Estimation of Expenditure Multiplier for India

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Abstract

This study focuses on estimation of expenditure multipliers for Combined, Central and State Government expenditure using a SVAR (Structural Vector Autoregression) framework. Multipliers have been estimated separately for capital outlay and revenue expenditure. Capital expenditure multipliers are estimated to be 1.5 - 3 times larger than revenue expenditure multipliers under different specifications. Additionally, the study indicates a prolonged multiplier effect of capital outlay with a peak multiplier to be expected after the third year of an exogenous fiscal shock. Estimates of multipliers are found to be higher for the state government expenditure vis-a-vis central government expenditure. This study indicates a policy proposal for reorientation of fiscal policy towards accommodating more physical and human capital expenditure to stimulate further investment and growth along with more decentralized implementation of projects with high localization aspects.

Keywords: Fiscal Multiplier, SVAR, Revenue Expenditure, Capital Expenditure, Impulse Response, Cholesky Decomposition, Variance Decomposition

JEL classification code: C32, E62, H50

1. Introduction

Expenditure multiplier is a metric used to infer the impact of changes in government expenditure on the output related variables in the economy[2]. In view of recent events such as the Global Financial Crisis and the ongoing COVID-19 pandemic, countries across the world have resorted to fiscal stimulus as a measure to revive the economy. However, optimal size, timing and focus of expenditure is not unanimous due to the existence of multiple feedback loops among multiple factors of interaction and depends on multiple factors such as macro fundamentals, structural constraints, degree of monetary policy transmission, degree of integration with the world market, geopolitical developments of the world amongst many others. Optimal size of government expenditure is always a widely contested debate because there are constraints to the size of sustainable expenditure that any economy can undertake. Distribution of planned expenditure across different sectors is one of the key elements in fiscal policy planning to achieve the desired

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[2] For instance, it could be inferred as the change in Gross domestic product of an economy with respect to an INR 1 change in the government expenditure.

objectives of growth in an economy. However, appropriate estimation of fiscal multiplier would be a key component for assessment of projected growth to derive a suitable policy path for fiscal planning. Interest in optimal fiscal stimulus planning has received more relevance in recent times due to limitations of conventional monetary policy primarily in advanced economies owing to zero lower bound short term policy rates.

There exists a wide array of methodologies and consequently multiple estimates for fiscal multipliers in the research undertaken so far. Estimated fiscal multipliers tend to vary across the country, time of the study and characteristics or state of the economy in consideration. Reasons for variation in the magnitude of estimated multiplier could be owed to the fact that transmission of government expenditure is highly non-linear and is dependent on multiple other forces of interactions such as fundamentals and state of the economy, consumption and saving patterns in the economy, degree of trade openness, monetary policy autonomy, debt levels, sectoral composition.

Fiscal policy of an economy could be seen as a combination of the following components (i) automatic stabilizer effect (tax revenues could increase as a result of increased economic activity) (ii) systematic discretionary components (expenditure owing to vision of increased development of transport network in the economy or planned expenditure for healthcare sector development) (iii) unexpected discretionary policy (increased spending due to war). Preliminary analysis of these three should be sufficient to indicate that there exists a simultaneity problem which needs to be addressed to estimate the multiplier for an economy. Methods to address these challenges would be discussed in Section 2. of this paper.

This paper would aim to estimate the magnitude of the fiscal multiplier separately for the following - (1) capital and revenue expenditure multiplier for central government (2) capital and revenue expenditure multiplier for state government (3) capital and revenue expenditure multiplier for combined government spending. Impulse Response Functions and Forecast Error Variance Decomposition would be used to analyze the response to exogenous shocks in government expenditure.

2. Literature Review

There is existence of wide literature in the domain of fiscal multiplier estimation which can be segregated into four major segments - (i) Dynamic Stochastic General Equilibrium (DSGE) models (ii) Time series (VAR, SVAR, STVAR, regime switching models) (iii) Narrative based models (iv) Panel data models using aggregate country groups data (v) Bucket Approach. However, all the methodologies have their strengths and limitations which would be discussed subsequently.

As suggested in Batini et. al (2014), model based estimations (such as DSGE models) are extremely advantageous in estimating macroeconomic outcomes as a function of interactions of behavior of microeconomic agents in the economy. However, the estimated outcomes are highly sensitive to the choice of parameters (for instance, the saving behavior of individuals in the economy, degree of correct policy anticipation of the agents, process of inflationary expectations of the agents, nominal price and wage

rigidity). Hebous (2009) has surveyed studies on effectiveness of fiscal policy and has discussed existence of variation in predictions from economic theory on the basis of whether an economy is best characterized as "Neo-classical" or "Keynesian" or whether consumers in the economy are "Ricardian" or "Non-Ricardian". For instance, if representative consumer in the economy is modeled as a "Ricardian" (forward-looking and anticipates long term wealth effects due to government spending policy), then the impact of increased government spending may not be positive as opposed to the case where the consumer has been modeled as "Non-Ricardian" (households that consume entire current income). Link between varying assumptions about agents of the economy and predicted outcomes necessitate a need for careful modeling of DSGE models to achieve outcomes that are closer to reality. Leeper, Walker, and Yang (2013) studied government spending multipliers for the US (1955-2016) under two distinct monetary-fiscal policy regimes and found larger multiplier ranges (1.5 to 1.9) under passive monetary and active fiscal policy regime in the long run horizon.

In the realm of empirical estimations, multivariate time series models such as VAR, SVAR are used because most of the series such as output variables, fiscal spending variable, short term interest rates are expected to be simultaneously determined in an economy. However, a challenge in VAR models is to segregate the impact of exogenous shocks. To deal with this, one of the widely used identification strategies has been adopted in Blanchard and Perotti (2002) using a structural VAR which imposes certain restrictions on the contemporaneous impact of variables justified on the basis of economic theory. An important aspect of SVAR models is that they reflect the average response of the target variable to exogenous shocks and hence must be used with caution. If the economy has undergone major structural changes, then regime switch models could be considered because they offer some flexibility in accounting for those changes. SVAR models are linear models and sometimes could have a limitation of capturing state-contingent variation. To address those issues, a few recent studies have used STAR (smooth transition autoregressive) models such as Granger and Teravistra (1993), STVAR models such as Auerbach and Gorodnichenko (2012). In these models, the probability of being in a certain regime (for eg. recession phase, financial market disruptions) is also modeled as a part of the system which could be altered by policy shocks, which can then result in a differential impact on the basis of the expected regime of the system.

"Narrative" models which make use of some exogenous historical events such as news about future military spending which may be determined by geopolitical developments and not due the state of the economy have the advantage of identifying exogenous shocks directly. For instance, Romer and Romer (2010) used congressional reports and presidential speeches to decipher the motivation for fiscal policy changes. This approach was used to infer changes in fiscal policy due to economic conditions and changes that were more exogenous in nature. Ramey (2011) used the Ramey Shaprio narrative approach in an SVAR framework and indicated that shock in government spending in a SVAR approach might be foreseeable and hence may not reflect accurate multipliers. News regarding potential defense spending was used to create dummy variables for the time period of the anticipated defense news for identification of shocks. They found the government spending multiplier to be in the range of 0.6 to 1.2. However, a limitation of

this approach might be the existence of too few instances of such spending shocks to capture the impact.

"Bucket" approach has been illustrated in Batini et. al (2014) which would primarily be useful for countries with no prior studies on estimated multipliers. This could be used as a baseline for new research to corroborate the magnitude of multiplier in a broader sense. This method essentially focuses on grouping countries with similar characteristics as a group and extrapolating the multipliers (obtained from empirical studies) with some adjustment on the basis of their deviation from average country group characteristics. These characteristics could be broadly classified as structural characteristics (such as trade openness, debt levels, exchange rate regime, labor market rigidity) or conjunctural characteristics (such as state of business cycle or degree of monetary accommodation).

There exists a wide literature for various Advanced Economies (AEs) compared to Emerging Market Economies (EMEs). There could be multiple channels for differences in their estimates. Multiplier could be higher in EMEs if there exists a less forward looking behavior of agents due to instability, higher liquidity constraints, higher slack in the economy, lower government debt. Multiplier could be higher if there's a high degree of precautionary saving, inefficient public expenditure management, smaller in size, more open in nature and higher interest spreads.

Blanchard and Leigh (2013) indicated a presence of potential underestimation of fiscal multipliers by the forecasters for a group of advanced countries. This finding was established by finding a negative coefficient when real GDP growth forecast errors were regressed on the fiscal consolidation forecast. The study highlighted the importance of precision in estimation of multipliers to achieve an accurate projection of effects of fiscal consolidation and stimulus. However, multipliers need to be estimated with due caution as they may be highly state contingent - that is varying across the countries with time.

There exist a host of studies for estimating fiscal multipliers in India. Bose and Bhanumurthy (2013) have used structural macroeconomic models for policy simulation using annual data from 1991-2012. Fiscal multipliers have been estimated under two scenarios - (i) without any restriction on fiscal deficit, (ii) with a restriction on fiscal deficit as suggested by the thirteenth finance commission. Capital expenditure, transfer payment multiplier, other revenue expenditure multiplier have been estimated to be of the magnitude of 2.45, 0.98, and 0.99 respectively. This indicates the existence of variation in the degree of effectiveness of fiscal multipliers. Under the fiscal deficit restriction, if the capital expenditure is not the ring fenced, then a negative multiplier of revenue expenditure has been observed potentially due to crowding out of the capital expenditure. On the contrary, increment in capital expenditure at the cost of revenue expenditure while maintaining the fiscal deficit target has been observed to increase the overall output by 1.99 times. This could suggest a focus on enhancement of capital expenditure for achieving growth objectives. Gechert (2015) study is based on a meta regression analysis to derive insights on spending multiplier after controlling for study design characteristics.

Study indicates that investment multipliers are greater than spending multipliers by 0.5 units.

Jain and Kumar (2013) used a SVAR analysis for estimating fiscal multiplier using annual data from 1980 -2012 using Cholesky orthogonalization (similar to Blanchard and Perotti (2002)) for identification of exogenous policy shocks. In line with the expectations, capital expenditure multiplier is higher compared to revenue expenditure multiplier as the estimation. Higher magnitude of multiplier has been observed for state government expenditure vis-a-vis central government expenditure. As per this paper, peak revenue expenditure multiplier has been estimated to be in the range of 0.19 (for central government) to 0.60 (for state government) whereas estimated peak capital outlay multiplier lies in the range of 0.85 (for central government) to 7.61 (for state government).

Goyal and Sharma (2018) used a SVAR approach with quarterly data on output and expenditure from 1998-Q1 to 2014-Q2 to estimate total, revenue and capital expenditure multipliers for the central government. Estimated cumulative revenue expenditure multiplier lies between 0.47 to 1.69 as per multiple specifications which include incorporation of combination monetary policy and supply shocks. For similar specifications, cumulative capital expenditure multiplier is estimated to be in the range of 2.15 to 4.02.

As discussed earlier, a majority of studies have reported higher estimates for capital expenditure multiplier compared to revenue expenditure multiplier. An article by Mishra (2021) has discussed the role of multiplier via increased public sector infrastructure to achieve the 5 trillion $ goal for the Indian economy. Investment accelerator mechanism has been briefly discussed which implies the mechanism through which increased infrastructure investment results in higher consumption which further spurs private investment resulting in further rounds of increased consumption and incomes and hence, an incremental investment - consumption cycle. This increased investment could result in growth of real GDP, enhanced employment opportunities and export competitiveness along with maintaining stable inflation by potentially enhancing supply capacity.

Presence of a wide assortment of methodologies warrants a careful examination of studies.[3] Inferences could be derived from the studies which indicate statistical or theoretical evidence of similarity in the assumptions of the underlying approach and structure of transmission mechanisms in the economy.

This paper is aimed at estimating an average baseline fiscal multiplier for the Indian economy by studying the annual data[4] from 1972- 2019.This paper uses an SVAR

[3] Gechert and Will (2012) used a meta regression analysis of 89 studies which suggests that estimated multiplier differs by method and time horizon of study

[4] Annual data series have been used due to absence of harmonized long time series quarterly data for fiscal variables. Born and Muller (2012) established that Blanchard and Perotti (2012) restrictions on contemporaneous relationship between output shocks and government expenditure could be valid for annual time series data by testing the assumption of government spending being pre-determined within a year. Findings from the study suggest that imposition of restriction on quarterly VAR model in accordance

approach with identification restrictions similar to Blanchard and Perotti (2002). This approach has the edge of proven credibility in the case of modeling an endogenous system and less susceptible to variations due to change in assumption of microeconomic agents' behavior. Additionally, in absence of multiple credible exogenous fiscal changes for following a narrative approach, this study is aimed at estimating average multipliers for India for multiple components. Fiscal multipliers have been estimated for multiple combinations of Combined (Center and State), Central and State government expenditure for the pairs of revenue and capital expenditure. This estimation methodology has been applied as it has rendered estimates according to theoretical expectations in studies conducted earlier and also allows for the flexibility of modeling multiple simultaneous variables without specifying assumptions about the behavior of individual agents in the economy (as in the case of DSGE models).

3. Background of Expenditure path in the Indian Economy

Nature and trends of expenditure components over the years have traced a journey spanning across multiple reforms and crises. A brief discussion on the trends of expenditure would be undertaken subsequently to provide a background about the expenditure composition in India. Revenue Expenditure of the government refers to the expenditure incurred for day-to-day functioning of government and provision of social (eg. education, health), economic (eg. agriculture industry, power) and general (eg. tax collections, external affairs) services. It majorly includes administrative and operational expenses for functioning of government departments, wages and salaries paid to government employees, interest payments, grants to states and Union Territories (UTs) and subsidies. Capital expenditure comprises expenditure that increases the assets or reduces liabilities of the government such as expenditure on building infrastructure, defense services expenditure, loans to public enterprises, states, UTs and foreign governments. Total expenditure is considered to be the aggregate of revenue and capital expenditure. It is expected that higher capital expenditure in infrastructure building could spur private investment and result in multiplier gains for the economy over longer periods. However, implementation of infrastructure plans planned under the capital budget might be subjected to longer gestation periods before completion of projects and hence the expected gains may not be instantaneous. On the contrary, increased revenue expenditure such as transfers and subsidies might result in enhanced consumption by the household with shorter lags.

Following are some of the broad highlights about the government expenditure pattern in India:

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with pre-determined annual government spending is not rejected by the data. Additionally, high similarity is observed between annualized impulse responses (on quarterly data) and impulse responses obtained from the model estimated on annual time series. Study by Beetsma (2008) has also indicated certain benefits of using annual data - such as shocks observed with annual data might be close to actual shocks, lower probability of shocks being anticipated one year before its actual existence, absence of potential seasonality effects in the data.

1. Table 1 showcases that after the 2000s, the average share of state expenditure has gained pace over the average share of central government expenditure. Figure 1 provides an additional insight by suggesting that revenue expenditure as a share for GDP has moved closely for both central and state government, showing departure around 2007, with state government revenue expenditure surpassing the central government revenue expenditure in the more recent times. However, a clearer trend of state government surpassing central government in terms of capital expenditure from 2002 onwards is observed.
2. Table 2 showcases that the share of combined (central and states) revenue expenditure (approximately above 80%) has been increasing over time and consequently the share of combined capital expenditure as a part of total expenditure has been declining over time. The same trend also holds true for state and central government expenditure when analyzed separately. It can be observed from Figure 2, that the pace of widening gap between revenue and capital expenditure for central government has increased from 2003. One of the potential reasons could be implementation of the FRBM act during which the Central government's expenditure fell by 2 percentage points from 16% of GDP to 14% GDP and capital expenditure witnessed a drop from approximately 4% to 2% of GDP.
3. Figure 3 showcases the trends in growth rate of real GDP and growth rate of real revenue and capital expenditure and it can be seen that there exists high volatility in the growth rate of capital expenditure implying a more discretionary nature for spending. This could be because in cases of states, capital expenditures witness a rise in the last quarter when there is a clearer information on revenue flows and fiscal deficit, However, it seems that revenue expenditure seems to be counter cyclical during crises episodes.

Table 1: Central and State Government expenditure as a share of Combined total expenditure

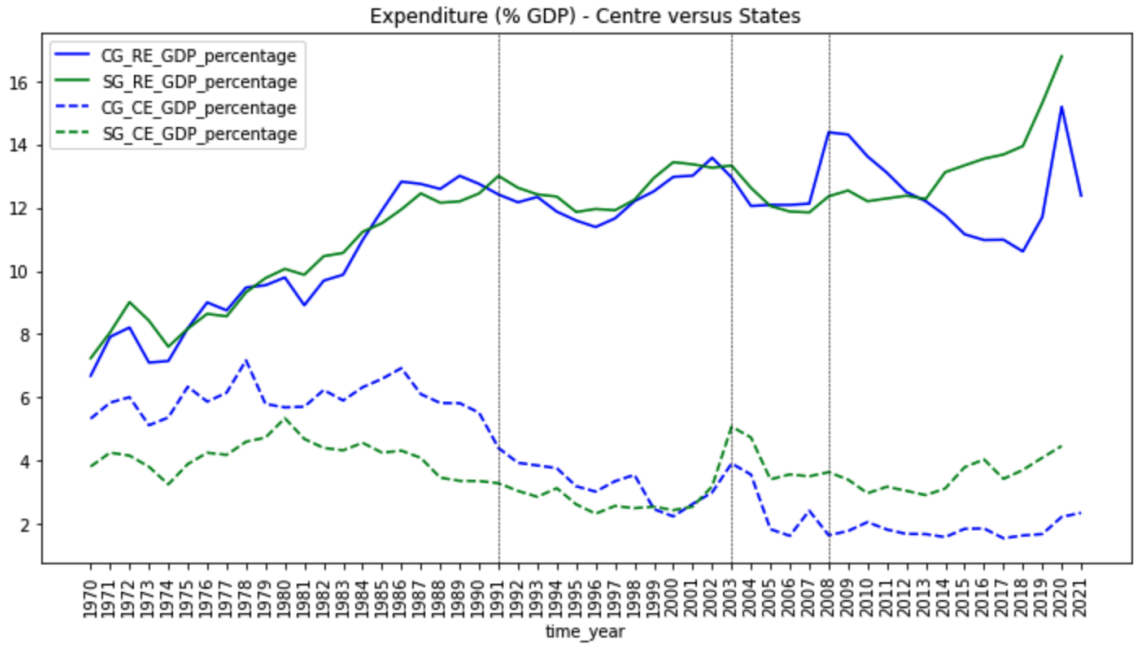
year	CG_share	SG_share
1970-1990	52.79	47.21
1991-2000	50.46	49.54
2001-2010	48.91	51.09
2010-2019	44.36	55.64
2020-2021	45.03	54.97

CG_share : Central government expenditure as a percentage of Combined total expenditure (average value over the time period)

SG_share : State government expenditure as a percentage of Combined total expenditure (average value over the time period)

Source: Computed from Database on India Economy (RBI)

Figure 1: Revenue and Capital expenditure for Central and State Government expenditure as a percentage of GDP



Label description:

CG_RE_GDP_percentage: Central government revenue expenditure as a percentage of GDP
SG_RE_GDP_percentage: State government revenue expenditure as a percentage of GDP
CG_CE_GDP_percentage: Central government capital expenditure as a percentage of GDP
SG_CE_GDP_percentage: State government capital expenditure as a percentage of GDP

Source: Computed from Database on India Economy (RBI)

Table 2: Combined Capital and revenue expenditure as a share of Combined total expenditure

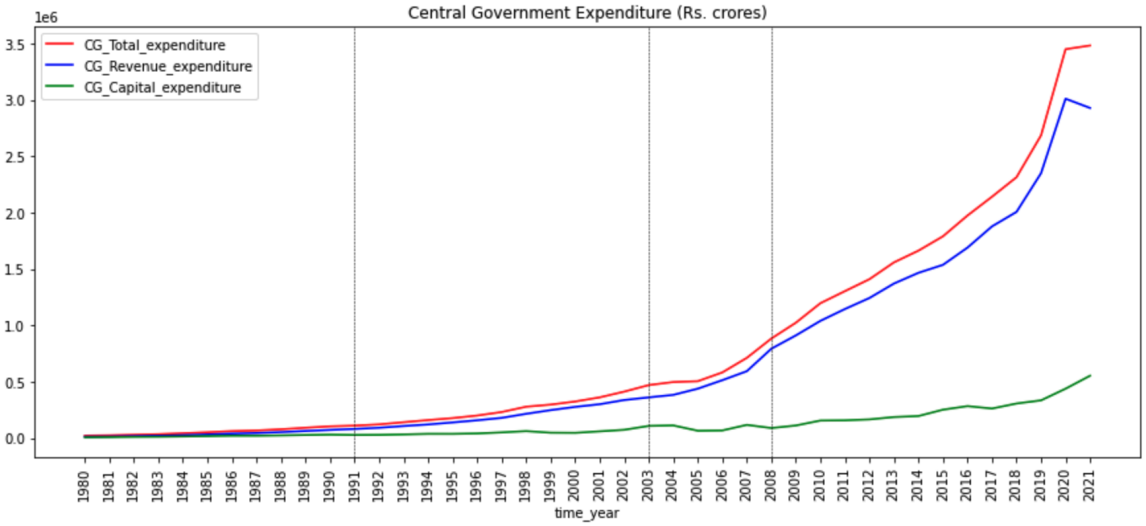
year	Combined_CE_share	Combined_RE_share
1970-1990	34.20	65.80
1991-2000	19.81	80.19
2001-2010	18.98	81.01
2010-2019	17.12	82.88
2020-2021	17.27	82.73

Combined_CE_share: Combined Capital expenditure as a percentage of Combined total expenditure

Combined_RE_share: Combined Capital revenue as a percentage of Combined total expenditure

Source: Computed from Database on India Economy (RBI)

Figure 2: Revenue and Capital expenditure for Central Government

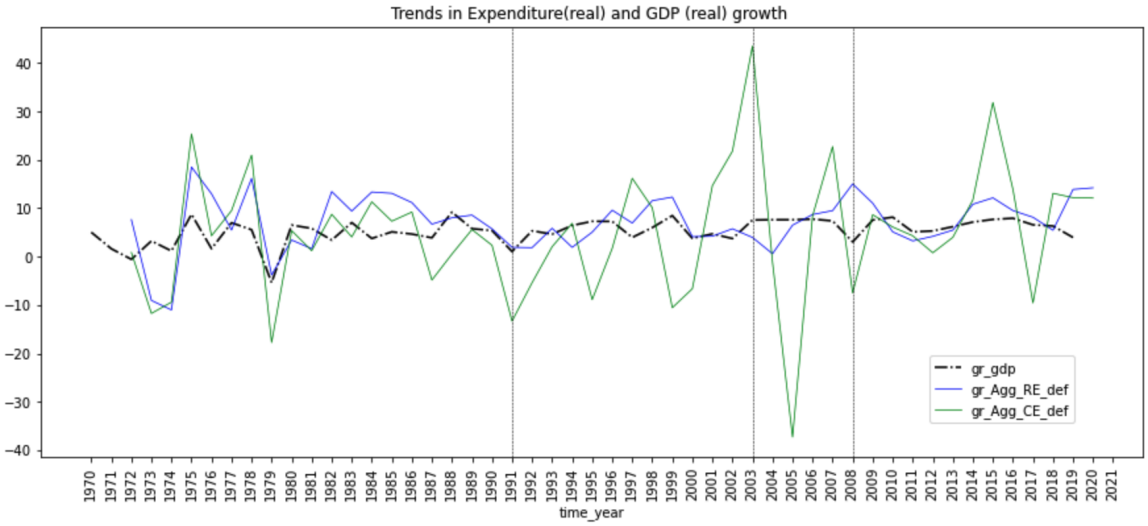


Label description:

CG_Total_expenditure: Central government total expenditure
CG_Revenue_expenditure: Central government revenue expenditure
CG_Capital_expenditure: Central government capital expenditure

Source: Computed from Database on India Economy (RBI)

Figure 3: Growth rate of GDP and Expenditure



Label description:

gr_gdp: Growth rate of real GDP
gr_Agg_RE_def: growth rate of aggregate(centre & states) revenue (real) expenditure
gr_Agg_CE_def: growth rate of aggregate(centre & states) capital (real) expenditure

Source: Computed from Database on India Economy (RBI)

4. Methodology and Data

It is evident from the literature and economic theory that fiscal variables and output growth variables may suffer from simultaneity bias because there are multiple interactions in an economy which result in a particular realization of the state of the economy. For instance output growth in a particular period may be driven by multiple factors such as - past growth momentum in the economy, increased investment activity, favorable global trade movements, technological breakthroughs. Therefore, it is imperative to use a modeling structure that captures the impact of exogenous fiscal policy shocks on output growth. As briefly discussed in Section 2, this paper uses the technique of SVAR by using the identification procedure adopted by Blanchard and Perotti (2002) which is based on Cholesky orthogonalization with government expenditure ordered before output growth and tax revenues. Cholesky orthogonalization can be broadly understood as imposition of certain restrictions on the parameters using the model that characterize contemporaneous relationships between a pair of endogenous variables. Implication of this identification procedure is equivalent to assuming that government expenditure may remain unresponsive to economic conditions in the instantaneous time period. This would be consistent with the assumption that fiscal policy is subject to implementation lags and hence, contemporaneous response to varying economic conditions can be ruled out. Tax revenue can contemporaneously respond to both economic growth and government expenditure. Representation of the SVAR model has been illustrated in Section 4.1.

4.1 Identification of the Structural VAR model

A reduced form VAR with p-lags could be represented in the following form:

$$z_t = \phi_0 + \phi_1 z_{t-1} + \phi_2 z_{t-2} + \dots\dots\dots\dots\dots\dots + \phi_p z_{t-p} + e_t \qquad (1)$$

where,

z_t = (K × 1) vector of stationary time series

ϕ_0= (K× 1) vector of constants and other exogenous variables

ϕ_j = (K × K) matrix of coefficients for j = 1,2, … , p

e_t = (N × 1) vector of reduced form errors with expectation 0 and a symmetric covariance matrix Ω_e

A structural form representation of the system of equations could be represented in the following form:

$$Az_t = A_0 + A_1 z_{t-1} + \phi_2 z_{t-2} + \dots\dots\dots\dots\dots\dots + A_p z_{t-p} + u_t \qquad (2)$$

where

A= (K × K) matrix of contemporaneous coefficients

A_j = (K × K) matrix of structural dynamic coefficients for j = 1,2, … , p

$\phi_j = A^{-1}A_j$

u_t = vector of structural errors with mean zero and a diagonal covariance matrix Ω_u

$\Omega_u : E(u_t u_t^{'}) = \{ D \text{ for } t = t^{'}, 0 \text{ otherwise}$ where D is a diagonal matrix

$e_t = A^{-1}u_t$

$\Omega_u = A^{-1}E(u_t u_t^{'})\ (A^{-1})^{'}$

It should be noted that u_t (vector of structural errors) is assumed to have a diagonal covariance matrix, implying that covariance between structural shocks of any pair of variables is zero and hence those shocks could be considered purely exogenous in nature. Last identity suggests that reduced form errors (e_t) can be expressed as a combination of structural form errors (u_t). Therefore, there is a need to transform the reduced form errors to infer uncorrelated structural shocks which can be used for a wide range of analysis such as Impulse response functions, forecast error variance decomposition.

Examination of (1) and (2) should suggest that equation (2) has more parameters to be estimated as compared to equation (1). Identification of equation (2) requires imposition of some restrictions on the structural system to have a just identified structure.

Order condition for identification of the structural model suggests that the number of free parameters in A and D put together should be equal to the number of estimated parameters in Ω_e. Since Ω_e is symmetric there are (K(K+1))/2 estimated parameters in Ω_e. This requires imposition of (K(K-1))/2 restrictions on the structural system.

4.2 Data sources and variable definitions:

Annual GDP data with 2011-12 as the base year at constant prices from 1970-71 to 2019-20 has been sourced from EPWRF.

Fiscal variables such as central government tax revenue, state government tax revenue, central government expenditure (capital, capital outlay and revenue), state government expenditure (capital and revenue) has been sourced from Handbook of Statistics on the Indian Economy (RBI). Expenditure, output and tax revenue variables form the vector of endogenous variables. Annual average of WPI index at 2011-12 base has been used to deflate all the fiscal and output variables to convert them from nominal to real terms. For estimation of capital expenditure multiplier, capital outlay expenditure has been used because as suggested in Jain & Kumar (2013), "Capital outlay has been deliberately chosen instead of capital expenditure as it constitutes only the investment expenditure and excludes debt repayments, etc by both levels of the government"

In order to control monetary policy, Call Money Rate has been used as an exogenous variable. However, instead of using nominal call money real, an ex-post real interest rate has been used which is defined as the difference between call money rate and one period

ahead expected inflation rate (which is assumed to be equal to actual one period ahead inflation rate). Call money rate could affect the multiplier via multiple channels. A potential channel could be that an accommodative monetary policy stance might support the presence of a higher multiplier of fiscal expansion.

Output gap (defined as the difference between actual and potential growth) has been incorporated as an exogenous variable to control for a proxy of potential slack in the economy. For instance, some literature has suggested in case the economy is at full employment, then fiscal expansion might result in some crowding out. As opposed to the case, when actual growth is below potential growth, a fiscal boost could result in increased consumption which could further result in enhancement of productive capacity.

World GDP growth time series has been incorporated as an exogenous factor to control for the effects of global sentiments and status of global economy. This would be highly relevant in recent times of globalization where the majority of countries are open-economies and are affected by the global environment.

Dummy variables to control for FRBM implementation and global financial crisis have been incorporated to control for the level change effect in the expenditure and economic growth.

One year lag of inflation and one year lag of exchange rate depreciation of INR vis-a-vis dollar has been included as exogenous factors to account for the momentum in exchange rate movements and inflation. Inflation has been defined on the basis of WPI index.

Short representations and descriptive statistics of the variables in consideration are mentioned in Appendix A.1 and Appendix A.3 respectively.

4.3 Derivation of spending multiplier:

To begin with, all the output and fiscal variables have been first converted into logarithms, which are then converted to growth rates for their use in the SVAR model. This has been done because the endogenous variables in consideration in their level form were non stationary, whereas they were found to be stationary in their first difference form. All the series used for the model were stationary using Augmented Dickey Fuller (ADF) test.

Additionally, a preliminary analysis of variables with Granger Causality tests does not indicate rejection of null hypothesis in the majority of the pairs of interest. However, growth of state government capital outlay seems to granger cause growth rate of GDP and growth rate of state government tax revenue. Owing to presence of high simultaneity and the aim of estimating multipliers, the study proceeds with implementation of more sophisticated models for further analysis.

Measurement of fiscal multiplier from the impulse response functions is in accordance with the method suggested by Spilimbergo et. al (2009). Multiplier has been defined as the change in output (ΔY) to an exogenous change in government expenditure (ΔG).

Three types of multiplier have been estimated in this study.

(i) Impact Multiplier: Evaluates the impact on the change in output to the change in output in the time period in which exogenous shock has taken place.

(ii) Peak Multiplier: Measures the largest impact over a time horizon 'N'

Symbolic representation for all the above are given below.

Impact multiplier: $\left(\equiv \frac{\Delta Y(t)}{\Delta G(t)} \right)$

Multiplier at some horizon N: $\left(\equiv \frac{\Delta Y(t+N)}{\Delta G(t)} \right)$

Peak multiplier: $\left(\equiv max_N \frac{\Delta Y(t+N)}{\Delta G(t)} \right)$

In order to estimate the government expenditure multiplier, following restrictions have been applied on the SVAR matrix :

$$\begin{bmatrix} e_t^{exp} \\ e_t^{gdp} \\ e_t^{tax} \end{bmatrix} = \begin{bmatrix} \beta_{11} & 0 & 0 \\ \beta_{21} & \beta_{22} & 0 \\ \beta_{31} & \beta_{32} & \beta_{33} \end{bmatrix} \begin{bmatrix} u_{1t} \\ u_{2t} \\ u_{3t} \end{bmatrix}$$

In the representation mentioned above, e_t^{exp}, e_t^{gdp}, e_t^{tax} represents vectors of reduced form errors for government expenditure growth , GDP growth, tax revenue growth and u_{1t} ,u_{2t} , and u_{3t} represents the vector of structural shocks. On the right hand side, the 3×3 matrix represents the matrix of contemporaneous restrictions in the structural matrix. These restrictions imply that expenditure growth responds to GDP growth and tax revenue growth with a lag and not in the same time period. Additionally, GDP growth doesn't respond to tax revenue growth within the same time period.

To estimate the multiplier, first the elasticity (α) is obtained, which is then multiplied with the historical average of output to spending ratio. Elasticity, which is defined as the responsiveness of output variable to fiscal variable, is measured as the ratio of impulse response of output to structural shock of fiscal variable and impulse response of spending variable to structural shock of fiscal variable.

$$Fiscal\ multiplier\ = \alpha\ .\ \left(\overline{\frac{Y}{G}}\right)$$

$$\alpha = \frac{\theta_{yg}}{\theta_{gg}}$$

where

α : Elasticity which is obtained from the ratio of the Impulse Response Functions

Y : Output(or GDP)

G : Fiscal(or the expenditure) variable

θ_{yg}: Impulse response of output growth to fiscal shock

θ_{gg}: Impulse response of expenditure growth to fiscal shock

4.3.1 Derivation of spending multiplier for State Government Expenditure:

As discussed in the previous subsection, elasticity is measured by dividing the ratio of impulse response functions. With reference to Figure 4.1, elasticity at time period 1 can be computed by dividing the value of the lower panel observed at horizontal axis of 1 by the value of upper panel observed at horizontal axis of 1. In this figure, the horizontal axis represents the time period for measurement of impact and the Y axis reflects the magnitude of impact. By following the above mentioned procedure the estimated elasticity is 0.043. To arrive at the multiplier, the estimated elasticity will be multiplied to the appropriate average of output to spending ratio (mentioned in appendix section A.2). Since, this multiplier has to be estimated for state government capital outlay, the relevant output to spending ratio would be 62.12 (mentioned in appendix section A.2), which when multiplied by the estimated elasticity results in an impact multiplier of 2.71 (shown in Table 3).

An analysis of the lower panel in Figure 4.1[5], which represents the path of impulse response, suggests that due to an exogenous shock to fiscal spending in time period 1, r output variables increase in the same period. However, the impulse response reaches a peak of magnitude in period 3. Following the definition of peak multiplier (mentioned in Section 4.3), the estimated peak multiplier for state government capital outlay is 5.32[6]. It can be observed that the positive response of fiscal spending shock to output variables remains positive for future time periods as well indicating a presence of long lasting impact of fiscal spending on output growth. This would be expected because spending of capital outlay is generally incurred on infrastructure developments projects such as enhancement of roads, transport, network, supply chain which could result in incremental

[5] Figure 4.2 and Figure 4.3 have been extracted from the broader system of impulse responses in Figure B1(a) and Figure B1(b) respectively to facilitate a concise explanation of multiplier calculation.

[6] Perotti (2006) estimated an investment spending multiplier of around 5 for Germany (studied the period from 1960Q1 to 1989 Q4).

consumption and productivity boost. Productivity boost could potentially result in incremental reinvestment of margin which could result in a consumption-investment spiral, thereby reflecting the long lasting impact of initial capital outlay fiscal stimulus. Initial boost in public investment is complementary to private investment. Higher multiplier value can be seen for state governments potentially reflecting higher effectiveness of localized and bottom-up planning which is more customized to bridge the gaps specific to a particular state. Multiple reports have suggested that the states fail to meet their budgeted capital expenditure potentially due to the tendency to cut down in periods of revenue shortfall or fiscal deficit targets. Cutting back on revenue expenditure is perceived to be perverse to political motives and hence face a higher resistance in spending cuts.

Figure 4.1 Impulse response of State Government Capital Outlay growth (upper plot) and GDP growth (lower plot) to a fiscal (state government capital outlay) spending shock (Shock1)

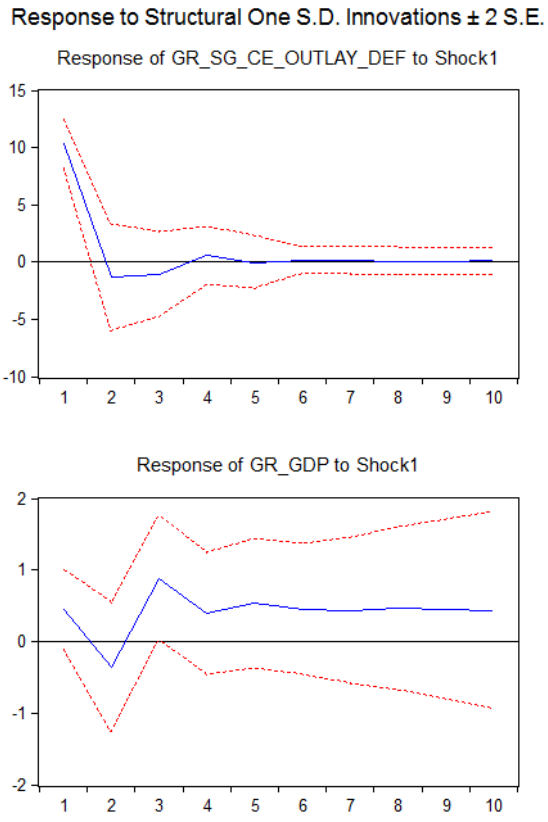
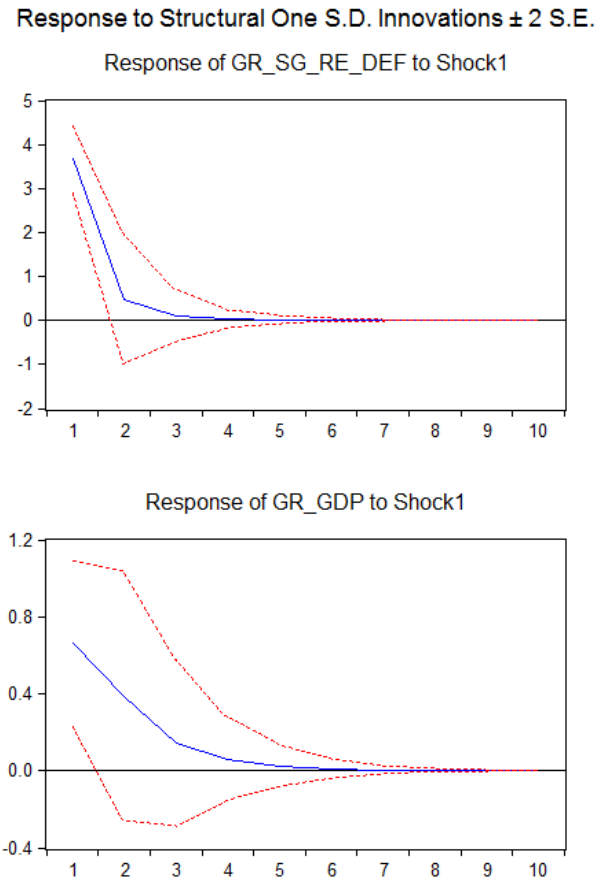


Figure 4.2 which represents the impulse response functions of spending and output variables with respect to an exogenous revenue spending shock. It can be observed in the lower panel that the impulse response of output variable to a structural revenue spending shock shows a gradual decline and eventually becoming negligible after 6 time periods. Using the process mentioned previously, revenue spending multiplier for the state government is estimated to be 1.74 with its peak impact coinciding with the time period

of initial shock and hence, the impact and peak multiplier have recorded the same value. This can be seen in contrast to capital outlay multiplier which continues to have a positive for a longer time horizon and has a higher magnitude compared to the revenue spending multiplier. Increased revenue expenditure may lead to a growth in consumption related sector in the initial time period, without having an incremental impact in distant time horizons.

Additional insights can be inferred from the Variance Decomposition analysis[7] of GDP growth as reflected in Table B1(a) in the appendix. Table B1(a) represents that shocks in state government capital outlay minimally affects variation in GDP growth in the short run, but its contribution increases significantly in the long run. On the flip side, inspection of Table B1(b) in the appendix suggests that the impact of state government revenue spending shocks remains broadly similar in the VDA of GDP growth.

Figure 4.2 Impulse response of State Government Revenue Expenditure growth (upper plot) and GDP growth (lower plot) to a fiscal (state government revenue expenditure) spending shock (Shock1)



[7] VDA (Variance Decomposition Analysis) reflects the proportion of variation in the considered variables due its "own" shocks versus shocks to the other variables.

Table 3: Multipliers for State Government Expenditure

Description	Impact Multiplier	Peak Multiplier	Peak Year
State Gov Capital Outlay	2.71	5.32*	3
State Gov Revenue Expenditure	1.74*	1.74*	1

4.3.2 Derivation of spending multiplier for Central Government Expenditure:

In line with the explanation in Section 4.3.1, this subsection is aimed at the analysis of capital outlay and revenue expenditure multiplier of the central government.

Figure B2(a) and Figure B2(b) in the appendix is representative of the system of the impulse response for the two scenarios of capital outlay and revenue expenditure shocks respectively. Inspection of the impulse response of GDP growth to spending shocks indicate that the response of GDP growth to central government capital outlay structural shocks witnesses a peak in period 4 with the impact multiplier value of 3.44 and peak multiplier value of 4.41 as shown in Table 4. Figure B2(b) showcases that impulse response of GDP growth is at its peak in the time period of exogenous revenue spending shock and declines in the subsequent time periods. Positive impact in the longer time horizons could be because central revenue expenditure also includes grants to states which could be used for developmental projects. Similar to the case of state government expenditure, the central government's capital outlay expenditure multiplier is greater than the revenue expenditure multiplier.

Table B2(a) and B2(b) refers to the VDA for central government capital outlay and revenue expenditure. It can be observed in Table B2(a) that the proportion of variation in GDP growth attributed to capital outlay growth increases by almost twice its value at the short run, whereas for revenue expenditure proportion in variation of GDP growth attributed to revenue expenditure shock remains broadly similar over the entire time horizon. This could be helpful in reiterating the long run effects of capital outlay on GDP growth. Peak central government capital outlay and revenue expenditure multiplier is lower that of the state governments which could indicate a higher impact of localized expenditure framework.

Table 4: Multipliers for Central Government Expenditure

Description	Impact Multiplier	Peak Multiplier	Peak Year
Central Gov Capital Outlay	3.44*	4.41	4
Central Gov Revenue Expenditure	1.31*	1.31*	1

4.3.3 Derivation of spending multiplier for Aggregate (combined state and centre) Government Expenditure

This subsection aims at understanding the trends in the magnitude of multipliers for aggregate (combined state and centre) expenditure.

Figure B3(a) and B3(b) indicates that the impulse response of GDP growth to aggregate expenditure follows broadly similar trends as mentioned in the sections earlier with aggregate combined capital outlay multiplier being higher than the combined revenue expenditure as shown in Table 5. Although the impact elasticity of expenditure is broadly similar for both central and aggregate government expenditure, the multiplier for aggregate expenditure is lower because of lesser magnitude of output to spending ratios (which is multiplied by the elasticity to arrive at the multiplier). Table B3(a) and B3(b) represents the VDA for the aggregate expenditure. However, the pattern in increasing proportion of aggregate capital outlay expenditure is lower in magnitude compared to the same analysis when the entities were considered separately. This might be because as per the historical data the magnitude and timing of growth rate of capital expenditure by both the state and central government are not perfectly synced which could add some noise in inferring the impact. For instance, in cases where there exists alternate years of peaks in capital expenditure by state and central government, versus a sustained high magnitude of either of the entities may be fundamentally different in terms of the nature of their impact. However, in both the cases the growth rate of combined capital expenditure might be similar in terms of magnitude and unless the distinction is specified, estimated impact might be noisy. This could be a useful insight to perform the analysis of expenditure impact at a disaggregated level (such as state versus centre, revenue versus capital, development versus non development) to infer qualitative and quantitative variations of their impact on the output variables. Estimated multiplier values seem to be higher than the multipliers reported for AEs in general. However, they are in line with the estimated multiplier for India (Bose and Bhanumurthy (2013), Jain & Kumar (2013)), China (Wang & Wen (2013)) Germany (Perotti (2004)). This could potentially be due to the existence of high slack, high unemployment, existing capacity constraints, market failures, credible public debt management and stable monetary policy environment which results in high responsiveness to a fiscal stimulus. However, studies have indicated a cautious spending strategy to avoid falling into the trap of high debt levels which could lead to perverse effects.

Table 5: Multipliers for Aggregate (combined States and Centre) Government Expenditure

Description	Impact Multiplier	Peak Multiplier	Peak Year
Combined Capital Outlay	2.02*	2.02*	1
Combined Revenue Expenditure	0.9*	0.9*	1

To summarize, capital outlay multipliers have been estimated to be higher than revenue expenditure estimates. State government expenditure multipliers seem to be higher than central government expenditure multipliers. Impulse response function analysis suggests that capital expenditure has a prolonged impact on output variables with peak multiplier at around the third year whereas the impact of revenue expenditure seems to flatten out after initial years. Variance decomposition analysis indicates that the contribution of capital expenditure shocks in variation of output variable increases in the long run. All these indicators combined together imply long run benefits of efficient capital expenditure in determination of output growth. Further policy implications of the observations have been discussed in Section 5.

5. Conclusion

The study so far has discussed the importance of accurate estimation of fiscal multiplier as a tool for fiscal policy making. Underestimation of fiscal multiplier might lead to a policy input of more than optimal fiscal consolidation. On the other hand, overestimation of multipliers might lead to an inefficient allocation of resources.

However, accurate estimation of multipliers is embedded with the issue of simultaneity bias. As discussed, there exists a wide spectrum of methodologies to infer the impact of exogenous fiscal policy shocks which have their own advantages and limitations. This study has used an SVAR framework with appropriate identification restrictions for estimation of fiscal multiplier.

In accordance with a priori expectations, capital outlay expenditure multipliers are significantly higher than revenue expenditure multiplier potentially owing to long lasting impact of infrastructure development and complementary private investment and consumption cycles associated with it. Higher fiscal multipliers for state governments have been revealed vis-a-vis the central government using a disaggregated analysis. This could be in tune with the recent recommendations of higher decentralization in implementation of schemes, adoption of a more bottom-up approach in areas and sectors which are more localized in nature.

Proposed further extension to this study would include estimation of a larger augmented set of endogenous macroeconomic variables such as inflation, financial market indices for extracting inferences on a holistic front. Additionally, estimation of state contingent multipliers would be integral for an optimal policy guidance in periods of macroeconomic distortions.

Multiple studies conducted so far for a group of countries (including India) have reported a high range for fiscal multiplier estimates and hence it is imperative to conduct an in-depth analysis of the assumptions and limitations of different methodologies, to ensure high degree of synchronization with the structure of economy in consideration.

In view of the same, for policy inputs, estimates for various components of expenditure from this study could be interpreted as an average multiplier impact. In this era of growing concerns of fiscal consolidation, this study suggests that expenditure should be reoriented towards sectors that stimulate further investment and have an impact for a longer time horizon such as physical and human capital formation[8]. Owing to higher multipliers for states, the central government could facilitate more options with lesser interest rates for funding capital building projects for the states. This could be packaged in a performance linked incentive funding structure. Central government could provide policy guidance to states for investing in areas that could boost exports and sales and hence enhanced revenues for states which could be reinvested for spending.

However, for a developing country like India with widespread inequalities and resource constraints, a calibrated balance between revenue expenditure and capital expenditure must be maintained with reorientation of quality and efficiency in plan implementation with an overarching consideration for investment in physical and human capital to reap the benefits of demographic dividend that India is witnessing.

[8] The Union Budget of 2022-23 for India has seen a significant growth in capital expenditure.

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Appendix

A. Information on variables used in the model

A.1 Description of the variable representations

Short representations of the variables in consideration are mentioned as follows:

GR_GDP: Growth rate of GDP at 2011-12 base year
GR_AGG_CE_OUTLAY_DEF: Growth rate of Aggregate (combined centre and states) Capital expenditure outlay (deflated)
GR_AGG_RE_DEF: Growth rate of Aggregate (combined centre and states) Revenue Expenditure (deflated)
GR_AGG_TAX_REV_DEF: Growth rate of Aggregate (combined centre and states) tax revenue (deflated)
GR_CG_CE_OUTLAY_DEF: Growth rate of Central Government Capital outlay (deflated)
GR_CG_RE_DEF: Growth rate of Central Government Revenue Expenditure (deflated)
GR_CG_TAX_REV_DEF: Growth rate of Central Government tax revenue (deflated)
GR_SG_CE_OUTLAY_DEF: Growth rate of State Government Capital outlay (deflated)
GR_SG_RE_DEF: Growth rate of State Government Revenue Expenditure (deflated)
GR_SG_TAX_REV_DEF: Growth rate of State Government tax revenue (deflated)

A.2 Average[9] of the ratio of GDP to fiscal variables

Output Variable	Fiscal Variable	Average Ratio
GDP	State Gov Capital Outlay (real)	62.12
GDP	State Gov Revenue Expenditure (real)	9.66
GDP	Central Gov Capital Outlay (real)	65.38
GDP	Central Gov Revenue Expenditure (real)	9.95
GDP	Aggregate Capital Outlay (real)	31.17
GDP	Aggregate Revenue Expenditure (real)	4.89

[9] Average of historical ratios (1972 -2019)

A.3 Descriptive statistics of the variables

Variable Name	Variable Description	Mean	Median	Maximum	Minimum	Std. Dev.
YEAR	Year			2019	1972	
GR_GDP	Growth rate of GDP at 2011-12 base year	5.37	5.80	9.19	-5.38	2.68
GR_AGG_CE_OUTLAY_DEF	Growth rate of Aggregate (combined centre and states) Capital expenditure outlay (deflated)	6.25	6.67	30.88	-13.88	10.51
GR_AGG_RE_DEF	Growth rate of Aggregate (combined centre and states) Revenue Expenditure (deflated)	7.00	6.82	18.53	-11.02	5.77
GR_AGG_TAX_REV	Growth rate of Aggregate (combined centre and states) tax revenue (deflated)	13.36	13.61	23.87	2.62	4.82
GR_CG_CE_OUTLAY_DEF	Growth rate of Central Government Capital outlay (deflated)	5.15	5.77	52.74	-41.83	16.96
GR_CG_RE_DEF	Growth rate of Central Government Revenue Expenditure (deflated)	6.72	7.53	21.73	-13.20	6.77
GR_CG_TAX_REV_DEF	Growth rate of Central Government tax revenue (deflated)	6.21	7.17	19.81	-15.76	8.00
GR_SG_CE_OUTLAY_DEF	Growth rate of State Government Capital outlay (deflated)	7.33	6.51	31.60	-10.75	9.65
GR_SG_RE_DEF	Growth rate of State Government Revenue Expenditure (deflated)	7.25	7.62	16.46	-16.18	5.65
GR_SG_TAX_REV_DEF	Growth rate of State Government tax revenue (deflated)	7.28	7.54	23.58	-5.51	5.59
REAL_INT	Annual CMR (adjusted for inflation)	1.88	2.43	13.91	-17.37	6.23
WGDP_GR_WB	World GDP growth	3.19	3.28	6.42	-1.31	1.38
PCT_YOY_INFLATION	Inflation based on WPI	6.92	6.21	25.20	-3.69	5.30

	index					
EX_RATE_US_DOLLAR_CHANGE	Change in exchange rate of rupee vis-a-vis dollar	-5.00	-4.49	8.74	-29.66	7.19
OUTPUT GAP	Difference of actual versus potential output					
Dummy_FRBM	Dummy takes the value 1 for years 2004-2007 else 0					
Dummy_GFC	Dummy takes the value 1 for years 2008- 2009 else 0					

B. Impulse Response Functions for various expenditure

Figure B1(a): Impulse Response Functions for State Government Capital Outlay Expenditure

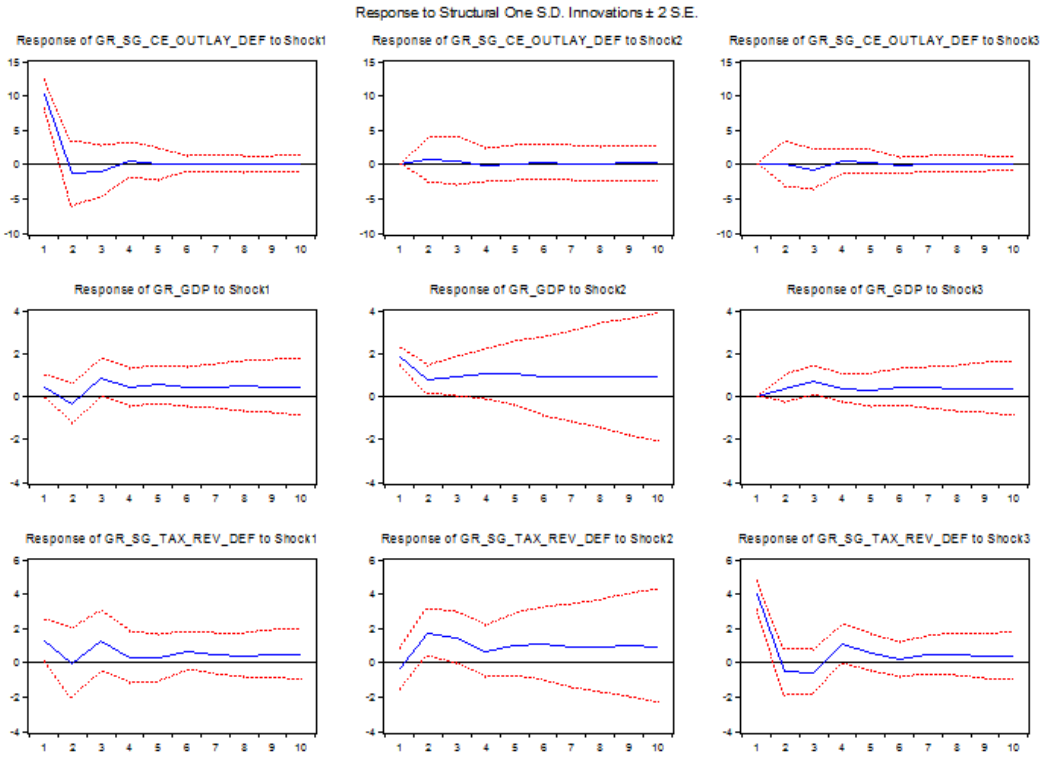

Table B1(a): Variance Decomposition for State Government Capital Outlay Expenditure

Variance Decomposition of GR_GDP:

Period	S.E.	GR_SG_CE_OUTLAY_DEF	GR_GDP	GR_SG_TAX_REV_DEF
1.00	1.90	5.59	94.41	0.00
2.00	2.12	7.32	89.74	2.94
3.00	2.58	16.67	73.08	10.24
4.00	2.83	15.80	74.15	10.04
5.00	3.07	16.44	74.22	9.34
6.00	3.27	16.39	73.50	10.11
7.00	3.45	16.29	73.27	10.45
8.00	3.62	16.40	73.18	10.42
9.00	3.78	16.47	73.00	10.53
10.00	3.92	16.46	72.88	10.66

Figure B1(b): Impulse Response Functions for State Government Revenue Expenditure

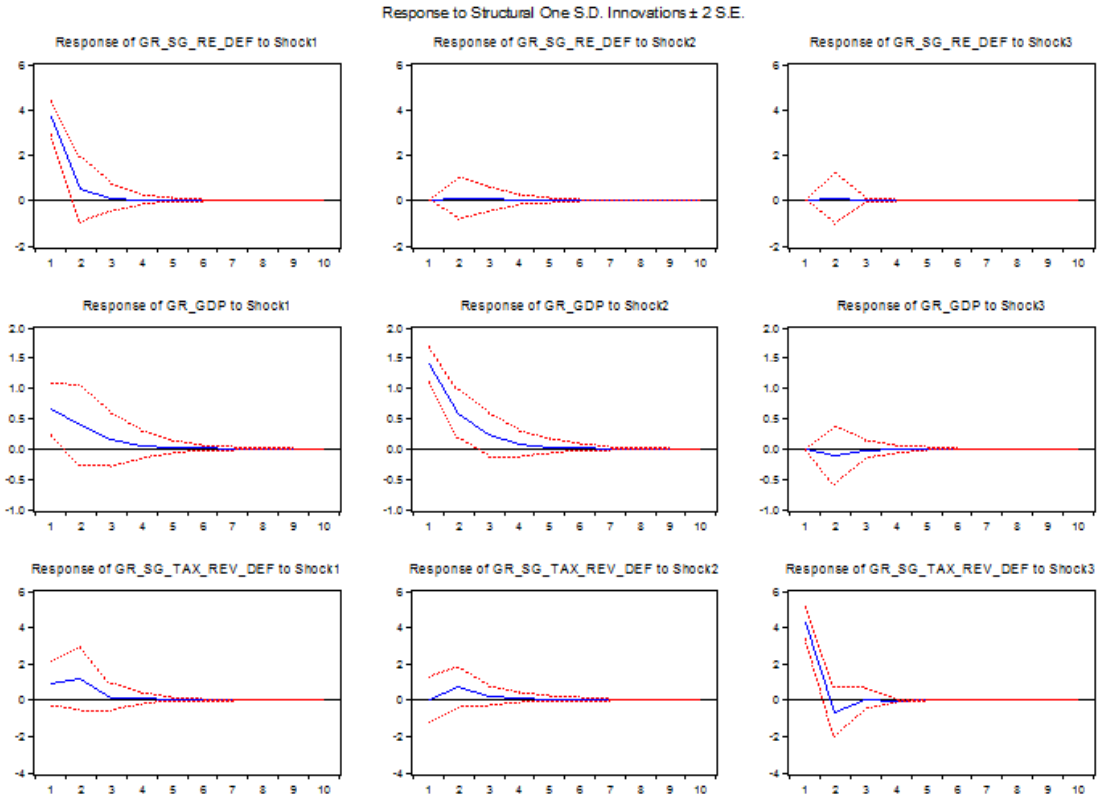

Table B1(b): Variance Decomposition for State Government Revenue Expenditure

Variance Decomposition of GR_GDP:

Period	S.E.	GR_SG_RE_DEF	GR_GDP	GR_SG_TAX_REV_DEF
1.00	1.55	18.14	81.86	0.00
2.00	1.70	20.18	79.43	0.39
3.00	1.72	20.43	79.17	0.40
4.00	1.72	20.47	79.12	0.40
5.00	1.73	20.48	79.12	0.41
6.00	1.73	20.48	79.12	0.41
7.00	1.73	20.48	79.12	0.41
8.00	1.73	20.48	79.12	0.41
9.00	1.73	20.48	79.12	0.41
10.00	1.73	20.48	79.12	0.41

Figure B2(a): Impulse Response Functions for Central Government Capital Outlay Expenditure

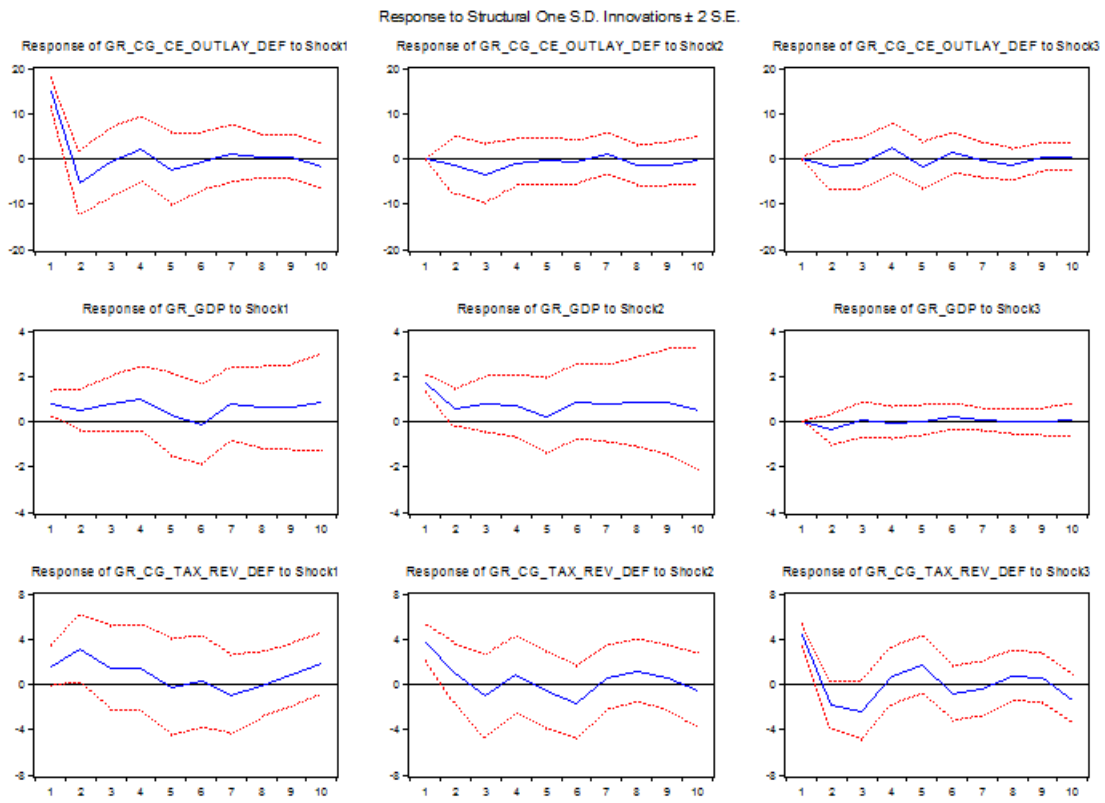

Table B2(a): Variance Decomposition for Central Government Capital Outlay Expenditure

Variance Decomposition of GR_GDP:

Period	S.E.	GR_CG_CE_OUTLAY_DEF	GR_GDP	GR_CG_TAX_REV_DEF
1.00	1.88	17.18	82.82	0.00
2.00	2.06	20.38	76.39	3.23
3.00	2.33	27.23	70.11	2.65
4.00	2.62	35.91	61.96	2.13
5.00	2.64	36.24	61.66	2.10
6.00	2.80	32.63	64.88	2.49
7.00	3.01	34.58	63.22	2.21
8.00	3.18	34.57	63.46	1.97
9.00	3.35	34.36	63.85	1.79
10.00	3.49	37.14	61.17	1.69

Figure B2(b): Impulse Response Functions for Central Government Revenue Expenditure

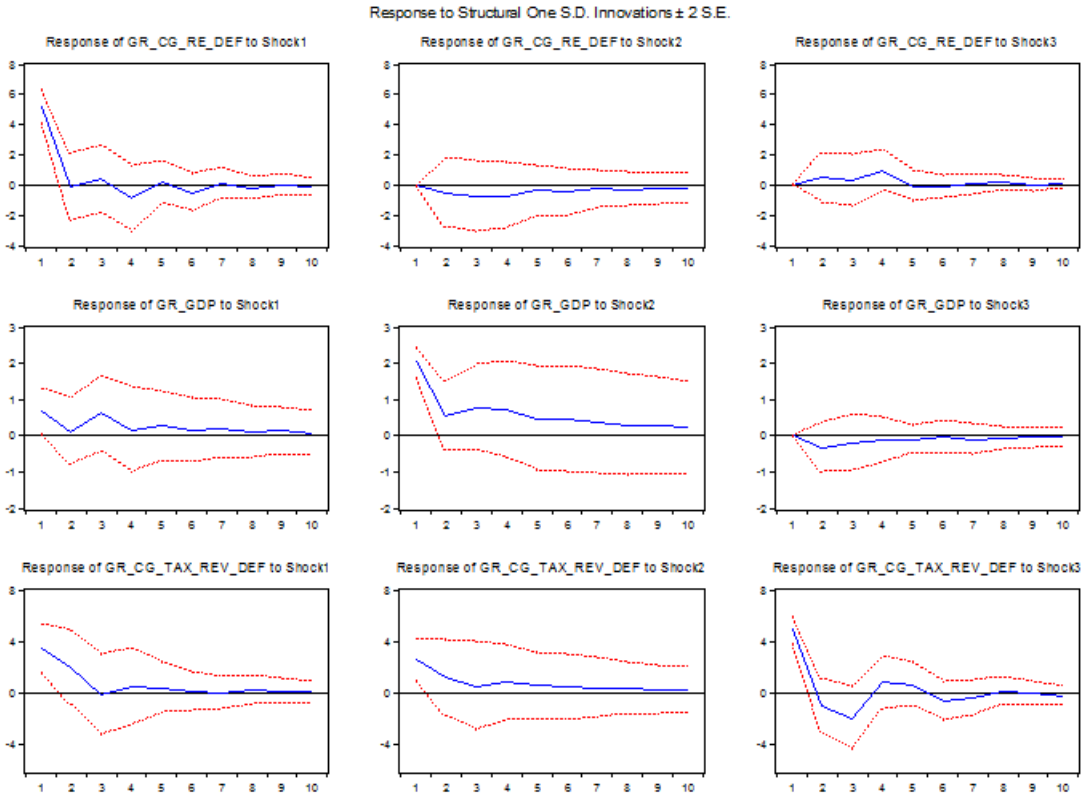

Table B2(b): Variance Decomposition for Central Government Revenue Expenditure

Variance Decomposition of GR_GDP:

Period	S.E.	GR_CG_RE_DEF	GR_GDP	GR_CG_TAX_REV_DEF
1.00	2.15	10.18	89.82	0.00
2.00	2.25	9.60	88.28	2.12
3.00	2.47	14.20	83.43	2.36
4.00	2.57	13.44	84.16	2.40
5.00	2.63	13.81	83.72	2.47
6.00	2.67	13.68	83.90	2.41
7.00	2.71	13.73	83.74	2.53
8.00	2.73	13.66	83.78	2.56
9.00	2.75	13.71	83.73	2.56
10.00	2.76	13.69	83.74	2.57

Figure B3(a): Impulse Response Functions for Aggregate Government Capital Outlay Expenditure

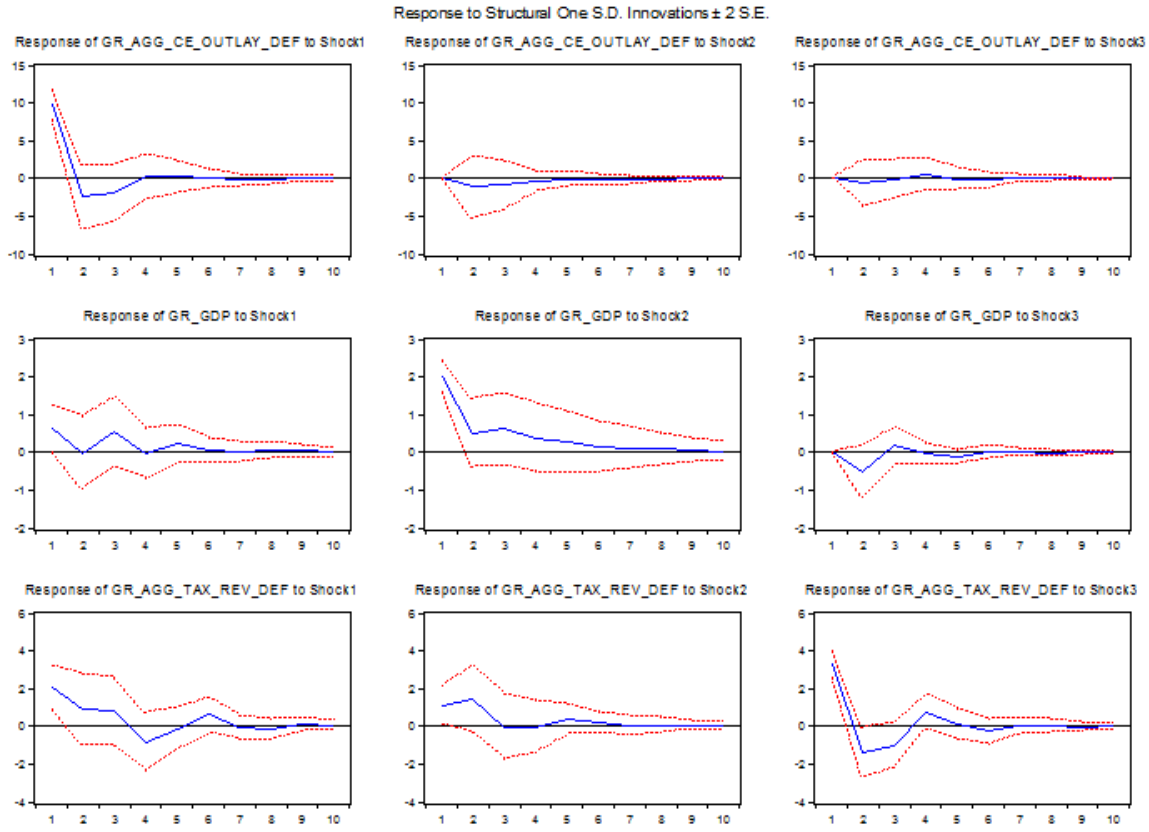

Table B3(a): Variance Decomposition for Aggregate Government Capital Outlay Expenditure

Variance Decomposition of GR_GDP:

Period	S.E.	GR_AGG_CE_OUTLAY_DEF	GR_GDP	GR_AGG_TAX_REV_DEF
1.00	2.11	9.06	90.94	0.00
2.00	2.23	8.13	86.85	5.01
3.00	2.38	12.34	82.74	4.92
4.00	2.41	12.04	83.15	4.81
5.00	2.44	12.69	82.41	4.90
6.00	2.45	12.71	82.41	4.88
7.00	2.45	12.68	82.45	4.87
8.00	2.45	12.71	82.42	4.87
9.00	2.45	12.72	82.41	4.87
10.00	2.45	12.72	82.42	4.86

Figure B3(b): Impulse Response Functions for Aggregate Revenue Expenditure

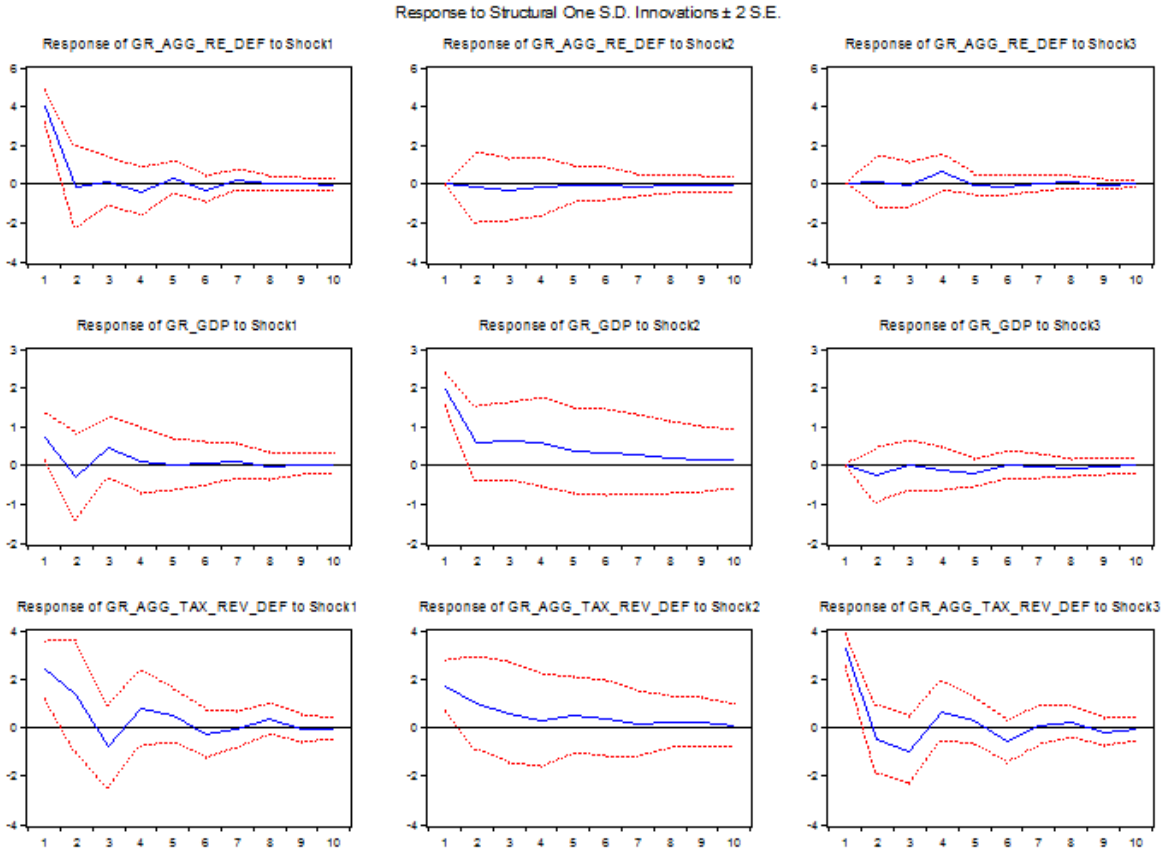

Table B3(b): Variance Decomposition for Aggregate Government Revenue Expenditure

Variance Decomposition of GR_GDP:

Period	S.E.	GR_AGG_RE_DEF	GR_GDP	GR_AGG_TAX_REV_DEF
1.00	2.11	12.40	87.60	0.00
2.00	2.21	12.98	85.82	1.20
3.00	2.34	15.19	83.74	1.07
4.00	2.42	14.39	84.39	1.22
5.00	2.46	13.96	84.21	1.83
6.00	2.48	13.76	84.44	1.80
7.00	2.49	13.73	84.46	1.81
8.00	2.50	13.63	84.45	1.92
9.00	2.51	13.58	84.48	1.93
10.00	2.51	13.56	84.51	1.93