under all the three specifications, whereas as far as the impact on output is concerned the magnitude of the impact effect is quite sensitive to the way the data is detrended. Generally the impulses die down quickly for all the variables in case of HP & FD specifications, except for the response of spending to its own shock where the base value is reached faster for the LT specification and the magnitude of fluctuation is also much smaller than the HP specification. To capture the effect of temporary fiscal shocks it is very important to ensure that the series are stationary. For both HP and FD specifications all the variables

including output are stationary making it possible to study the temporary effects. Whereas when the series are not detrended properly the impact is a linear mix of permanent and temporary effect and as Baxter & King (1993) have shown that permanent and temporary shocks do not have similar effect on the economy. The impact of fiscal shock on private consumption is quite strong in the initial few quarters. The impact of tax shock on consumption is stronger and significant than the effect of a spending shock but if the policy aims at controlling private consumption by way of a tax shock then the effect may not sustain more than four quarters.

7. Conclusion

This paper has focused on studying the effect of fiscal shock on the level of economic activity in India using SVAR methodology. Results from two types of identification schemes used in the empirical literature (Recursive and Blanchard & Perrotti) are similar in the way output responds to a fiscal shock. Next we tried to use alternative detrending approaches to see whether it will have any significant impact on the variables. Findings are sensitive to the way the series are detrended. If the stationary conditions are not met it will be difficult to separate the impact of temporary and permanent fiscal shocks on the economy.

References

Baxter, Marianne, and Robert G. King. 1993. "Fiscal Policy in General Equilibrium." *The American Economic Revie*w, 83(3): 315-334.

Blanchard, Olivier, and Roberto Perotti. 1999. "An Empirical Characterization of the Dynamic Effects of Changes in Government Spending and Taxes on Output." National Bureau of Economic Research Working Paper 7269.

Blanchard, Olivier, and Roberto Perotti. 2002. "An Empirical Characterization of the Dynamic Effects of Changes in Government Spending and Taxes on Output." *The Quarterly Journal of Economics*, 117(4): 1329-1368.

Caldara, Dario, and Christophe Kamps. 2008. "What are the Effects of Fiscal Shocks? A VAR-based Comparative Analysis." European Central Bank Working Paper 877.

Campbell, John Y., and N. Gregory Mankiw. 1989. "Consumption, Income and Interest Rates: Reinterpreting the Time Series Evidence." In *NBER Macroeconomic Annual 1989*, *Volume 4*, ed. Olivier Jean Blanchard and Stanley Fischer, 185-246. USA: MIT Press.

Castro, Francisco de. 2003. "The Macroeconomic Effects of Fiscal Policy in Spain." Bank of Spain Working Paper 0311.

Corsetti, Giancarlo, André Meier, and Gernot Müller. 2009. "Fiscal Stimulus with Spending Reversals." International Monetary Fund Working Paper WP/09/106.

Edelberg, Wendy, Martin Eichenbaum, and Jonas D.M. Fisher. 1999. "Understanding the Effects of a Shock to Government Purchases." *Review of Economics Dynamics*, 2(1): 166-206.

Enders, Walter. 2008. *Applied Econometrics Time Series*. 2nd ed. USA: John Wiley and Sons Inc.

Fatas, Antonio, and Ilian Mihov. 2001. "The Effects of Fiscal Policy on Consumption and Employment: Theory and Evidence." Centre for Economic Policy Research Discussion Paper DP2760.

Fatas, Antonio, and Ilian Mihov. 2003. "The Case for Restricting Fiscal Policy Discretion." *The Quarterly Journal of Economics*, 118(4): 1419-1447.

Gali, Jordi, J. David López-Salido, and Javier Valles. 2004. "Understanding the Effects of Government Spending on Consumption." European Central Bank Working Paper 339.

Giavazzi, Francesco, and Marco Pagano. 1995. "Non-Keynesian Effects of Fiscal Policy Changes: International Evidence and the Swedish Experience." Centre for Economic Policy Research Discussion Paper DP1284.

Heppke-Falk, Kirsten H., Jörn Tenhofen, and Guntram B. Wolff. 2006. "The Macroeconomic Consequences of Exogenous Fiscal Policy Shocks in Germany: a Disaggregated SVAR Analysis." Deutsche Bundesbank Discussion Paper 41/2006.

Hemming, Richard, Michael Kell, and Selma Mahfouz. 2002. "The Effectiveness of Fiscal Policy in Stimulating Economic Activity- A Review of the Literature." International Monetary Fund Working Paper 02/208.

IMF World Economic Outlook 2001.

Kuismanen, Mika, and Ville Kamppi (2010). "The Effects of Fiscal Policy on Economic Activity in Finland." *Economic Modelling*, 27(5): 1315-1323.

Lendvai, Julia. 2007. "The Impact of Fiscal Policy in Hungary." *ECFIN Country Focus*, 4(11): 1-6.

Mountford, Andrew, and Harald Uhlig. 2002. "What Are the Effects of Fiscal Policy shocks?" Centre for Economic Policy Research Discussion Paper DP3338.

Pereira, Alfredo M., and Oriol Roca Sagales. 2006. "On the Effects of Fiscal Policies in Portugal." Department of Economics, College of William and Mary Working Paper 35.

Perotti, Roberto. 2002. "Estimating the Effects of Fiscal Policy in OECD Countries." European Central Bank Working Paper 168.

Perotti, Roberto. 2005. "Estimating the Effects of Fiscal Policy in OECD Countries." IGIER University of Bocconi Working Paper 276.

Perotti, Roberto. 2007. "Fiscal Policy in Developing Countries: A Framework and Some Questions." World Bank Policy Research Working Paper WPS4365.

Rahman, Habibur Md. 2005. "Relative Effectiveness of Monetary and Fiscal Policies on Output Growth in Bangladesh: A VAR Approach". Policy Analysis Unit Bangladesh Working Paper WP0601.

Ramey, Valerie A., and Matthew D. Shapiro. 1998. "Costly Capital Reallocation and the Effects of Government Spending." *Carnegie-Rochester Conference Series on Public Policy*, 48:145-194.

Mankiw, Gregory N. 2000. "The Savers-Spenders Theory of Fiscal Policy." *American Economic Review*, 90(2): 120-125.

Rezk ,E., Avramovich,M.C.& Basso,M. 2006. "Dynamic Effects of Fiscal Shocks upon Diverse Macroeconomic Variables: A Structural VAR Analysis for Argentina." Bank of Italy Working Paper Available at www.bancaditalia.it/studiricerche/convegni/atti/fiscal_ind/

Rotemberg, Julio J., and Michael Woodford. 1992. "Oligopolistic Pricing and the Effects of Aggregate Demand on Economic Activity." *Journal of Political Economy*, 100(6): 1153-1207.
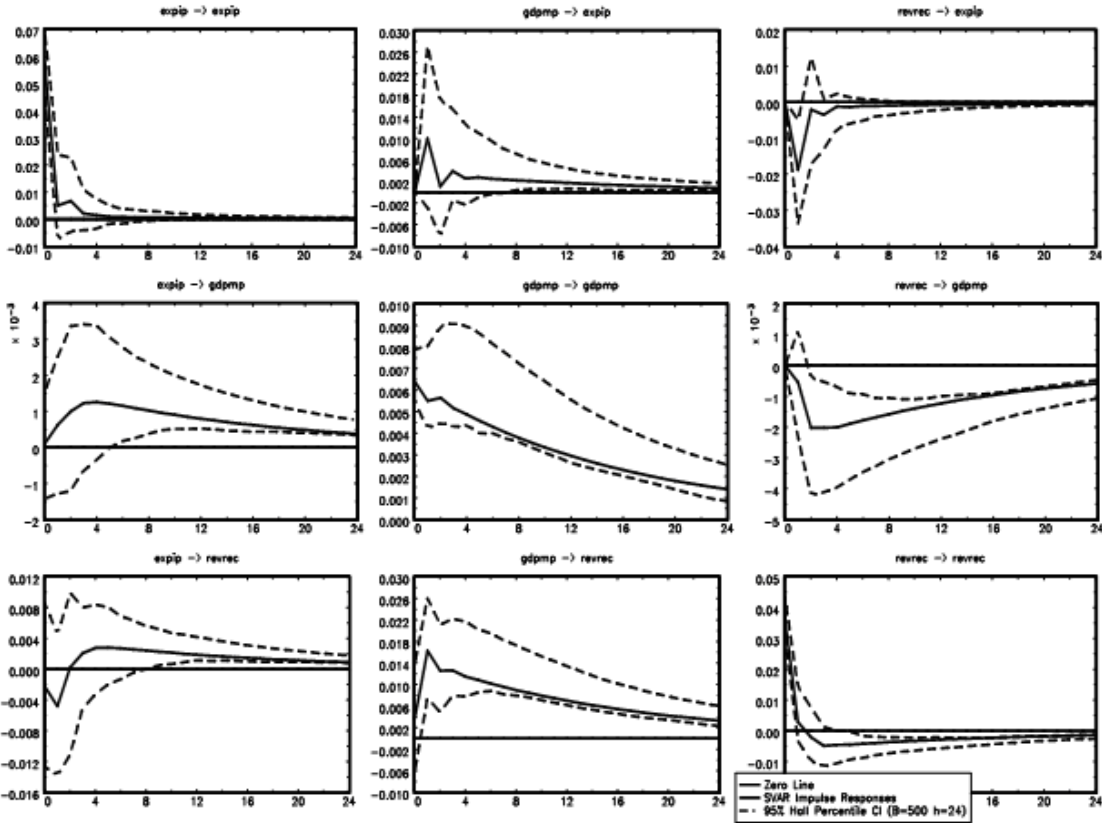
Van den Noord, Paul Joseph. 2000. "The Size and Role of Automatic Fiscal Stabilizers in the 1990s and Beyond." OECD Economics Department Working Paper 230.

Appendix

Figure 1

Impulse Responses for the Baseline Three Variable Recursive VAR

SVAR Impulse Responses for the Baseline Model

Confidence Bands are for the 95th Percentile

Figure 2

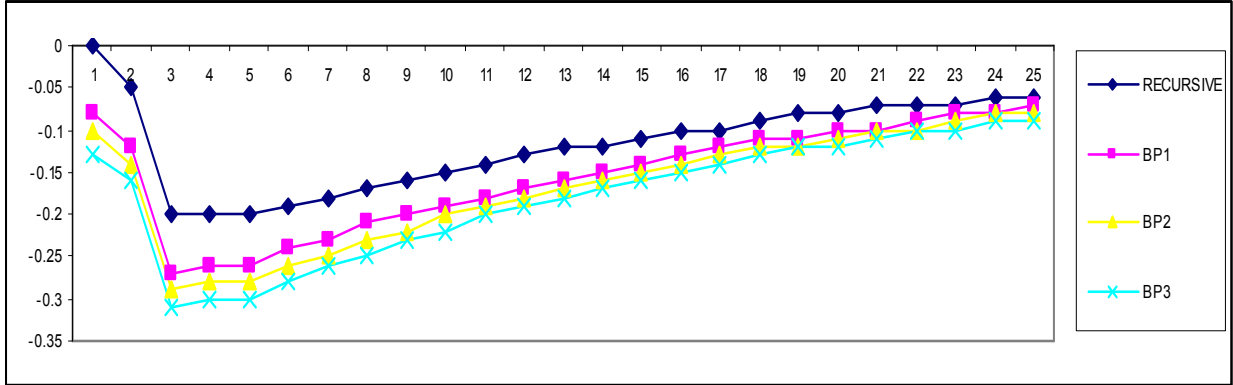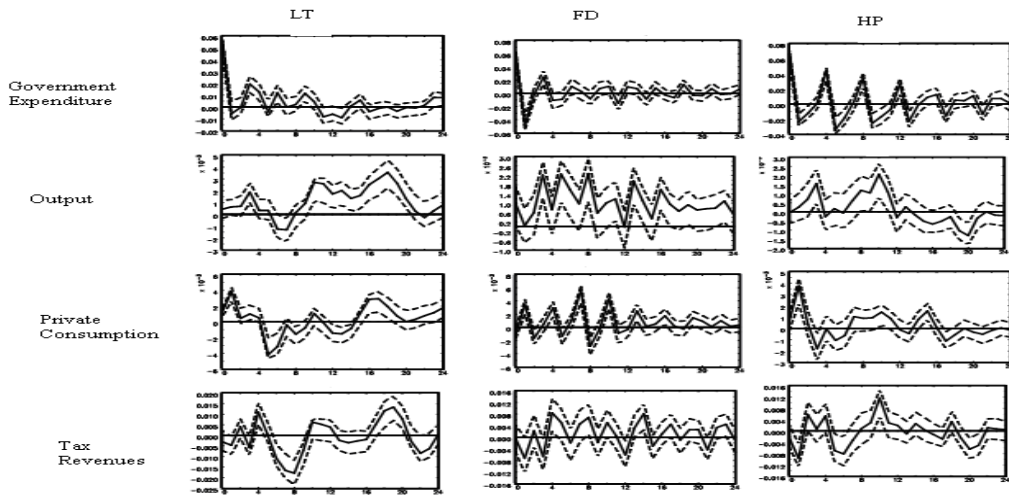Impulse responses for the Impact of Tax Shock on Output

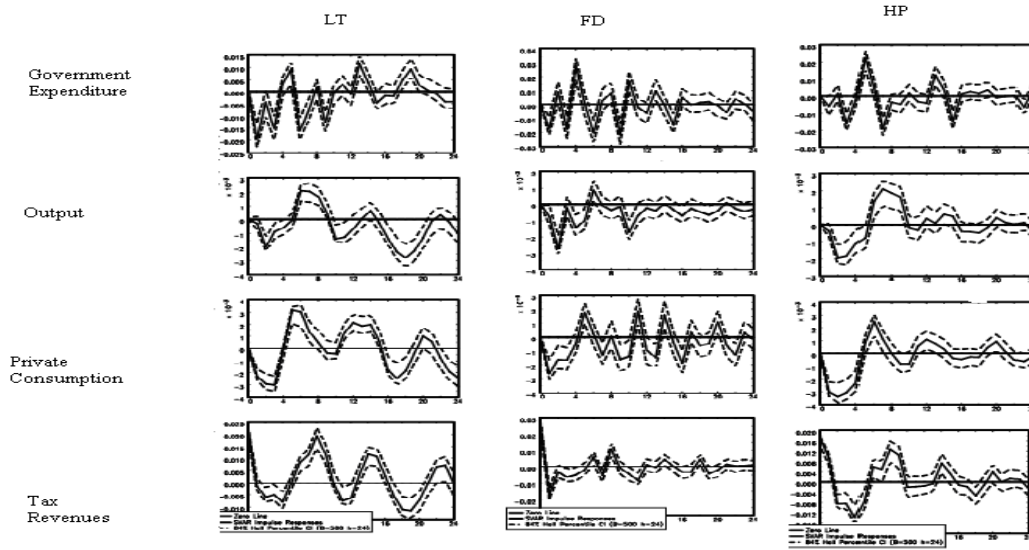**Figure3**

Sensitivity Analysis*

Fig. 3a: SVAR Impulse Responses for shock to Government Spending

*Confidence Bands are based on 16th and 84th percentiles with 500 replications.

Fig. 3b

SVAR Impulse Responses for shock to Tax Revenues

*Confidence Bands are based on 16th and 84th percentiles with 500 replications.