Revisiting the Role of Fiscal Policy in Determining Interest Rates in India

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Abstract

The role of fiscal policy in affecting interest rates has been examined extensively in emerging market economies such as India. While the findings of the existing studies diverge, some suggesting crowding out while a few suggesting otherwise, the relationship is ever-evolving depending upon the structure of the economy and the strength of the financial markets. Hence, it is necessary to continuously validate some of the macro relations such as the relationship between fiscal policy and interest rates. Towards this, the present paper tries to revisit the empirical relationship by using the Structural Vector Autoregression and Toda-Yamamoto causality approach. The study tries to empirically examine and understand the transmission channel through which fiscal policy could affect short-term, medium-term and long-term interest rate in India. Our results suggest that the fiscal deficit has direct and indirect effects on the interest rates. While there appear to have a marginal impact in the short-term, however, through the indirect channel, i.e., through inflation, fiscal policy has a larger positive impact on interest rates in the long run. It also finds that shocks to foreign interest rate and inflation tend to increase interest rates in India. In terms of the policy, in the long run, there is a need for containing structural part of fiscal deficit within the Fiscal Responsibility and Budget Management (FRBM) framework.

Key Words: - Fiscal Deficit; Interest Rate; Structural Vector Autoregression (SVAR); India.

JEL Classification Codes: H62, E40, C32

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1. Introduction

The relationship between fiscal policy and interest rate is one of the most widely discussed, debated and unsettled issues in applied macroeconomics. It has remained an important issue for economists as well as policymakers due to mixed findings in the existing empirical literature. As part of economic reforms since 1991, there is a shift in interest rate regimes from an administered regime to a more market-determined interest rate in many emerging market economies such as India. In addition, through institutional reforms, financing of fiscal deficit has shifted from seigniorage financing to bond financing in India. Although there is still a very high Statutory Liquidity Ratio (SLR) mechanism, at present, the Governments compete for funds with other private borrowers in the market due to phasing out of automatic monetization of fiscal deficit. Hence, any rise in the fiscal deficit, given the constraints on money supply, is expected to put upward pressure on market interest rates.[1] Due to globalization and international financial market integration, the capital flows would make the domestic financial markets more volatile and vulnerable to the international shocks/recessions/cycles, which also result in interest rate parity across the countries.

During the 2008 financial crisis, as part of coordinated fiscal stimulus measures, India's fiscal deficit has widened. Did the stimulus lead to the persistence of fiscal deficits? If so, has it affected interest rates in India? Does it affect various domestic interest rates such as short term, medium term and long term interest rate in India? What are the channels through which fiscal deficit affects interest rates? If there is any such effect, will it be a short term and temporary one or will have permanent effects? These are all policy issues that need to be addressed empirically.

In the literature, there are basically two competing views that explain the relationship between budget deficits and interest rates. Some empirical studies find that government budget deficits have no significant effect on interest rates (Plosser, 1982; Evans, 1985; Hoelscher, 1986; Barro and Martin, 1990; Cheng, 1998; Garcia and Ramajo, 2004; Kelikume, 2016). Their arguments of no linkage or a decline in the sensitivity of

[1] In the standard neoclassical model, fiscal deficits (other things being given) reduce national savings and increase aggregate demand. This creates an excess supply of government debt, leading to higher real interest rates. Bond financing of fiscal deficit causes a supply of fresh government securities in the securities market. The increased supply of government securities (ceteris paribus) would put downward pressure on prices of these government securities. Hence, it drives up domestic interest rates.

interest rate to the fiscal deficit are based on global financial markets integration, global capital flow to finance the domestic deficit, and also under the paradigm of Ricardian Equivalence Theorem (Tanzi, 1985).[2]

In contrast, other studies find that government budget deficits have exerted a significant positive effect on interest rates (Tseng, 2000; Kiani, 2009; Cebula and Cuellar, 2010; Baldacci and Kumar, 2010; Ezeabasili and Mojekwu, 2011; Bonga, 2012; Claeys et.al., 2012; Kameda, 2014). These studies show that the impacts of budget deficits on interest rates operate through income and wealth effects on demand for money and shortage of funds available for investment (see Mohanty, 2016), i.e. a mismatch between intended investment and availability of supply of funds. Part of the conflicting results can be explained by differences in the choice of variables, methodology and sample period, while a large extent can also be explained by a change in economic structure and openness. Baldacci and Kumar (2010) found that higher deficits and public debt lead to a significant increase in long-term interest rates for a panel of 31 advanced and emerging market economies. However, the precise magnitude depended on initial fiscal, institutional and other structural conditions, as well as spillovers from global financial markets. Aisen and Hauner (2013) argued that the effect of budget deficits on interest rates was only significant under one of several conditions, i.e., for high deficits, mostly domestically financed, interacting with high domestic debt, low financial openness, liberalized interest rates and low financial depth.

The literature on fiscal deficit and interest rate are extensively studied for developed countries.[3] In the case of India, there are few empirical studies that have focused on the link between fiscal deficit and interest rates. Chakraborty (2002) attempted to address this empirical linkage and suggested that deficit does not induce interest rate in India, rather the causality runs from interest rate to fueling fiscal deficit. Goyal (2004) re-examined this linkage by incorporating monetary variables and found similar results. Das (2004) also found that interest rates do not necessarily depend on fiscal deficit in India

[2] However, the linkage between fiscal deficit and interest rates may become weaker due to free capital mobility among economically integrated countries, and offset any interest rate differentials. Then, rate of interest does not increase as a result of fiscal expansions because foreign savings replace domestic savings. In an open economy, reduction in national savings may be complemented over a period of time by capital inflows leading to real exchange rate appreciation rather than higher real interest rates (Gale and Orszag, 2002). If economic agents behave like 'Ricardian Equivalence' manner, i.e., their savings increase in anticipation of future tax hikes to fulfill the inter-temporal budget constraint, then it may reduce the impact of fiscal deficit on interest rates. Similarly, if an economy has excess capacity, high domestic savings, highly developed financial market or passing through a severe recession, then fiscal deficit-interest rates linkage may become weaker.

[3] The selected studies on this issue are given in the appendix section (Table 1).

and for a number of other countries in the world. As the relationship between fiscal deficit and interest rate could change due to a change in institutional structure as well as shocks (Global Financial Crisis), there is a need to re-validate this issue in India. Thus, the objective of the paper is to empirically examine and understand the transmission channel through which fiscal deficit would affect various domestic interest rates in India. It also undertakes causality analysis between the interest rate and other selected variables by dividing the total sample into pre and post-financial crisis period.

The study uses the most recent data from 1996:Q1 to 2018:Q3 through Structural Vector Autoregression (SVAR) method to examine the relationship between the fiscal deficit and interest rate in India. The direction of causality among the variables is analyzed for both pre-crisis and post-crisis period. In contrast with the existing studies on India, which finds no linkage between fiscal deficit and rate of interest, the study finds that fiscal deficit has a positive impact on interest rate through both direct (short term) and indirect channel (long term).

The rest of the paper is organized as follows. Section 2 presents the analytical framework for model specification. Section 3 describes the data and the methodology used in the analysis. Empirical results are presented and analyzed in Section 4. Section 5 presents a summary of concluding remarks and recommendations.

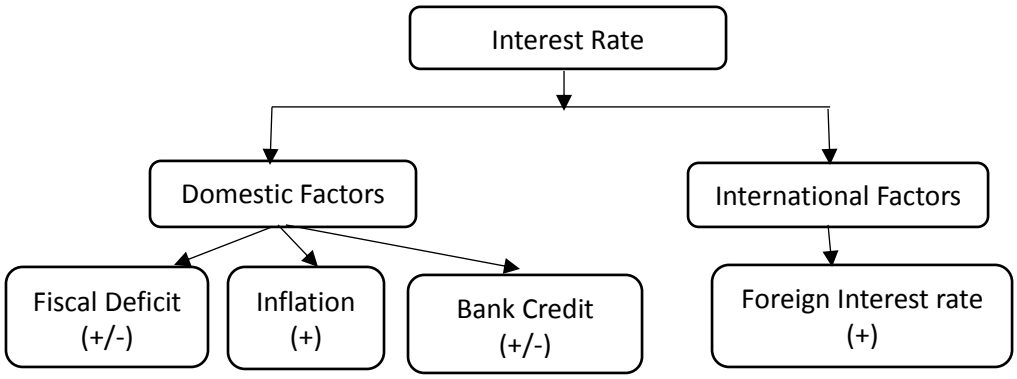
2. Analytical framework

There exist three different theoretical paradigms to explain the linkage between budget deficit and interest rate, i.e. Neo-classical, Keynesian and Ricardian. The Neo-classicals state that a rise in budget deficit leads to an increase in interest rate. The Keynesians envisage that though an increase in budget deficit raises the interest rate, such an increase in interest rate also stimulates savings and capital formation. Hence, timely fiscal deficit may have a beneficial effect on the economy. But the Ricardian Equivalence Theorem (RET) argues that deficit merely postpones taxes for future tax liabilities and therefore tax-financing and debt-financing of deficit have equal impact on the economy. Therefore, the deficit does not have any impact on the interest rate (Barro, 1974).

India, although not a fully open economy, has been increasingly opening the economy for foreign participation. Therefore, the domestic interest rates in India might depend on both domestic and foreign factors. Within domestic factors, the interest rate

can be determined by fiscal and/or monetary policy. We have taken fiscal deficit as an instrument for fiscal policy, and growth of bank credit to the commercial sector and inflation rate as relevant variables for monetary policy. Similarly, the foreign interest rate is chosen as a proxy for international factors. Literature on interest rate determination, especially by Edwards and khan (1985) for emerging countries and Bhattacharya et al. (2008) for India, have identified many factors such as foreign interest rates, domestic inflation expectations, forward premium, country risk premium, exchange rate expectations, money supply, income, yield spread, credit disbursement, foreign institutional investments, etc. However, due to data constraint, less observation and the SVAR framework, we have selected only a few major variables, based on our objective, for carrying out the empirical analysis. The analytical framework that explains the relationships among the selected variables are shown in Chart 1.

Chart-1: Analytical Framework



Source: Author's Interpretation

Section 1 of this paper has explained clearly the channels through which fiscal deficit affects the interest rate. Bhanumurthy and Agarwal (2003) showed that the Fisher relation[4] is still valid in the Indian context. Dua and Pandit (2002) found that foreign interest rates play a major role in determining interest rates in India. This finding is also supported by Bhattacharya et al., (2008) in India. The impact of monetary policy on interest rate is well addressed in the literature. Here, we have used the growth rate of bank credit to the commercial sector to verify the credit channel of interest rate determination.

Following the analytical framework (as derived in chart-1), the models used in the literature such as Edwards and Khan (1985), Dua and Pandit (2002), Bhattacharya et al.

[4] Fisher relation elucidates that the nominal interest rates will tend to change at the same rate as change in expected inflation.

(2008), and based on data availability, it has used the following reduced-form specification for the domestic interest rate in India.

$$\text{Interest rate} = f(\text{foreign interest rate, fiscal deficit, bank credit, inflation}) \ldots \ldots \ldots (1)$$

A priori, the foreign interest rate is expected to have a positive impact on the domestic interest rate. Unless domestic interest rates move with international interest rates, it would have an impact on the capital flows. The expected signs of the fiscal deficit would be ambiguous, which depend on various structural and cyclical factors such as excess capacity, domestic saving, a condition in the financial markets, recession in the economy etc. Growth of bank credit to the commercial sector might have ambiguous effects on the domestic interest rate. If the growth of bank credit enhances money supply, it will have a negative effect on interest rate while, if the commercial sector demands more credit, it will have a positive impact on the interest rate. The inflation rate is likely to have a positive impact on nominal interest rates. Otherwise, a rise in the expected inflation rate would bring down real interest rates and consequently distort savings and investment in the economy. In the next section, we describe the data and methodology used for the estimation of eq-(1).

3. The Data and Methodology

3.1. The Dataset

The study has used various term interest rates such as 15-91 days Treasury bill rate, and yields on 1-year, 5-year and 10-year government of India securities. It has used quarterly time series data from 1996:Q1 to 2018:Q3 for the empirical analysis[5]. The data on domestic variables such as the selected interest rates, fiscal deficit, bank credit to commercial sector and inflation are obtained from the "*Handbook of Statistics on the Indian Economy*", Reserve Bank of India (RBI). It has considered 15–91 days Treasury bill rate (YTBR) and the yield on 1-year government of India securities (YLDO) as a proxy for short term interest rate, the yield on 5-year government of India securities (YLDF) as a proxy for medium term interest rate, and yield on 10-year government of India securities (YLDT) as a proxy for long term interest rate. The inflation rate (INFL) is calculated from the GDP deflator. As high-frequency data on the fiscal deficit has a wide variation and also unreliable, we have used the growth rate of bank credit to government sector (BCGV) as a

[5] Note: Q1, Q2, Q3 and Q4 denote April to June, July to September, October to December and January to March quarters, respectively.

proxy for fiscal deficit in this study. The fiscal deficit is largely financed by borrowing from markets as automatic monetization of fiscal deficit was phased out by 1997. Thus, bank credit to the Government sector might be a good proxy for fiscal deficit. It has also used the growth of bank credit to the commercial sector (GBCC) to verify the credit channel of monetary policy. Federal treasury bill rates of 3-months (FTBR) and 1-year federal reserve treasury bill rate (FYLDO), 5-year federal reserve treasury bill rate (FYLDF) and 10-year federal reserve treasury bill rate (FYLDT) are used as proxies for foreign interest rate and are collected from the Federal Reserve Bank of USA website.

For a better understanding of the dynamic relationship between fiscal deficit and interest rate, causality analysis is being carried out in both pre-global financial crisis (from 1996:Q1 to 2007:Q4) and post-global financial crisis (2009:Q1 to 2018:Q3). The causality analysis helps in answering the crucial question of whether the global financial crisis had any differential impact on domestic interest rate in India. The analysis is carried out for various nominal interest rates. The trend in the selected domestic interest rates are plotted in Figure 1 (appendix). It shows that while there is a co-movement between the interest rates (both short and long term) in the initial period of reform, however, there is divergence immediately after the crisis period. What are the factors that explain such fluctuations in interest rates? Is it due to domestic factors or due to fluctuation in the global financial market? If so, what are these domestic factors, which explain the variation in these interest rate? This paper tries to address these issues using an SVAR framework, which is explained in the subsequent section.

3.2. Methodology

3.2.1. Specification of the SVAR Model

The SVAR methodology is adopted to examine the linkage between fiscal deficit and interest rate along with other relevant macro variables in India. Here, the equation (1), which defines domestic interest rate as a function of foreign interest rate, fiscal deficit, bank credit to the commercial sector, inflation, and itself is examined with the SVAR framework as follows.

$$INTR_t = F(U_t^{FOIN}, U_t^{BCGV}, U_t^{GBCC}, U_t^{INFL}, U_t^{INTR}) \dots\dots\dots\dots\dots (2)$$

Since the structural shocks in equation (2) are unobservable, additional identifying restrictions are necessary to uncover the underlying structural shocks in the model. A

five-variable VAR[6] model has been considered in order to extract the five structural shocks.

In matrix notation,

$$B_0 Y_t = a + B(L)Y_{t-1} + U_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (3)$$

The corresponding reduced form is:

$$A(L)Y_t = a + \varepsilon_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (4)$$

Where,

$A(L) = B_0^{-1}B(L)$ and $\varepsilon_t = B_0^{-1} U_t$; Y_t be a five-element vector of the endogenous variables; a is the vector of constant; ε_t is the vector of VAR residuals and U_t is the vector of structural shocks. Then, the structural VAR model may be written as $A\varepsilon_t = BU_t$.[7] The structural innovation U_t is assumed to be orthonormal, i.e., its covariance matrix is an identity matrix, $[E[U_t U_t'] = I$. In order to identify A and B, at least $n(3n-1)/2$ restrictions have to be imposed to exactly identify the system. The following restrictions are imposed in this study for identifying the effects of structural shocks. Shocks to foreign interest rate, fiscal deficit, growth of bank credit and inflation are assumed to affect the domestic interest rate. Hence, it is determined endogenously in the system. Inflation is assumed to be affected by shocks to fiscal deficit and growth of bank credit. Increase in fiscal deficit and growth of bank credit imply a rise in money supply in the economy, which tend to increase inflation in the economy. Growth of bank credit to the commercial sector is assumed to be affected by a rise in the fiscal deficit. An increase in fiscal deficit requires fresh financing. Market borrowing constitutes a major portion of deficit financing in India. Given the availability of resources, any increase in public borrowing would affect the availability of credit to other non-government agencies. Shocks to other variables in the system have no short run effects on the foreign interest rate and also on fiscal deficit. Here, restrictions are imposed to make the variables as a simple autoregressive process.

The SVAR model derives from the above-mentioned restrictions, can be specified as follows:

[6] The order of the unrestricted VAR has been determined as six according to the Akaike Information Criterion (AIC) and stability condition is satisfied.

[7] ε_t and U_t are vectors of observed (reduced form) residuals and unobserved structural shocks respectively. A and B are 5th matrices which fix the linear relationship between structural shocks and the VAR residuals.

$$\begin{bmatrix}1 & 0 & 0 & 0 & 0\\ 0 & 1 & 0 & 0 & 0\\ 0 & 0 & 1 & 0 & 0\\ 0 & 0 & 0 & 1 & 0\\ 0 & 0 & 0 & 0 & 1\end{bmatrix}\begin{bmatrix}e_t^{FOIN}\\ e_t^{BCGV}\\ e_t^{GBCC}\\ e_t^{INFL}\\ e_t^{INTR}\end{bmatrix}=\begin{bmatrix}1 & 0 & 0 & 0 & 0\\ 0 & 1 & 0 & 0 & 0\\ 0 & a_{GBCC}^{BCGV} & 1 & 0 & 0\\ 0 & a_{INFL}^{BCGV} & a_{INFL}^{GBCC} & 1 & 0\\ a_{INTR}^{FOIN} & a_{INTR}^{BCGV} & a_{INTR}^{GBCC} & a_{INTR}^{INFL} & 1\end{bmatrix}\begin{bmatrix}U_t^{FOIN}\\ U_t^{BCGV}\\ U_t^{GBCC}\\ U_t^{INFL}\\ U_t^{INTR}\end{bmatrix} \quad \text{.....(5)}$$

Where, the coefficient of a_{GBCC}^{BCGV} is the response of bank credit to the commercial sector due to unexpected shock of fiscal deficit, a_{INFL}^{BCGV} and a_{INFL}^{GBCC} are the response of inflation due to structural shock of fiscal deficit and bank credit to the commercial sector respectively. a_{INTR}^{FOIN}, a_{INTR}^{BCGV}, a_{INTR}^{GBCC} and a_{INTR}^{INFL} are the response of domestic interest rate due to structural shocks to foreign interest rate, fiscal deficit, bank credit to the commercial sector, inflation respectively. The empirical analysis is discussed in the next section.

4. Empirical Analysis

This section presents the unit root tests along with impulse response functions and variance decomposition analysis from the SVAR model.

4.1. Unit Root Tests

The Augmented Dickey-Fuller (ADF), Phillips-Perron (PP) and Kwiatkowski, Phillips, Schmidt, and Shin (KPSS) unit root tests are conducted to check the order of integration of these variables. The estimated unit root results show that all these variables are stationary at their levels, i.e., I (0) (See Table 2 in Appendix). The null hypothesis of no unit root is rejected at their levels (except GBCC) by the ADF and PP test. Similarly, KPSS unit root test also does not reject the null of stationary at their levels for all the selected variables. Thus, these variables are stationary and integrated of the same order, i.e., I (0).

4.2. Structural Parameter Estimates

Table 3 shows that the coefficients of the response of all these selected interest rates due to structural shock of fiscal deficit (BCGV) are positive and statistically significant. It shows that the impact is relatively higher on long term interest rates than on short term interest rates. In other words, persistently high fiscal deficit, which makes the Government to issue long term bonds and securities for financing, could put upward pressure on long term interest rates.

Table 3: Structural Parameter Estimates

Variable	YTBR		YLDO		YLDF		YLDT	
	Coefficient	S.E	Coefficient	S.E	Coefficient	S.E	Coefficient	S.E
FOIN	0.28**	0.11	0.21*	0.11	0.28**	0.11	0.31**	0.11
BCGV	0.39***	0.13	0.29**	0.12	0.36**	0.13	0.49***	0.14
GBCC	0.11	0.12	0.14	0.12	0.11	0.12	0.20	0.13
INFL	0.52***	0.12	0.46***	0.12	0.49***	0.12	0.56***	0.12

Note: *, **, and *** shows significance levels at 10%, 5% and 1% respectively.
Source: Author's Calculation.

Similarly, the results also show that the response of the selected interest rates due to structural shock of foreign interest rate (FOIN) is also significant and positive. Such positive impact of foreign interest rate on most of the domestic interest rates is expected because any difference between domestic and foreign interest rate would cause flow (outflow or inflow depending on the difference) of capital from the domestic economy. However, it shows that the growth of bank credit does not have any significant impact on any of the domestic interest rates. The estimated result also shows that the structural shock of inflation on all these interest rates are positive and highly significant. It implies that higher the inflation, higher will be the nominal interest rates in the economy. The results from estimated impulse response functions are discussed in the next section.

4.3. Impulse Response Analysis

The impulse response analysis of interest rate due to one standard deviation shocks to foreign interest rate, fiscal deficit, bank credit, inflation, and its own shock within the SVAR framework is described here. The impulse response analysis has been estimated over twelve quarter horizons.

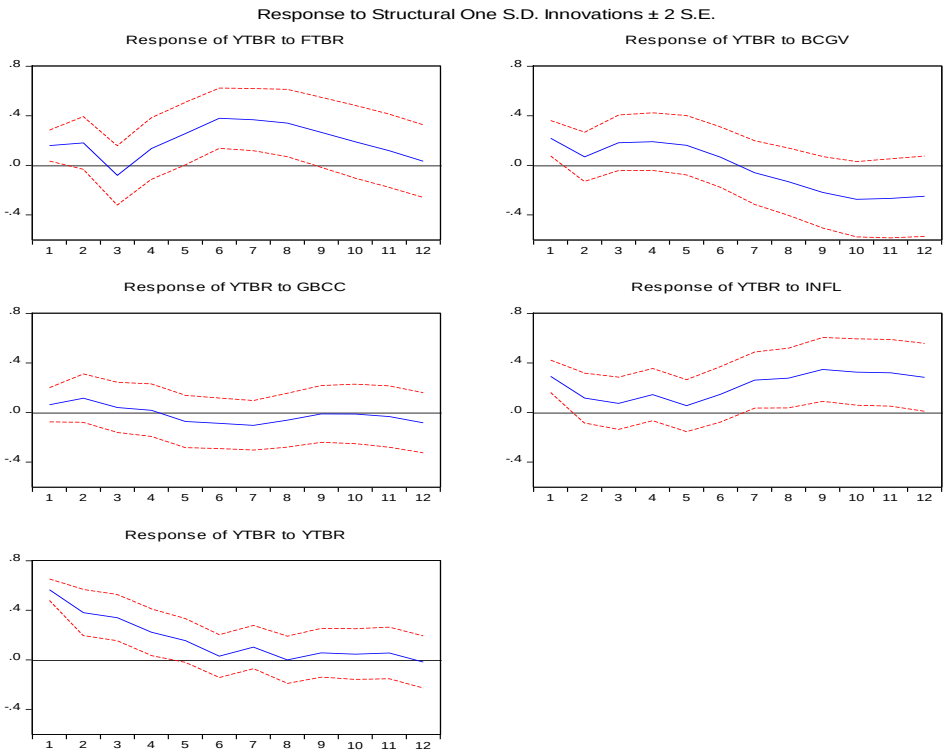
4.3.1. Impulse Response Analysis of Short Term Interest Rate

Figure 2 and figure 3 show the impulse response function of short term interest rates, i.e., 15-91 Treasury bill rate (YTBR) and Yield on 1-year Government securities (YLDO) respectively.

Shock to fiscal deficit has a positive impact on both short term interest rates up to the 2nd quarter, which implies that fiscal deficit has a temporary effect on short term interest rates. Fiscal deficit accumulates borrowing requirement of the government. The

consequent rise in public debt with the issue of fresh government bonds and securities pushes up interest rates in the economy. A shock to foreign interest rate[8] tends to increase both short term interest rates, it has remained positive over the following quarters. As described earlier, any large difference between the foreign interest rate and domestic interest rates could affect the foreign capital flows in the short term. A shock to the growth of bank credit has a negligible effect on the selected short term interest rate. Shock to inflation has a very significant positive effect on both short term interest rates, which would continue for a long time horizon. It responds positively to its own shock and it declines gradually over quarters.

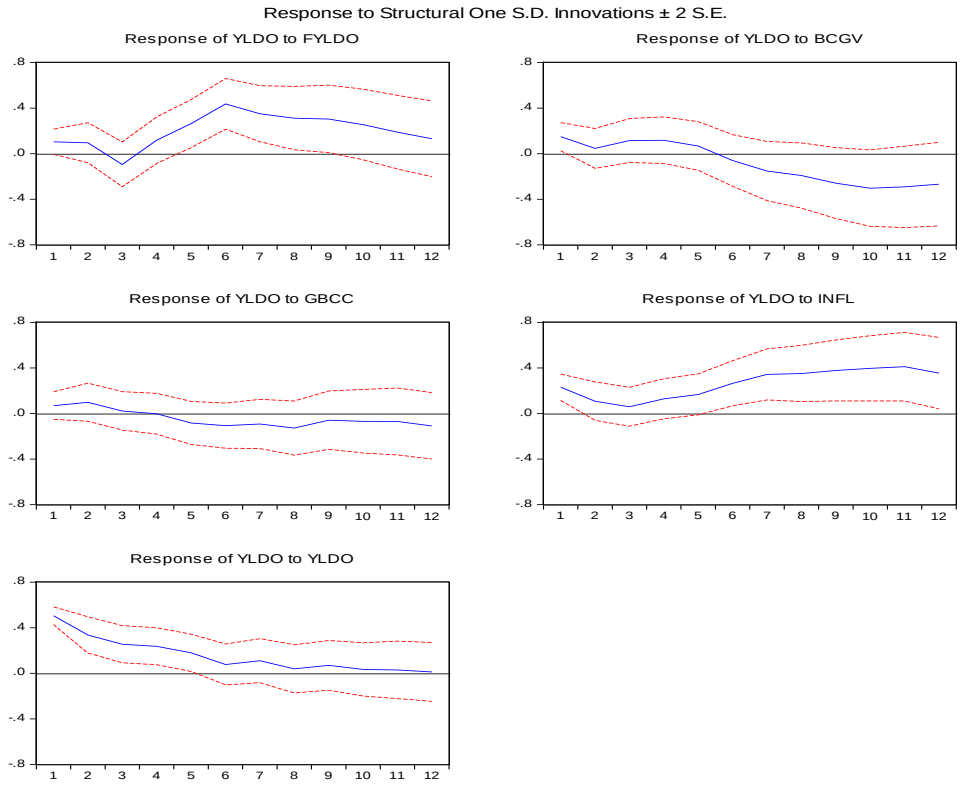
Figure 2. The impulse Response Function of Yield on 15-91 Treasury Bill Rate



Source: Authors calculation

[8] 3-month Federal Treasury bill rates is used as a proxy for foreign interest rate in the YTBR SVAR model, while 1-year Federal Reserve Treasury bill rate is used in the YLDO SVAR model.

Figure 3. The Impulse Response Function of Yield on 1-Year Government Securities



Source: Authors calculation

4.3.2. Impulse Response Analysis of Medium Term Interest Rate

Figure 4 presents previously defined shocks to yield on 5-year government securities (YLDF). One standard deviation innovation to fiscal deficit tends to increase the medium term interest rate for a shorter period (up to Q2), then it decreases to zero for the following quarters. Shock to foreign interest rate[9] and inflation have a positive and significant impact on it for a longer horizon. Similar to the earlier results, bank credit has a negligible influence on it. It responds positively to its own shocks.

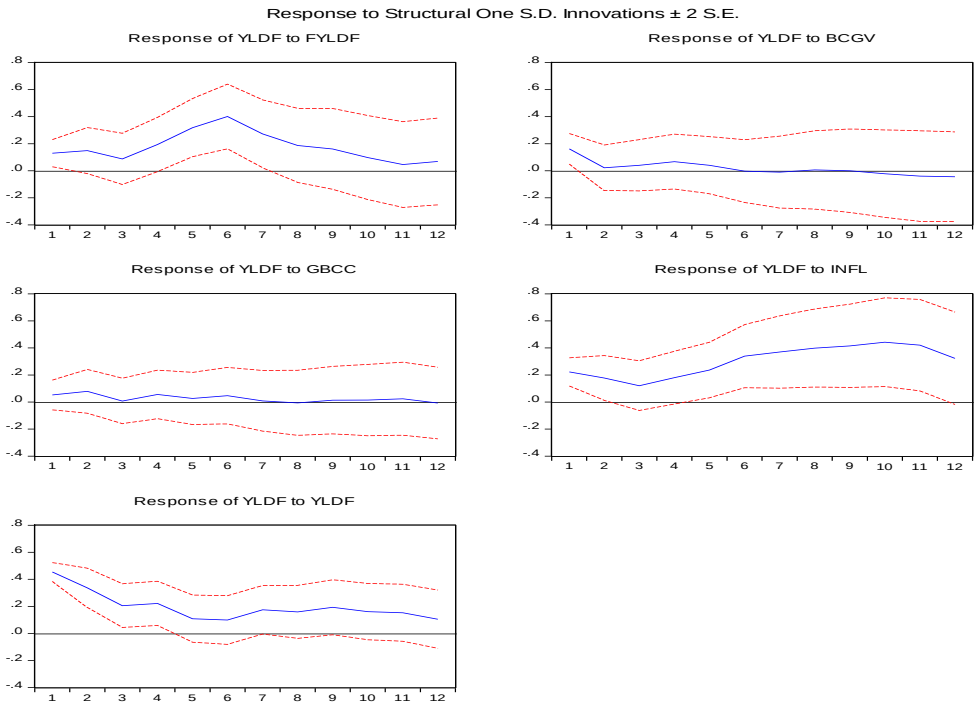
4.3.3. Impulse Response Analysis of Long Term Interest Rate

Figure 5 describes the impulse response analysis of yield on 10-year government securities (YLDT) due to shocks to foreign interest rate, fiscal deficit, bank credit, inflation, and its own shock. A shock to fiscal deficit tends to have a positive effect on it for the initial

[9] 5-year Federal Reserve Treasury bill rate are is used as a proxy for foreign interest rate in the YLDF model.

2 quarter, consistent with the earlier findings. It responds positively to inflationary shock. As expected, a shock to the foreign interest rate[10] has a positive and significant impact on long term interest rate. Similar to earlier results, bank credit has an insignificant effect on the long term interest rate. A positive effect on long term interest rate is observed to its own shock.

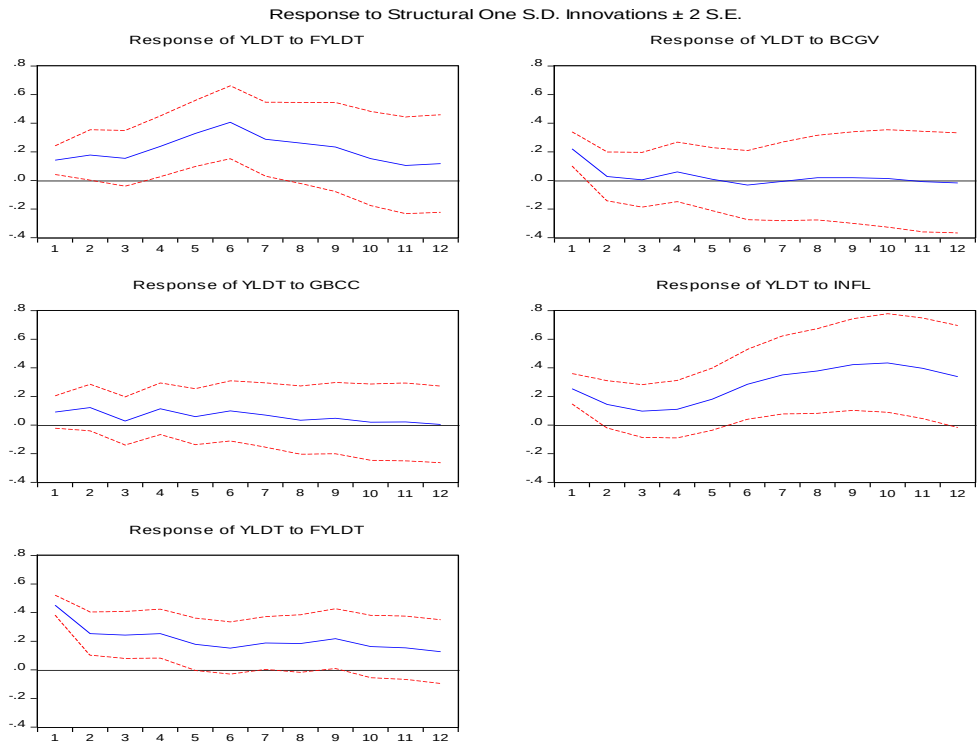
Figure 4. The Impulse Response Function of Yield on 5-Year Government Securities



Source: Authors calculation

[10]10-year Federal Reserve treasury bill rate are is used as a proxy for foreign interest rate in the YLDF model.

Figure 5. The Impulse Response Function of Yield on 10-Year Government Securities



Source: Authors calculation

Thus, the impulse response analysis suggests that a rise in fiscal deficit tends to raise the short, medium and long term interest rate for a temporary period. Later, it does not affect directly in the following quarter.

4.4. Variance Decomposition Analysis

Variance decomposition is a useful tool to provide information about the relative importance of each of the shocks in the system. It separates the variation in an endogenous variable into the component shocks to the system. Table 4 reports the percentage of the forecast error variance of the selected interest rates due to shocks in the structural VAR model for one quarter, fourth quarter, eighth quarter, and twelfth quarter horizon in the future.

Table 4. Variance Decomposition of Selected Domestic Interest Rate

15-91 Treasury Bill Rate (YTBR)						
Period	**S.E.**	**FTBR**	**BCGV**	**GBCC**	**INFL**	**YTBR**
1	0.37	5.27	9.94	0.81	17.66	66.32
4	0.94	8.48	12.46	1.96	12.76	64.33
8	1.38	31.56	10.04	2.71	17.12	38.57
12	1.53	26.33	16.96	2.17	27.87	26.66
1 year Government Securities (YLDO)						
Period	**S.E.**	**FYLDO**	**BCGV**	**GBCC**	**INFL**	**YLDO**
1	0.40	3.15	6.40	1.36	15.33	73.77
4	0.93	6.26	7.51	2.16	12.340	71.66
8	1.42	31.42	7.20	3.52	25.42	32.44
12	1.63	26.03	15.49	2.98	36.08	19.42
5 year Government Securities (YLDF)						
Period	**S.E.**	**FYLDF**	**BCGV**	**GBCC**	**INFL**	**YLDF**
1	0.48	5.55	8.72	0.90	16.42	68.39
4	0.86	12.57	4.92	1.82	19.16	61.52
8	1.17	28.66	2.19	0.96	37.43	30.77
12	1.32	20.89	1.63	0.68	52.20	24.60
10 year Government Securities (YLDT)						
Period	**S.E.**	**FYLDT**	**BCGV**	**GBCC**	**INFL**	**YLDT**
1	0.44	5.82	14.04	2.40	18.64	59.10
4	0.77	18.35	7.35	5.14	14.86	54.30
8	0.98	33.37	3.26	3.37	29.14	30.85
12	1.10	26.10	2.19	2.35	44.50	24.86

Source: Authors calculation

The results indicate that 66.32 per cent of variations in YTBR is explained by its own shock in the first quarter. Shocks to inflation, fiscal deficit and foreign interest rate contribute nearly 18 per cent, 10 per cent, 23.97 per cent and 5 per cent of variations respectively in the YTBR in the first quarter. In the longer horizon, inflation (27.87%), foreign interest rate (26.33%) and its own shock (26.66%) explains major variations in YTBR. Fiscal deficit explains nearly 17 per cent of variations in it. However, YLDO is largely influenced by its own shock (nearly 74%) followed by inflation shock, and fiscal deficit shock in the short run, while in the long run horizon inflation, foreign interest rate shock plays a more important role along with fiscal deficit shock, and its own shock. Fiscal deficit shock contributes only 15.49 per cent of variations in YLDO in the long run horizon.

Variation in the medium term and the long term interest rates are explained mostly by their own shock followed by inflation and fiscal deficit in the first quarter. Shocks to fiscal deficit explain nearly 9 per cent and 14 per cent of the variations in the medium term and the long term interest rates respectively in the first horizon. In the long run horizon, a shock to inflation explains significant variation in both of the interest rates followed by

its own shock and foreign interest rate. Shock to bank credit has played a negligible role in explaining the variation of all the selected interest rate.

Overall, the variance decomposition results find that all the selected interest rates are highly explained by its own shock, inflation and fiscal deficit in the short horizon, while these are explained by inflation, foreign interest rate and itself in the longer horizon. The following section discusses the causality between domestic interest rate, fiscal deficit, inflation and bank credit.

4.5: Testing Casual Relationship in Pre- and Post-Global Financial Crisis Period

The global financial crisis of 2008 had an adverse impact on world economies. It had a relatively little impact on India for which it recovered quickly from the slowdown in the economy. However, the fiscal deficit in India has widened after the global financial crisis because of various fiscal stimulus package implemented to counter the ill effects of the global crisis on the economy. Money and credit markets had been affected indirectly through the dynamic linkages. In our context, to capture the macroeconomic impact of the global financial crisis and also to substantiate SVAR results, we try to compare the causality between domestic interest rate, fiscal deficit, inflation and bank credit in the pre-crisis period (1996:Q1 to 2007:Q4) and the post-crisis period (2009:Q1 to 2018:Q3).

Our earlier SVAR results confirm the relationship between these selected variables during the sample period. It would be very important to know the direction of the causal relationship between the variables of interest, i.e., whether it is unidirectional or bidirectional. Therefore, a modified version of the Granger causality test proposed by Toda and Yamamoto (T-Y, 1995) is applied to examine the direction of the causal relationship between domestic interest rate with fiscal deficit, inflation and bank credit.[11]

The T-Y approach is carried out in the following VAR system:

[11] The advantage of this test is that it can be applied to all series, i.e., I (0), I (1) or I (2), and whether these series are cointegrated or not-cointegrated. This approach fits a standard vector autoregressive (VAR) model in the levels of the variables, irrespective of their level of integration. Thus, the risk associated with the possibility of wrongly identifying the integration order of the series is minimized. The first step is that the order of integration (d_{max}) of the series under consideration and the optimal lag, k has to be determined. Then a ($k+d_{max}$) order of VAR is estimated, and the coefficients of the last lagged d_{max} vector are ignored. The application of the Toda and Yamamoto (1995) procedure ensures that the usual test statistic for Granger causality has the standard asymptotic distribution, where valid inference can be made.

Between Interest Rate and Fiscal Deficit

$$INTR_t = \alpha_0 + \sum_{i=1}^{k} \alpha_1 INTR_{t-i} + \sum_{i=k+1}^{d_{max}} \alpha_2 INTR_{t-i} + \sum_{i=1}^{k} \beta_1 BCGV_{t-i} + \sum_{i=k+1}^{d_{max}} \beta_2 BCGV_{t-i} + \epsilon_{1t} \dots\dots (6)$$

$$BCGV_t = \gamma_0 + \sum_{i=1}^{k} \gamma_1 BCGV_{t-i} + \sum_{i=k+1}^{d_{max}} \gamma_2 BCGV_{t-i} + \sum_{i=1}^{k} \delta_1 INTR_{t-i} + \sum_{i=k+1}^{d_{max}} \delta_2 INTR_{t-i} + \epsilon_{2t} \dots\dots (7)$$

Between Interest Rate and Inflation

$$INTR_t = \alpha_0 + \sum_{i=1}^{k} \alpha_1 INTR_{t-i} + \sum_{i=k+1}^{d_{max}} \alpha_2 INTR_{t-i} + \sum_{i=1}^{k} \beta_1 INFL_{t-i} + \sum_{i=k+1}^{d_{max}} \beta_2 INFL_{t-i} + \epsilon_{3t} \dots\dots (8)$$

$$INFL_t = \gamma_0 + \sum_{i=1}^{k} \gamma_1 INFL_{t-i} + \sum_{i=k+1}^{d_{max}} \gamma_2 INFL_{t-i} + \sum_{i=1}^{k} \delta_1 INTR_{t-i} + \sum_{i=k+1}^{d_{max}} \delta_2 INTR_{t-i} + \epsilon_{4t} \dots\dots (9)$$

Between Interest Rate and Bank Credit

$$INTR_t = \alpha_0 + \sum_{i=1}^{k} \alpha_1 INTR_{t-i} + \sum_{i=k+1}^{d_{max}} \alpha_2 INTR_{t-i} + \sum_{i=1}^{k} \beta_1 GBCC_{t-i} + \sum_{i=k+1}^{d_{max}} \beta_2 GBCC_{t-i} + \epsilon_{5t} \dots\dots (10)$$

$$GBCC_t = \gamma_0 + \sum_{i=1}^{k} \gamma_1 GBCC_{t-i} + \sum_{i=k+1}^{d_{max}} \gamma_2 GBCC_{t-i} + \sum_{i=1}^{k} \delta_1 INTR_{t-i} + \sum_{i=k+1}^{d_{max}} \delta_2 INTR_{t-i} + \epsilon_{6t} \dots\dots (11)$$

Between Fiscal Deficit and Inflation

$$BCGV_t = \alpha_0 + \sum_{i=1}^{k} \alpha_1 BCGV_{t-i} + \sum_{i=k+1}^{d_{max}} \alpha_2 BCGV_{t-i} + \sum_{i=1}^{k} \beta_1 INFL_{t-i} + \sum_{i=k+1}^{d_{max}} \beta_2 INFL_{t-i} + \epsilon_{7t} \dots\dots (12)$$

$$INFL_t = \gamma_0 + \sum_{i=1}^{k} \gamma_1 INFL_{t-i} + \sum_{i=k+1}^{d_{max}} \gamma_2 INFL_{t-i} + \sum_{i=1}^{k} \delta_1 BCGV_{t-i} + \sum_{i=k+1}^{d_{max}} \delta_2 BCGV_{t-i} + \epsilon_{8t} \dots\dots (13)$$

Where,

INTR: Various selected domestic interest rate such as YTBR, YLDO, YLDF and YLDT. The other variables are defined before. The causal relationship from fiscal deficit to interest rate (eq.6), inflation to interest rate (eq.8), bank credit to interest rate (eq.10), and inflation to fiscal deficit (eq.12) implies $\beta_{1i} = 0 \forall_i$. Similarly, the causal relationship from

interest rate to fiscal deficit (eq.7), interest rate to inflation (eq.9), interest rate to bank credit (eq.11), and fiscal deficit to inflation (eq.13) imply that $\delta_{1i} = 0 \forall_i$. Results of the causality tests are presented in Table 5 to 8 by using the optimal lag selected by different lag selection criteria.

The results of Table 5 show that in the pre-crisis period, causality runs one-way from short term interest rate to fiscal deficit, while there exists bi-directional causality between fiscal deficit and both the medium term and long term interest rate. However, in the post-crisis period, there exists bidirectional causality between short term interest rate (YLDO) and fiscal deficit, and causality runs one-way from the medium and long term interest rates to fiscal deficit. Thus, while a high interest rate could have led to higher deficits, we also find strong feedback impact of fiscal deficit on medium to long term interest rate, especially in the pre-crisis period. Similarly, in the post-crisis period, we find a mixed picture.

Table 5: Causality Analysis between Fiscal Deficit and Interest Rate

	Pre-Crisis Period			Post-Crisis Period		
Variables	**Lag**	**Statistics (Chi-sq)**	**Direction of Causality**	**Lag**	**Statistics (Chi-sq)**	**Direction of Causality**
BCGV ≠ YTBR	1	0.03 (0.87)	Unidirectional (YTBR→BCGV)	5	5.79 (0.33)	No Causality
YTBR ≠ BCGV	1	4.30** (0.04)		5	6.62 (0.25)	
BCGV ≠ YLDO	1	1.75 (0.19)	Unidirectional (YLDO→BCGV)	5	10.81* (0.06)	Bidirectional (BCGV↔YLDO)
YLDO ≠ BCGV	1	3.98** (0.05)		5	11.05** (0.05)	
BCGV ≠ YLDF	1	3.46* (0.06)	Bidirectional (BCGV↔YLDF)	6	8.92 (0.18)	Unidirectional (YLDF→BCGV)
YLDF ≠ BCGV	1	2.69* (0.10)		6	16.99** (0.01)	
BCGV ≠ YLDT	1	3.14* (0.08)	Bidirectional (BCGV↔YLDT)	4	5.46 (0.24)	Unidirectional (YLDT→BCGV)
YLDT ≠ BCGV	1	2.88* (0.09)		4	16.04*** (0.00)	

Note: * Significance at 10%, ** Significant levels at 5%, and *** Significant levels at 1%. ≠ refers to "does not Granger Cause".

The results of Table 6 show that inflation does not Granger cause interest rate is rejected for all the interest rate in the pre-crisis period. Thus, it implies that causality runs one-way from inflation to interest rate during the pre-crisis period. However, in the post-crisis period, causality runs one way from inflation to YLDO, and both way in between inflation and YTBR, and inflation and long term interest rate. The causality analysis

between bank credit and interest rate is not uniform (Table 7). For example, in the post-crisis period, there exists a one-way causality from interest rate to bank credit, while in another instance, it shows also one-way causality from bank credit to interest rate. Thus, the credit channel of interest rate is not clear. However, while testing causality between fiscal deficit and inflation (Table 8), it finds that causality runs one-way from fiscal deficit to inflation throughout the full sample period and post-crisis period.[12]

Table 6: Causality Analysis between Inflation and Interest Rate

	Pre-Crisis Period			Post-Crisis Period		
Variables	**Lag**	**Statistics (Chi-sq)**	**Direction of Causality**	**Lag**	**Statistics (Chi-sq)**	**Direction of Causality**
INFL ≠ YTBR	6	25.56*** (0.00)	Unidirectional (INFL→YTBR)	1	6.89** (0.01)	Bidirectional (INFL↔YTBR)
YTBR ≠ INFL	6	8.03 (0.24)		1	2.85* (0.09)	
INFL ≠ YLDO	1	2.96* (0.08)	Unidirectional (INFL→YLDO)	1	4.07** (0.04	Unidirectional (INFL→YLDO)
YLDO ≠ INFL	1	0.01 (0.93)		1	2.35 (0.13)	
INFL ≠ YLDF	1	2.80* (0.09)	Unidirectional (INFL→YLDF)	1	1.34 (0.25)	No Causality
YLDF ≠ INFL	1	0.05 (0.83)		1	0.48 (0.49)	
INFL ≠ YLDT	6	12.67** (0.05)	Unidirectional (INFL→YLDT)	4	8.68*** (0.07)	Bidirectional (INFL↔YLDT)
YLDT ≠ INFL	6	2.87 (0.82)		4	19.71*** (0.00)	

Note: * Significance at 10%, ** Significant levels at 5%, and *** Significant levels at 1%. ≠ refers to "does not Granger Cause".

The causality analysis finds a crucial and very interesting finding in the case of India. It shows that the fiscal deficit has both a direct and indirect effect on domestic interest rates in India. The direct impact of fiscal deficit on interest rate is appearing to be temporary, which is supported by the results of impulse response analysis. However, in the indirect channel, fiscal deficit causes inflation which in turn has a larger impact on interest rates and this is supported by both impulse response and the causality analysis. The results of impulse response show that inflation has a very strong, positive and highly significant impact on the selected interest rates in the longer horizon than in the shorter horizon. Thus, this fiscal policy transmission mechanism between the fiscal deficit and

[12] It finds no causality between inflation and fiscal deficit in the pre-crisis period.

interest rate is through the inflation route in India. Thus, in India, there is a need to look at the issue of the Fiscal Theory of the Price Level (FTPL) as addressed in the literature for other countries (Creel and Bihan, 2006; Xu and Serletis, 2017 and Bassetto, and Cui, 2018).[13]

Table 7: Causality Analysis between Bank credit and Interest Rate

	Pre-Crisis Period			Post-Crisis Period		
Variables	**Lag**	**Statistics (Chi-sq)**	**Direction of Causality**	**Lag**	**Statistics (Chi-sq)**	**Direction of Causality**
GBCC ≠ YTBR	2	5.61* (0.06)	Bidirectional (GBCC↔YTBR)	3	1.64 (0.65)	Unidirectional (YTBR→GBCC)
YTBR ≠ GBCC	2	6.95** (0.03)		3	9.66** (0.02)	
GBCC ≠ YLDO	2	12.71*** (0.00)	Unidirectional (GBCC→YLDO)	1	2.70* (0.10)	Unidirectional (GBCC→YLDO)
YLDO ≠ GBCC	2	3.83 (0.15)		1	0.73 (0.39)	
GBCC ≠ YLDF	1	3.21* (0.07)	Bidirectional (GBCC↔YLDF)	1	3.14* (0.08)	Unidirectional (GBCC→YLDF)
YLDF ≠ GBCC	1	3.33* (0.07)		1	0.32 (0.86)	
GBCC ≠ YLDT	3	4.84 (0.18)	No Causality	1	3.58* (0.06)	Unidirectional (GBCC→YLDT)
YLDT ≠ GBCC	3	4.41 (0.22)		1	0.22 (0.64)	

Note: * Significance at 10%, ** Significant levels at 5%, and *** Significant levels at 1%. ≠ refers to "does not Granger Cause".

Table 8: Causality Analysis between Fiscal Deficit and Inflation

Sample	**Variables**	**Lag**	**Statistics (Chi-sq)**	**Direction of Causality**
Full Period	INFL ≠ BCGV	2	4.21 (0.12)	Unidirectional (BCGV→INFL)
	BCGV ≠ INFL	2	9.31** (0.01)	
Pre-Crisis Period	INFL ≠ BCGV	1	0.46 (0.79)	No Causality
	BCGV ≠ INFL	1	2.81 (0.25)	
Post-Crisis Period	INFL ≠ BCGV	2	0.38 (0.83)	Unidirectional (BCGV→INFL)
	BCGV ≠ INFL	2	17.36*** (0.00)	

Note- ** Significant levels at 5%, and *** Significant levels at 1%. ≠ refers to "does not Granger Cause".

[13] The issue of FTPL in India will be addressed in the future study.

5. Conclusion and Policy Implication

The linkage between the fiscal deficit and interest rate is one of the ambiguous and unsettled issues in the macroeconomics literature. This issue assumes importance mainly for four reasons. Firstly, the extended IS-LM framework predicts that an increase in the fiscal deficit will result in an increase in interest rate. Hence, crowding out possibility exists in the economy. Secondly, due to globalization, the financial markets are getting increasingly integrated. Thus, the effects of a rise in interest rate induced by fiscal deficit can spread globally and can create financial instability. Thirdly, the fiscal and monetary policy coordination might be required for managing the macroeconomic uncertainties and instability in the country. And finally, the 2008 crisis could have potentially change the dynamic relationship between the macroeconomic variables, especially the linkage between fiscal deficit, inflation and interest rate due to fiscal stimulus measures.

The main focus of the paper is to empirically examine and understand the transmission channel through which fiscal deficit would affect various domestic interest rates in India. The SVAR model is employed to examine fiscal deficit-interest rate linkage in India, for the period 1996:Q1 to 2018:Q3. Then, T-Y approach to Granger causality is used to analyse the direction of causality among variable of interest in both pre-crisis and post-crisis period. The impulse response analysis suggests that fiscal deficit has a positive effect on the selected short term, medium term and long term interest rates in India. While this direct impact is found to be temporary, there appears to have a large indirect impact through inflation as the impact of fiscal deficit on inflation is found to be positive and highly significant. Similarly, shocks to foreign interest rate and inflation tend to increase all these interest rates for a longer horizon. However, bank credit has a negligible effect on interest rates in India. Variance decomposition analysis finds that all the selected interest rates are highly explained by its own shock, inflation and fiscal deficit in the short horizon, while these are influenced by inflation, foreign interest rate and itself in the longer horizon. The results of the causality analysis confirm that fiscal deficit causes inflation and which in turn causes interest rate in India. It implies that although fiscal deficit has a short run direct impact, indirectly it could affect interest rates through the inflation route in the longer horizon in India. Hence, in order to maintain macro-economic stability, there is a need to focus on fiscal and monetary coordination with a decisive fiscal consolidation road map that is less inflationary and would have an expansionary impact on growth.

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Appendix

Table 1: Selected Empirical Studies on Link between Fiscal Deficit and Rate of Interest

Author(s)	Countries	Estimation Period	Methodology/ Econometric Technique	Major findings
Tanzi (1985)	USA	1960-1984	Neo-classical Model with Regression Analysis	Found a decline in the sensitivity of interest rate to the fiscal deficit over the years due to growing global financial markets integration and global capital flow to finance the domestic deficit.
Evans (1985)	USA	1858-1950	2SLS	An insignificant negative relationship between interest rate and deficits.
Hoelscher (1986)	USA	1953- 1984	Loanable Funds Framework with Semi-reduced form Regression Models	Deficits do not impact short term rates but do have a positive impact on long term rates.
Barro and Martin (1990)	Belgium, Canada, France, Germany, Japan, Netherlands, Sweden, the UK, and the US	1952:2-1989:3	Reduced Form Regression	World budget deficits and world government debt have no effect on the determination of world real interest rates.
Tseng (2000)	USA	1971:M1 - 1997: M12	Partial Equilibrium Single Equation Model, Regression Analysis	Federal deficits had a significant positive effect on real interest rates.
Cheng (1998)	Japan	1955-1993	Cointegration and Granger Causality	No causality between budget deficits and long term interest rates, but detects feedback causality between budget deficits and short term interest rates.
Goyal (2004)	India	1996:M4-2001:M9	VAR	Bi-directional causality between gross fiscal deficit and real interest rate.
Das (2004)	India	1990-91 to 2000-01	OLS	Interest rates do not necessarily depend on the fiscal deficit in India and for a number of other countries in the world.
Garcia and Ramajo (2004)	Spain	1964-2000	Two-Stage Least Squares (2SLS)	Budget deficits did not appear to raise long run nominal interest rates.

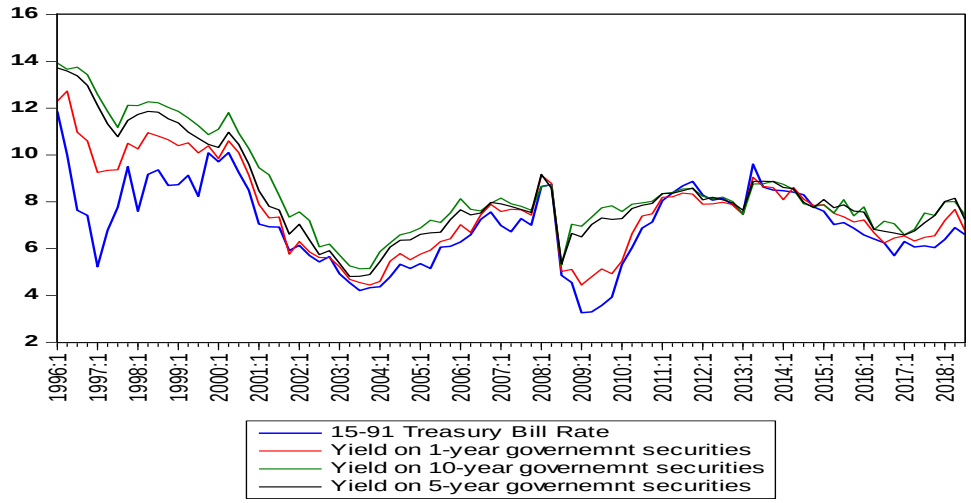
Bhattacharya et al. (2008)	India	1996:04 to 2005:03	ARDL and VAR	Although the interest rates depend on some domestic macroeconomic variables such as yield spread and expected exchange rate, the movement of international interest rates primarily influence them, but with a significant lag.
Kiani (2009)	US	1962-2005 (Quarterly Data)	ARCH and GARCH	Significant positive linkage between budget deficits and slope of the yield curve.
Cebula and Cuellar (2010)	US	1973:Q1–2007: Q4	TSLS	Federal budget deficit exercised a positive and statistically significant impact on the ex-ante real interest rate yield on Moody's Baa-rated corporate bonds.
Baldacci and Kumar (2010)	31 Advanced and Emerging Market Economies	1980-2008	Generalized Method of Moments (GMM)	Higher deficits and public debt lead to a significant increase in long-term interest rates.
Ezeabasili and Mojekwu (2011)	Nigeria	1970-2006	VECM	A positive and statistically significant relationship between deficit and interest rate.
Claeys et al. (2012)	OECD and Emerging Economies	1990–2005	Spatial Lag Modeling through Maximum Likelihood Estimation	Weak crowding-out effect of public debt on domestic long term interest rates among OECD countries and stronger crowding out effect among Emerging markets.
Bonga (2012)	South Africa	1970:Q3 - 2008:Q3	VAR	A positive relationship between budget deficits and long term interest rate.
Aisen and Hauner (2013)	60 Advanced and Emerging Economies	1970–2006	GMM	A highly significant positive effect of budget deficits on interest rates.
Kameda (2014)	Japan	1981-2008	FMOLS	Deficit and government debt has a positive impact on the interest rate.
Kelikume. (2016)	18 Sub-Saharan Africa countries	2000-2014	Panel VAR	The budget deficit has a neutral impact on the interest rate.
Akram and Li (2019)	US	Monthly data (1960-2008)	ARDL	An increase in the ratio of the federal fiscal balance lowers long-term government bond yield.

Table 2. Results of Unit Root Tests

Variables	ADF test	PP test	KPSS test	Order of integration
YTBR	-3.435**	-3.684**	0.184*	I(0)
YLDO	-2.646*	-2.669*	0.363**	I(0)
YLDF	-2.718*	-2.718*	0.457**	I(0)
YLDT	-2.603*	-2.617*	0.545***	I(0)
BCGV	-3.160**	-2.646***	0.100*	I(0)
INFL	-3.632**	-2.830**	0.153*	I(0)
GBCC	-1.495	-2.528	0.331*	I(0)
FTBR	-2.733*	-1.626*	0.101*	I(0)
FYLDO	-1.876*	-1.632*	0.101*	I(0)
FYLDF	-1.728*	-1.728*	0.131**	I(0)
FYLDT	-3.286*	-3.250*	0.100*	I(0)

Note: *, **, and *** shows significance levels at 10%, 5% and 1% respectively.

Figure 1: Trends of Selected Domestic Interest Rate



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