

## **The Relationship Between Budget Deficit and Interest Rates In India**

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### **ABSTRACT**

There are growing consensuses regarding the efficiency and efficacy in the use of fiscal policy in stabilization, redistribution and also in the conduct of monetary policy. Despite inadequate revenues in the fiscal system to match the aggregate spending of the Government, the issue of deficit financing is not meaningfully addressed. A well-designed fiscal stimulus measures are prerequisite for those economies, including India, where fiscal space is perceived to be limited. This study is a modest attempt to capture the dynamic links between the Government deficits and interest rates through Hsiao based Granger causality. The evidences based on quarterly as well as on annual data clearly demonstrate the one-way causality from fiscal deficit to interest rate. Other possibilities of causality are ruled out as per the estimates produced.

**Keywords:** Fiscal deficit, primary deficit, interest rate, VAR.

### **I. INTRODUCTION**

The persistent use of fiscal policy for the prudent macroeconomic management in order to bring desirable adjustments in both short run and long run cannot be repudiated and disputed. Expansionary fiscal policy remained one of the key macroeconomic instruments that have always been practiced for the stimulation of economic activities in the context of aggregate demand management policies. India is also one of those developing countries that primarily approached the expansionary fiscal policy to bring short term as well as long term changes in the economy without ideally taking care of three gap

dynamics that have been prevailing in macroeconomic adjustments. Oflate, it has often been claimed that the dependence on the fiscal stimulation measures for the prolonged period suffers from the minimal ability to handle the oscillations in the economy and to improve the economic resilience. Perhaps this has led and has been leading to the problem of certain amount of instability in the economy along with rising concerns on the issue of sustainability of debts. Sources of instability can be traced back from the lag effects of decisions and implementations of fiscal policies and, desired outcomes are not achieved at the targeted level by appropriately recognising lag effects and policy dynamics. This raises a very important question on the efficiency of fiscal policy to bring about desirable adjustments process.

There are growing consensuses regarding the efficiency and efficacy in the use of fiscal policy in stabilization, redistribution and also in the conduct of monetary policy. Despite inadequate revenues in the fiscal system to match the aggregate spending of the Government, the issue of deficit financing is not meaningfully addressed. A well-designed fiscal stimulus measures are prerequisite for those economies, including India, where fiscal space is perceived to be limited. Indian economy has been experiencing a significant deterioration in the fiscal situation since eighties, except for few years, essentially due to the continuous and persistent rise in the fiscal deficit and, as a result, the monetization of the fiscal deficit has taken a serious turn even when there is considerable increase in the borrowings from the domestic and international markets.

Growth in the size of monetized deficit and deficit financing has negative spillover effects that are crucial to understand. First, if the fiscal deficit is monetized, it would cause demand-pull inflation through increase in the stock of high-powered money. Contemporaneous effect of monetized deficit results into price adjustment as output takes substantial time to respond. Second, due to the limited availability of loanable funds, there is a trade-off between deficit financed public expenditures and private investments and this in turn, puts upward pressure on the market interest rate. Since the private investment is sensitive to cost of borrowings, the rise in interest rate could results into “crowding-out” of private investment. Possibly, overall slowdown in capital formation will also be experienced by the country if the government investments are not rightly directed towards the development of infrastructure that encourages the private investment. Third, in an open economy, higher domestic interest rate will attract foreign investors due to interest rate differentials. This will increase the capital inflows in the economy while making some changes in the private portfolio adjustment in a manner that investors may direct their funds to the domestic markets. This alters the net capital outflows leading to appreciation of domestic currency and thereby changing the trade flows.

Some studies have examined the relationship between fiscal deficit and interest rate by incorporating various macroeconomic dynamics in the context of India.<sup>1</sup> This issue merits the further investigation at least for two reasons. Primarily, the context needs to be analysed by incorporating various concepts of the government deficits. Secondly, the implications of external sector on domestic interest rates, net capital flows and changes in the exchange rate have to be taken into account to model the dynamics between budget deficits and interest rates.

Despite several schools of thoughts on the theoretical foundations on issues pertaining to the relationship between the government deficits and interest rates, an empirically comprehended view is that the positive relationship between fiscal deficit and interest rate is an important question for the conduct of monetary policy and debt management. When the economies are actively involved in financial globalization coupled with financial inclusion, it generates good amount of researchable debate on how variations in interest rates can be modelled in the context of crowding-out, particularly financial crowding-out and their impact on external capital market.

The rest of the paper is organized as follows. Essentially, the focus is given on various theoretical claims that fiscal deficit necessarily raises the interest rates in Section II, while Section III deals with a brief literature review and, Section IV discusses the model and data that have been used in this study. Section V presents the results and evidences followed by concluding remarks in Section VI.

### II. THEORETICAL UNDERPINNING

A considerable amount of development in theoretical and empirical literature is the outcome of the debate that has evolved on fiscal deficit and interest rate over time.<sup>2</sup> There is no unique agreement on the debate essentially due to the kind of structural adjustment and inflation behaviour that economies have experienced over the years. The well-articulated framework was initiated by neoclassical traditions of thought in analyzing real interest rate behaviour through the market adjustment for loanable funds that can bring about equality between ex-post savings and ex-ante investments. The role of fiscal deficit in influencing either nominal interest rate or real interest rate was very limited and probably the allocative efficiency was assumed to be taken care by the market. Later versions on neoclassical literature would presumably accept direct crowding-out arising out of persistent rise in the fiscal deficit leading to increase in both real and nominal interest rates. The markets for goods and for finance are visualized as independent entities in classical literature and possibly this has led to the formation of saving-precedes-investment sort of dichotomy which was not settled down to have an integrated approach. It was Keynes and the Keynesians who have assigned the predominant role for the public expenditure for minimizing the fluctuations in the growth rates by essentially introducing the dynamics between fiscal deficit and interest rate. The implications that would fall on savings and investments are essentially conceived to have originated from multiplier-accelerator dynamics. This has resulted into the framework of investments-preceding-savings model wherein fiscal deficit accelerates consumption and investment behaviour. So called direct crowding-out<sup>3</sup> and financial crowding-out are the fundamental links on which considerable movement in the real interest rate is perceived to be prevailing. Either Keynes or Keynesians have prescribed a limit to fiscal deficit which could be consistent with economy under consideration or under some adjustment process. But it is assumed that depending upon the macroeconomic adjustment and financial market scenario the crowding-out should be taken into account as fiscal deficit might push down the private investments, which in turn raises the real rate of interest under stable price scenario. Financial crowding-out<sup>4</sup> can lead to good amount of substitution between the government bonds and private bonds even when the expected inflation is not augmented properly by investors. Financial crowding-out also depends on range of availability of the government securities, expected inflation rate, risk-return trade-off, financial market conditions, monetary policy stance, etc. Therefore, the extent of financial crowding-out inspite of not taking into account of or in the absence of direct crowding-out should be examined in the context of both behaviour of financial markets and the behaviour of central banks. Even if post-Keynesian theories allow for endogenous determination of money supply, the relationship between fiscal deficit and interest rate within the framework of crowding-out essentially depends on the stability of demand for money and interest sensitivity of bonds and financial instruments. Nevertheless, if we place the idea of neoclassical and Keynesian thoughts while augmenting for rational behaviour of the investors, the proactive money market participation can absorb immediate liquidity effect of fiscal deficit even when bond markets are subdued. The reverse possibility is that when the bond markets are subdued, the excess liquidity can pose serious implications while deficit is financed by borrowings.

More comprehensive view on deficits versus taxes can be traced from Ricardian equivalence theorem. Though, it is not directly related to the topic under consideration here the borrowing today for taxing tomorrow has larger implications on financial market dynamics and open market operations

including seigniorage. It can be well understood that today's borrowings will tend amount to tomorrow's taxes, as claimed by Ricardian equivalence theorem, has a very stringent assumptions such as stable price scenario consistent with steady rate of growth, well developed and matured financial system, smooth coordination link between fiscal and monetary policies, no supply shocks, and stable balance of payment and exchange rate scenario. It may not be possible to ideally observe such assumptions in realities but, appropriate coordination between monetary and fiscal policies under well- developed financial system might produce some evidence for Ricardian equivalence. It is an empirical question to debate whether certain key assumptions are traceable in the data for economy under consideration even if Ricardian equivalence is partly true. Indirectly, Ricardian equivalence is placed for analysis when one talks of the linkages between the government deficits and interest rates.

Ever growing literature on the dynamic relationships between fiscal deficit and interest rates certainly will gain both theoretical and empirical attention not only for intellectual debate but also for policy analysis, especially, when there is an increasing integration among financial markets worldwide and arrival of new range of instruments on money markets and capital markets, and therefore, one is motivated to model the policy analysis while taking into account risk-return trade-off.

### **III. LITERATURE REVIEW**

Macroeconomic implications of discretionary fiscal actions and ever-increasing government expenditures invariably result into escalation in the size of debt and deficit. This in turn, produces fluctuations in the steady rate of growth, instability in the financial markets, volatility in exchange rates, rise in the inflation rates, oscillations in the interest rates, crowding-out of private investments, etc. To gain some sort of a deeper insights into the dynamic adjustments in the range of interest rates primarily due to fiscal deficit, a brief of certain evidences is presented below.<sup>5</sup>

#### **International Experiences**

Pragmatic work on economic theorizing would emphasize and motivate a way forward for not only a better intellectual debate but also for effectively bringing forth the fundamental and radical policy options to deal with mutually exclusive macroeconomic processes for a subject under consideration. The early studies by Hoelscher (1983), Evans (1985, 1987) and Darrat (1989) did not find any evidences for the positive links between fiscal deficit and interest rates. The examination by Evans (1985) did not support the government spending consistent with inflation as that could lead to reduction in the welfare by putting the marginal tax rate on the higher side. Hoelscher (1983) detected no significant relationship between federal borrowing and short-term interest rates and claimed that expected inflation, monetary factors and economic activities are the primary determinants of short-term interest rates. Investigations by Spector and Cott (1988), Cebula (1997) and, Gale and Orszag (2004) found significant positive linkages between fiscal deficit and interest rates for the USA. Spector and Cott (1988) claimed that the conceptual association between budget deficit, interest rate and crowding-out depends on the slope of IS and LM schedules. Owing to the flatter IS schedule and steeper LM schedule greater would be the possibility of crowding out. Private investments are more sensitive than real demand for money for a given change in the interest rate and therefore, the possibility of crowding-out will be very high. Findings of the Darrat (1989) rejected the conventional proposition that budget deficits cause the long-term interest rates and supported the reverse causality between the two variables. Cebula (1997) gave a detailed account on how the accumulation of fiscal deficit over a period of time reduces the availability of loanable funds for the private investments. This imbalance between the availability of the credit and demand for the same puts the pressure on interest rate. A later study by Cebula (2003) found bi-directional causality between primary deficit which was used as federal budget deficit measure and ex ante long term interest rate. Gale and Orszag (2004) inferred that federal budget deficits reduced the national savings and raised the long-term interest rates. Dell' Erba and Sola (2016) concluded that more

than 60 percent of variance in the long-term interest rates for OECD countries was explained by the global monetary and fiscal policy stances. Kelikume (2016) suggested that if debt sustainability ratio stayed within limit, sub-Saharan African economies would not have had to bother about the effects of rising government borrowing on interest rates.

### **Indian Experiences**

A study by Nachane, Karnik and Hatekar (1997) emphasized on reduction in the overall borrowings of the Government as that raised the short-term interest rate during the period 1992 through 1996. Discontinuation of the ad-hoc treasury bills replaced the concept of budget deficit to fiscal deficit after 1997. D'Souza (1999) examined that the growing fiscal deficit increased the domestic interest rates relative to foreign interest rates. Consequently, the real exchange rate had been amplified and this led to deterioration in the net exports. He further suggested the credible reduction in fiscal deficit so as to create expectations of depreciation through corrections in real interest rates to generate positive impacts on investment flows consistent with current sustainable current account balance. Investigation by Rao (2000) accentuated on substantial reduction in the government borrowings and monetized deficit to maintain the domestic interest rate and inflation rate under the desired level.

Some studies were also devoted to examine the causality between fiscal deficit and interest rate in the Indian context. Chakraborty (2002) found unidirectional causality running from real interest rate to fiscal deficit during the period January 1993 to December 1999. On the contrary, Goyal (2004) had confirmed two-way causality between the same variables through a VAR model. Investigations were also extended to understand the effects of deficit financing on private investments. Das (2004) invalidated the argument of escalation in the real interest rates due to fiscal deficit (measured as a proportion to GDP) for India as well as for other countries and as a result, private investments were not affected by increased public borrowings in the post liberalization period. Re-examination of the same issue by Das (2010) concluded that even after the government borrowed from the credit market the loanable funds were sufficiently available for private investors. In the recent periods, concerns for effects of crowding-out of the government borrowings have been extended to evaluate the behaviour of the investors in the financial market. Chakraborty (2012) inspected financial crowding-out under deregulated interest rate regime. She found not much significant association between fiscal deficit and interest rates. Rani and Kumar (2017) confirmed the positive linkage between fiscal deficit and long run interest rate.

### **IV. MODEL AND DATA DESCRIPTION**

The strong macroeconomic relationship between the government deficits and interest rates on empirical evidences appears to be valid in the context of cross sections of economies can also be possible for India. The liberalization of financial markets and significant development concerning to the depth of the financial system today, while actually accounting for sizeable markets for the government securities, present a strong case to investigate implications of fiscal deficit on interest rates.

What India stands today on the dynamics of financial system on macroeconomic policy is comparatively complex and definitely has a clear deeper macroeconomic links compared to the system we had twenty years before. There is a strong need for clearly articulating the dynamics on appropriate coordination between monetary and fiscal policies in terms of regulations on financial markets, auctions of the government securities, interest payments on public debt, monetization of fiscal deficit and wealth creation of the government borrowings for achieving proper policy framework for fiscal management

and also for interest rate policy of the RBI. The focus is given here to identify the relation that could emerge between budget deficits<sup>6</sup> and interest rates in both short run and long run. There are evidences of strong markets prevailing for the government securities.<sup>7</sup> SLR has been actively used for the government borrowings for quite some time in India and the relative significance of SLR is gradually becoming important for the conduct of monetary policy rather than fiscal accommodation. What was considered to be captive market once for the government securities is slowly becoming relatively active market for the same by commercial banks. Figure 1 of the appendix is showing evidences of the schedule commercial banks holding a greater number of government securities than minimum prescribed under SLR.<sup>8</sup> This is coupled with the active auctioning of the government securities motivate the analyst to examine the cross-section choices of the investors on risk-return trade-off and also to investigate the willingness of the people for investing in risk-less securities. It is also imperative to investigate that to what extent the government securities are interest rate sensitive and risk free. Scatteredly developed empirical literatures suggest that the public holdings of the government securities are considerably increasing while diversifications of the government securities have become somewhat restricted. Owing to this fact, portfolio adjustment, especially strong risk aversion promotes investment in the government securities by both banking and non-banking entities to optimize good returns. Electronic payment system and e-clearing counters have strengthened this process.

It is evident that crowding-out generates not only the diversion of funds between the government and private but also produces asset substitution by actually altering both nominal and real interest rates.<sup>9</sup> Because banks are now increasingly becoming fund managers, investment in the government securities are treated more elaborately in their banking policies than merely as SLR requirements. It is yet inconclusive to analyze whether financing of fiscal deficit by borrowings and issuing of treasury bills impacts the money markets or long-term bonds markets. More particularly the liquidity effect of fiscal deficit has no clear dimension to recognise portfolio adjustment and interest rate changes.

This study concentrates on the analytical association between budget deficits and interest rates while not getting into deeper details on dynamic and complex behavioral relationship between fiscal and monetary sectors. There are some quick observations that can be drawn from the information presented in Table I of the appendix. The situation on the fiscal front has been continuously deteriorating due to persistent rise in the unproductive public expenditures which have escalated the size of revenue deficit and subsequently the fiscal deficit. Stagnation in the growth of revenues and rigidity in controlling expenditures, which mainly consist of wages and salaries, interest payments and huge subsidies, are the key reasons for the growing deficits in revenue account. Various fiscal measures were adopted on the account of increasing fiscal stress. In the light of curtailing the size of unproductive government spending “Expenditure Commission” was established and the method of “Zero Based Budgeting (ZBB)” was introduced during late nineties. The enactment of Fiscal Responsibility and Budget Management Act (2003) was another key reform announced that primarily focused on bringing down the size of fiscal and revenue deficits. It also emphasized on the adjustment of the government expenditure towards the capital spending in the manner that not only increases the capital formation but also procures decent return over the investments. The positive effect of these measures can be very well articulated from the sharp reduction of fiscal deficit after 2003-04. Fiscal consolidation that was achieved during the period 2003 and 2007 by following the fiscal targets was disrupted during the 2008 financial crisis. Unprecedented growth in the global commodity prices and effects of aftermath of the financial crisis in the year 2008-09 led to the fiscal expansion by both tax cuts and expenditure hikes. As a result, the fiscal deficit as a percentage to GDP had once again started rising.<sup>10</sup> If we look at the government policies and data on fiscal deficit after 2011-12, it is very clear that the Government wanted to revert back to its pre-crisis scenario by focusing on the fiscal consolidation. For the majority of the years during the sample period, similar co-movement can be observed between fiscal deficit and monetised deficit. Net RBI credit to the Government is a serious concern for long term implications on money supply and inflation

and therefore, the market borrowing of the Government predominant element in deficit financing. Risk free nature of the government securities, inflation expectations, financial crises and financial instability could be the possible reasons that pushed the financial institutions to invest more in the government dated securities. Figure2 of the appendix represents the yield on government dated securities having the maturity of 5 and 10 years along with yield on 91 days treasury bills. Leaving the room for real interest rates and excluding few years, the trend in the nominal interest rate is not similar and it can be observed that 91 days treasury bills and yield on dated securities are not showing same trend for some years.

### Data Description

Various issues of database on Indian Economy and Handbooks of Statistics on Indian Economy published by RBI are the major sources of data. Empirical investigation is first carried out by covering the quarterly data from 1996: Q1 to 2020: Q3 and then the estimation is made for annual data during the period 1996-97 and 2019-20. Study distinguishes the effects of government deficits on interest rates for the short and long runs<sup>11</sup>. Persuasion of major reforms in 1991 thoroughly changed the economic situation in India and therefore, Post liberalization period has been chosen for the analysis. Owing to international integration and globalization and also for deregulation and market-oriented policies, the study period is suitable to capture real effective exchange rate (REER), capital flows and other macroeconomic variables more uniformly.

Understanding on monetary and fiscal coordination demands appropriate selection of interest rate so that the intricacies in the interest rates due to the government deficits can be accurately captured. Call money rate, bank rate, treasury bill rates (91 days T-Bill, 182 days T-Bill, and 364 days T-Bill), prime lending rate and yield on the government dated securities for various maturity periods, etc. are important rates that are available in the Indian context. Call money market rate and bank rate cannot be taken into account for estimation as former is highly volatile and latter does not change much. Among all treasury bill rates, 91 days treasury bills satisfy certain time series properties and the requirement of high frequency data to capture the short-term interest rate. Whereas, other two treasury bill rates are not uniform in terms of its continuity and date of issue. More importantly 91 days treasury bill rates suit quarterly data analysis without much modification. Prime Lending Rate cannot be taken for the long term interest rate as it is a policy variable and does not contain necessary information on market dynamics. To finance fiscal deficit the Government often issue bonds and hence, considering yield on the government dated securities as a long run interest rate will very well serve our purpose. Yield on the government dated securities for SGL transactions whose maturity period is 10 years is measured as long run interest rate.

According to Fischer effect, nominal interest rate has one to one adjustment tendency to follow the pattern of inflation, and to capture the long run effect of interest rate the same has to be adjusted for inflation. Thus, the relevant interest rates can be transformed into real interest rates as:

$$i_n = i_r + \pi_e \quad \dots(1)$$

Where,  $i_n$  is nominal interest rate,  $i_r$  is real rate of interest and  $\pi_e$  is expected inflation.

Expected inflation is calculated through autoregressive process and appropriate diagnostic tests are carried out to identify the model and the coefficients are significant at 1 percent level for the quarterly data series and, Hodrich-Prescott (HP) filter is used for annual data.<sup>12</sup>HP filter decomposes a

series into cyclical  $(\pi_t - \mu_t)$  and trend  $(\mu_t)$  components by minimizing the variance of cyclical component around trend series.

$$\sum_{t=1}^T (\pi_t - \mu_t)^2 + \lambda \sum_{t=2}^{T-1} ((\mu_{t+1} - \mu_t) - (\mu_t - \mu_{t-1}))^2 \quad \dots(2)$$

Here,  $\lambda$  is a constant and  $T$  is the number of observations. In minimization of variance,  $\lambda$  reflects the penalty of incorporating fluctuations into the trend. A trend series is well smoothed when the value of  $\lambda$  is large which forces the change in trend to be as small as possible. As  $\lambda \rightarrow \infty$ , the change in trend is constant and  $\mu_t$  approaches a linear trend.

### Vector Autoregression

Hsiao (1981) based Vector Autoregression (VAR) framework has been carried out to analyse macroeconomic causality to empirically understand complex causal relationship. Before getting into the details of Hsiao's framework, a general form of VAR is presented to understand the foundation of Hsiao autoregressive process. The structure of the VAR system is formulated to incorporate feedback relationships among the endogenous variables while allowing for the impacts of exogenous variables.

A general form of model can be written as:

$$Ay_t = B_1y_{t-1} + \dots + B_p y_{t-p} + Cz_t + \varepsilon_t \quad \dots(3)$$

Where,  $y_t$  is vector of endogenous variables consist of short- and long-term interest rates and, fiscal and primary deficits.  $A$  is matrix that shows possibility of simultaneous effects among endogenous variables.  $B$  is matrix of lag effects ( $y_{t-p}$ ) of endogenous variables on their current observations. Matrix  $C$  signifies effects of the exogenous variables on the endogenous variables.  $z_t$  represents vector of exogenous variables comprise of net capital flows, REER, and money supply.  $\varepsilon_t$  is vector of innovations that may contemporaneously correlated but are uncorrelated to their own lagged values. However, Hsiao based autoregression has been applied to examine the causality.

A general form of Hsiao based autoregression model<sup>13</sup> is

$$y_t = A_{11}(L)y_t + A_{12}(L)x_t + \varepsilon_t^{y_t} \quad \dots(4)$$

$$x_t = A_{21}(L)y_t + A_{22}(L)x_t + \varepsilon_t^{x_t} \quad \dots(5)$$

Where,

$$A_{ij}(L) = \sum_{l=1}^{M_{ij}} A_{ijl} L^l \quad \dots(6)$$

$L$  is the lag operator such that  $Ly_t = y_{t-1}$ .  $\varepsilon_t^{y_t}$  and  $\varepsilon_t^{x_t}$  are white noise innovations.  $M$  is *a-priori* specified highest possible order for  $A_{ij}$ .

According to Hsiao (1981), least squares can be applied to estimate  $A_{ij}(L)$  which are specified in the equations 4 and 5 as this will produce consistent and asymptotically normally distributed estimates. Therefore, Hsiao ignored the correlation in the innovations and suggested to apply Akaike's (1969) Final Prediction Error (FPE) criterion to determine the order of lags in  $A_{ij}$ . The FPE is defined as the (asymptotic) mean square prediction error;

$$FPE \text{ of } y_t = E(y_t - \hat{y}_t)^2 \quad \dots(7)$$



$$\hat{y}_t = \hat{\alpha} + \hat{A}_{11}^m(L)y_t + \hat{A}_{12}^n(L)x_t \quad \dots(8)$$

The system can be estimated by applying OLS. Order of lags for  $A_{11}$  and  $A_{12}$  are such that  $m$  and  $n$  respectively can be estimated from equation 4 through final prediction error criterion.  $M$  in equation 6 is pre-specified highest order of lag which implies that  $m, n \leq M$ . Under Hsiao framework, it is also assumed that as the length of past history increases, the dependence between  $\hat{A}_{ij}$  and recent values of  $y$  and  $x$  are going to be decreasing. The inference for equivalent  $F$ -test can be obtained from the FPE in the system, which is placed in the context of Lagrange multiplier test on chi-square framework. Minimum value of FPE has been chosen to determine the order of lags in  $\hat{A}_{ij}$ . Akaike's FPE can be expressed as:

$$FPE_y(m, n) = \frac{T+m+n+1}{T-m-n-1} \cdot \frac{Q_y(m, n)}{T} \quad \dots(9)$$

$$Q_y(m, n) = \sum_{t=1}^T (y_t - \hat{A}_{11}^m(L)y_t - \hat{A}_{12}^n(L)x_t - \hat{\alpha})^2 \quad \dots(10)$$

Where,  $T$  is number of observations,  $m$  is lag length of variable  $y$  and  $n$  is lag length of variable  $x$  in equations 9 and 10. Granger Causality under Hsiao's model can be detected from the following criteria which can be applied for inference if the equation satisfies  $\chi^2$  test.

1. If  $FPE_y(m, n) < FPE_y(m, 0)$  then  $x_t$  Granger causes  $y_t$  (i.e. the prediction of  $y$  using  $x$  is more accurate than without using  $x$ ). Denoted by  $x_t \rightarrow y_t$ .
2. If  $FPE_y(m, n) < FPE_y(m, 0)$  and,  $FPE_x(m, n) < FPE_x(m, 0)$ , we say that feedback occurs between  $x$  and  $y$ . Denoted by  $x_t \leftrightarrow y_t$ .

Hsiao has also suggested following procedure for the identification of the system:

- i. Using FPE criterion, order of the one-dimensional autoregressive process, say  $y$  would be determined.
- ii. Now,  $y$  would be treated as only output variable in the estimation framework and variable  $x$  would be included as the manipulated variable which controls the outcome of  $y$ . For analysing and determining the lag structure of  $x$ , final prediction error criterion will be used and the lag operator of  $y$  is assumed to be same as specified in step (i). *iii.* Smallest FPE can be found by comparing step (i) and step (ii). If FPE of step (i) is smaller than FPE of step (ii), a one-dimensional autoregressive representation of  $y$  is used. If converse is true, we say  $x \rightarrow y$ .
- iv. Repeat step (i) to step (iii) for  $x$  process and now consider  $y$  as manipulated variable.

This method can be extended to include more subsets of manipulated variables by following the same procedure (Hsiao 1981). As Hsiao has not mentioned about the order in which multiple manipulated variables have to enter into the system of equations, Caines, Keng and Sethi (1981) have formulated the specific gravity criterion for ordering the input variables. This study follows the similar method. Specific gravity of the causal variable is the reciprocal of bivariate final prediction error and the rank of the causal or manipulated variables will be assigned in the order of decreasing specific gravity (Caines, Keng and Sethi 1981).

## V. RESULTS AND EVIDENCES

Estimation is possible only if the variables under inspection satisfy the time series properties. Appropriate formulation of Augmented Dickey Fuller (ADF) unit root test is conducted by including drift and trend for both quarterly data series and annual data set to examine stationarity in the short term and long-term real interest rates. Other variables such as budget deficits, capital flows, money supply and REER are also tested in the similar manner.  $\alpha$  is the test coefficient for the unit root test. Suitable lag length has been selected on the basis of Akaike Information Criterion (AIC), Schwarz Information Criterion (SIC) and Hannan-Quinn Criterion (HQC). ADF test results confirm rejection of null hypothesis that there is a unit root in the time series. The results are reported in Tables 1 and 2 below.

Table 1: Augmented Dickey Fuller Test for Quarterly Data

Variable	$\alpha$	MacKinnon Value
RSI	-0.21	-2.93**
RLI	-0.13	-2.78***
REER	-0.23	-3.18***
$\Delta$ NCF	-1.54	-14.96*
GFD	-1.30	-7.50*
$\Delta$ MS	-1.36	-12.31*

Notes:

(i)\*\*\*, \*\* and \* denote significant at 10%, 5% and 1% levels respectively.

(ii)RSI: Real Short Run Interest Rate, RLI: Real Long Run Interest Rate, REER: Real Effective Exchange Rate,  $\Delta$ NCF:

Change in Net Capital Flows, GFD: Gross Fiscal Deficit as a percentage to GDP and  $\Delta$ MS: Change in Broad Money.

Table 2: Augmented Dickey Fuller Test for Annual Data

Variable	$\alpha$	MacKinnon Value
RSI	-0.28	-2.08**
RLI	-0.32	-3.50**
GRNCF	-1.29	-5.37*
GRPD	-1.11	-4.30**
GRFD	-1.07	-4.16**
$\Delta$ GRMS	-1.33	-5.70*

Notes:

(i)\*\*\*, \*\* and \* denote significant at 10%, 5% and 1% levels respectively.

(ii) RSI: Real Short Run Interest Rate, RLI: Real Long Run Interest Rate, GRNCF: Growth Rate of Net Capital Flows.

GRPD: Growth Rate of Real Primary Deficit, GRFD: Growth Rate of Real Fiscal Deficit and  $\Delta$ GRMS: Change in Growth Rate of Broad Money.

Stationarity is an essential condition to carry out causality analysis and therefore, no unit root in the variables that are used in the study is a clear direction for the detection of causality. Hsiao based vector autoregression along with final prediction errors are estimated. For a fair understanding of the dynamics in the lag length, maximum lags (M) are assumed to be ten for quarterly data and five for annual data. Though, the VAR structure estimated for annual data are analysed up to five lags, the first lag suits the model estimation due to the fact that the data contain compact information that we have on

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the sample size and also due to inference on the relevant statistics that can capture the feedback structure. To detect the direction of causality, first we treated interest rates as a controlled or output variables and the rest of the variables are treated as manipulated or input variables. Estimation is performed by sequentially entering the input variables as per the rank arrived through specific gravity criterion, which is reported in the Tables II and IV for quarterly data and Tables III and V for annual data of the appendix. Various formulation of the system has been estimated and it is found that immediate first lag for the controlled variables seems to be more appropriate by the inference based on chi-square estimates and, it seems that the feedback structure has also been properly captured. Accordingly, the lag structure of the manipulated variables is determined by computing final prediction error which is consistent with chi-square inference by varying the lags from one to ten for quarterly data.

Table 3: Causality Detection of Interest Rates and Causal Variables for Quarterly Data

Controlled Variable	Manipulated Variables				Final Prediction Error	$\chi^2$ Statistic
<b>Short Term Interest Rate</b>						
RSI (1)	Intercept				1.332337	46.583
	$\Delta$ NCF (9)				1.077416	58.992*
	$\Delta$ NCF (9)	GFD (7)			0.976050	61.780*
	$\Delta$ NCF (9)	GFD (7)	$\Delta$ MS (7)		0.905998	62.421*
	$\Delta$ NCF (9)	GFD (7)	$\Delta$ MS (7)	REER (1)	1.018771	64.100*
<b>Long Term Interest Rate</b>						
RLI (1)	Intercept				0.689795	61.108
	$\Delta$ MS (6)				0.598160	61.817*
	$\Delta$ MS (6)	REER (6)			0.611360	62.564*
	$\Delta$ MS (6)	REER (6)	GFD (7)		0.613838	63.941*
	$\Delta$ MS (6)	REER (6)	GFD (7)	$\Delta$ NCF (9)	0.553062	67.914*

Notes: (i)\* denotes significant at 1% level. (ii) Values in parentheses are lags of the variables.

Table 4: Causality Detection of Interest rates and Causal Variables for Annual Data

Controlled Variable	Manipulated Variables			Final Prediction Error	$\chi^2$ Statistic
<b>Short Term Interest Rate</b>					
RSI (1)	Intercept			2.409179	8.109
	GRFD (1)			1.024000	12.944*
	GRFD (1)	GRNCF (1)		1.238226	11.167*
	GRFD (1)	GRNCF (1)	$\Delta$ GRMS (1)	0.719325	14.941*
<b>Long Term Interest Rate</b>					
RLI (1)	Intercept			0.234100	16.797
	GRFD (1)			0.246673	15.327*
	GRFD (1)	$\Delta$ GRMS (1)		0.216032	15.532*
	GRFD (1)	$\Delta$ GRMS (1)	GRNCF (1)	0.204865	6.093*

Notes: (i)\* denotes significant at 1% level. (ii) Values in parentheses are lag of the variables.

Table 5: Causality Detection of Interest rates and Causal Variables for Annual Data

Controlled Variable	Manipulated Variables			Final Prediction Error	$\chi^2$ Statistic
<b>Short Term Interest Rate</b>					
RSI (1)	Intercept			2.300689	8.109
	GRPD (1)			2.569765	8.482*
	GRPD (1)	GRNCF (1)		1.568304	11.147*
	GRPD (1)	GRNCF (1)	$\Delta$ GRMS (1)	0.758972	11.392*
<b>Long Term Interest Rate</b>					
RLI (1)	Intercept			0.234100	16.797
	GRPD (1)			0.469078	16.818*
	GRPD (1)	$\Delta$ GRMS (4)		0.383642	14.302**
	GRPD (1)	$\Delta$ GRMS (4)	GRNCF (1)	0.478517	15.495**

Notes: (i) \*\* and \* denote significant at 5% and 1% levels respectively. (ii) Values in parentheses are lags of the variables.

The real rates of interest for both short and long terms are output variables and, other macro variables are considered as input variables in Tables 3,4 and 5. <sup>14</sup>Hsiao causality inference suggests if  $FPE(m, n)$  is more than  $FPE(m, 0)$  the input variables do not Granger cause the controlled variable while

considering chi-square inference. The direction of causality is clear if one looks at Table 3 for quarterly data, the final prediction error falls when fiscal deficit and money supply are introduced while chi-square is significant. Final prediction error increases when REER is introduced and rises significantly, therefore, fiscal deficit and money supply cause short run real interest rate. Gross fiscal deficit and net capital flows cause long run interest rate as final prediction error falls and chi-square test improves significantly. Quarterly data estimates reveal that there is strong one-way causality from fiscal deficit to interest rates when money supply and net capital flows are taken into account. The Tables 4 and 5 are composed of estimates from the annual data and the only difference is that the Table 4 takes into account fiscal deficit and Table 5 is analysed on primary deficit. It is clear from final prediction errors and chi-square values that the fiscal deficit causes short term real interest rate while controlling for net capital flows and money supply. In case of long-term interest rate no causation from fiscal deficit appears to be true as chi-square value is not supporting causality. Final prediction error is also very high for primary deficit. Other variables entering in the system do not cause the long-term interest rate when we take primary deficit as input variable. In case of short-term interest rate, no unidirectional causality is found from primary deficit to the real interest rate and, when other variables are taken into account as manipulated variables one-way causation appears to be true for other variables as final prediction error falls and chi-square statistics improve significantly.

It can be inferred that the variations in short run real interest rate possibly can be due to the dynamics in the money market through issuing of treasury bills and substitution between the government short term financial instruments and private financial products. As commercial banks and other financial institutions are actively involved in treasury bills market and also in the auctioning process, it is clear that high risk preference falls especially during the volatile situations. Actually, the Government aimed at some sort of working capital via issuing of 91 days treasury bills and as a result the short run scenario in the money market is altered with composite portfolio of people changing quite frequently across all the segments of investors depending on the kinds of situations that prevail in the financial markets. This reveals the emerging complexities arising out of the relationships among fiscal deficit, treasury bills market and short-term interest rate structure in the Indian context and accordingly, critical matters connected to fiscal and monetary policy nexus become very important for policy co-ordinations. Though, this study does not go into the details of macro econometric aspects of the same, it throws some evidences of causality between fiscal deficit and short-term interest rate. Arguably, the long-term interest rate is not caused by the fiscal deficit is something expected as instruments in the money and capital markets are probably not extensively substituted for the government bonds and bills.

When we take primary deficit into account, real interest rate is not caused by the same as it is evident from the estimates reported in Table 5. It is reasonable to understand that the interest payments, at least in Indian context, put huge pressure on liquidity management on treasury bills and therefore, on interest rates. Once interest payment is removed from the deficit concept, the analytical foundations between the government deficits and interest rates are eliminated. Therefore, fiscal deficit is an important conceptual framework not only to estimate the appropriate model but also to deal with policy dynamics meaningfully.

Table 6: Causality Detection of the Budget Deficits and Interest Rates

Controlled Variable	Manipulated Variable	Final Prediction Error	$\chi^2$ Statistic
GFD (1)	Intercept	4.535814	0.640
	RSI (1)	4.502973	5.363***
GFD (1)	Intercept	4.535814	0.640
	RLI (1)	4.65939	0.658
GRFD (1)	Intercept	1856.897	0.103
	RSI (1)	2125.226	0.228
GRFD (1)	Intercept	1856.897	0.103
	RLI (1)	2143.694	0.139
GRPD (1)	Intercept	152730.6	0.194
	RSI (1)	166988.4	2.286
GRPD (1)	Intercept	152730.6	0.194
	RLI (1)	164519.4	2.333

Notes: (i)\*\*\* represents significant at 10 percent level. (ii) Values in parentheses are lag length of the variables.

It is imperative to note that the estimates in Table 6 do not support any causation from either short term or long-term interest rates to the government deficits. However, there is a thin link that appears to be significant at 10 percent level with reference to real short term interest rate. This may not be giving any economic sense as better comprehension cannot be achieved due to the fact that information accounted for estimating relevant models is already sufficient on quarterly data. Alternative estimates did not improve the efficiency. Accordingly, the chi-square value which is significant at 10 percent level should not be taken as final gospel truth. Estimates for other input variables such as net capital flows and change in the money supply are not produced in the Table 6 as final prediction error increases enormously when we input these variables into the system. This indicates no one way causality from all input variables to primary deficit.

## VI. CONCLUSION

This study is a modest attempt to capture the dynamic links between the government deficits and interest rates through Hsiao based Granger causality. The evidences clearly demonstrate the one-way causality from fiscal deficit to interest rate. Other possibilities of causality are ruled out as per the estimates produced. We fully understand that the causality analysis is no more substitute for a large scale macroeconomic modeling or detailed time series analysis. However, based on the empirical evidences reported here the following conclusive inferences can be made for policy analysis. First, strong influence of fiscal deficit on short term interest rate might trigger short term financial instability through inconsistent variation in the issuing of short-term treasury bills and also via the substitution between private short-term instruments and treasury bills. This could presumably put pressure on commercial borrowings and interest payments if real interest rate increases. Secondly, this might put some sort of a constraint in the conduct of monetary policy especially when discretion is limited for smoothening out the short run maladjustment in the money market. Although, the fiscal deficit or primary deficit does not cause the long-term interest rate, the yield curves for both long term and short-term securities and bills can alter the short run market if investors want to avoid risks. Thirdly, the net capital flows appear to be strongly impacting real interest rates and accordingly, conduct of monetary and fiscal policies to create favorable climate to attract and retain capital flows is very important especially when there are some abnormal changes in the real interest rates while prices are volatile. This has to be worked out with sustainable current account deficit. Fourthly, overall debt (both

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short and long terms) burden and commercial borrowings should be waived vis-a-vis the issuing of fresh instruments and auctioning process so as to optimize interest payment burden. Lastly, issue of fiscal consolidation and management partly now depend on the short run financial market behavior and risk-return trade-off that would exist for both private sector and for the Government.

### NOTES

1. Rao (2000) analysed the relationship between budget deficit, money creation and debt financing under static and dynamic framework by focusing on interest rate and tight money paradox.
2. Comprehensive understanding on the theoretical debate can be gained from Kahn (1978), Barro (1987), Buiter (1990) and Das (2010).
3. Direct crowding-out refers to the substitution of private to public spending and vice-versa that occur through public sector investment/capital stock and public sector consumption. Excessive public borrowings, limit the availability of credit and this in turn, raises the interest rates. Rising interest rates alter the interest sensitive private investments.
4. This phenomenon deals with substitution of the government bonds and securities for private bonds and securities and vice-versa by rational behaviour of investors. The crowding-out of private investments consisting of short term and long-term financial instruments due to increase in the rate of interest is called as financial crowding-out (Buiter1990). Chakraborty (2012) analysed the concepts of crowding-out in detail by following the tradition of Buiter (1990).
5. The review here is not exhaustive and only key empirical evidences are presented.
6. Usage of the term government deficits or budget deficits refer to both the concepts of deficits namely, fiscal deficit and primary deficit.
7. The literature on loanable funds revealed that in India, interest rates were reduced with the excess investment in the government securities by commercial banks over and above the SLR norm (Das 2010).
8. For more empirical details refer to Das (2010).
9. It is important to point out that the real interest rate is invariably affected when there is a stable inflation and low unemployment.
10. The supplementary demands for the grants on the account of the farm loans waiver, implementation of sixth pay commission and funding of the prioritized project of eleventh five-year plan had further raised the government expenditure (Economic Survey 2008-09).
11. The short run and short term are alternatively used to mean the same. The similar analogy applies to long run and long term.
12. Following Goyal (2004) and Chakraborty (2012) inflationary expectation is computed from HP filter.

13. This study adopts the methodology of the causality analysis from Hsiao (1981).
14. The actual real variation in the exchange rate captured by Real Effective Exchange Rate (REER) for annual data seems to be insignificant. Though there appears a trend in REER, the quarterly data capture the trend around cyclical and seasonal variations properly. Therefore, we decided to drop variable REER for annual data.

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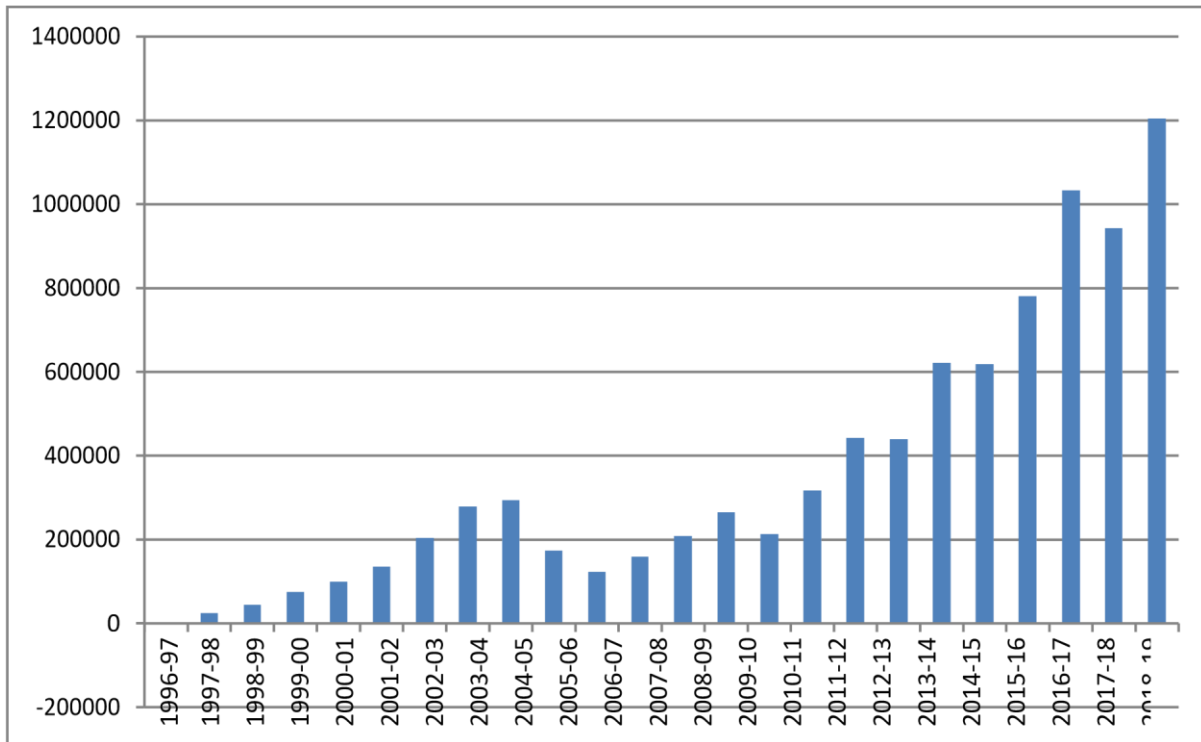


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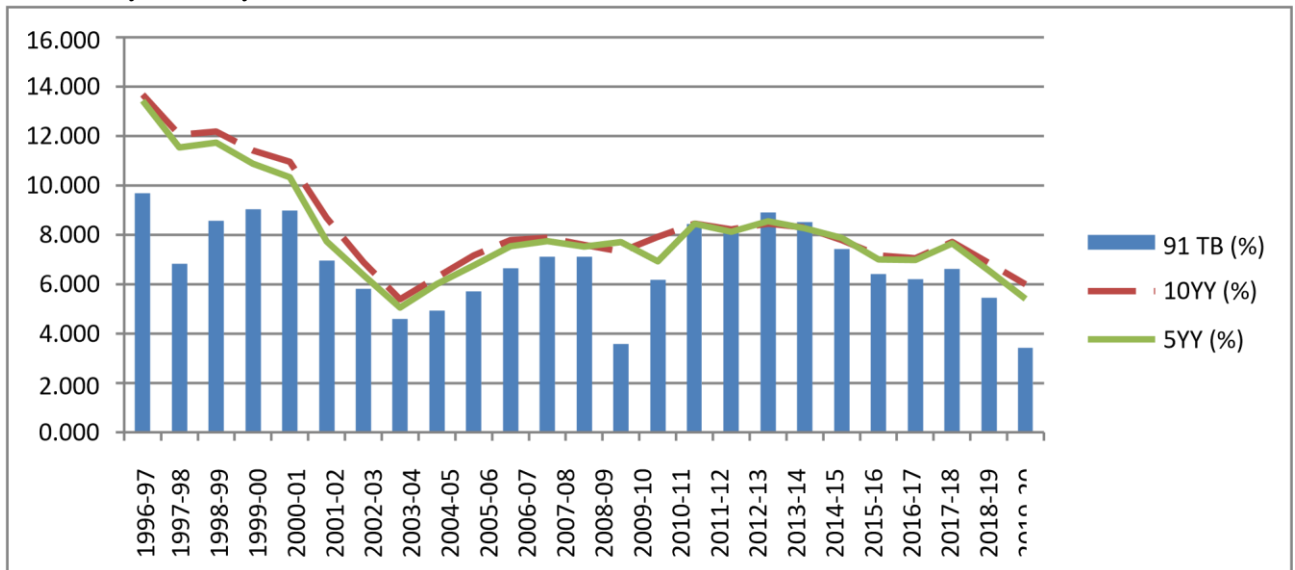
**APPENDIX:**

Figure 1: Difference of schedule commercial banks' investment in the government securities and minimum SLR requirement.



Source: Calculated from Handbook of Statistics on Indian Economy 2019-20, Reserve Bank of India.

Figure 2: Yields on SGL transactions in the government dated securities for 5- and 10-years maturity and 91 Days treasury bills



Source: Handbook of Statistics on Indian Economy 2019-20, Reserve Bank of India.

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Table (I): Gross Fiscal Deficit, Gross Primary Deficit and Monetised Deficit as a Percentage to GDP

Year	199 6-97	199 7-98	199 8-99	199 9-00	200 0-01	200 1-02	200 2-03	200 3-04	200 4-05	200 5-06	200 6-07	200 7-08
<b>GFD/GDP</b>	4.70	5.66	6.29	5.18	5.46	5.98	5.72	4.34	3.88	3.96	3.32	2.54
<b>GPD/GDP</b>	0.51	1.48	1.97	0.72	0.90	1.42	1.08	- 0.03	- 0.04	0.37	- 0.18	- 0.88
<b>MD/GDP</b>	8.65	8.65	8.20	7.03	6.85	6.11	4.53	1.32	- 0.73	0.14	0.05	- 2.34

Year	200 8-09	200 9-10	201 0-11	201 1-12	201 2-13	201 3-14	201 4-15	201 5-16	201 6-17	201 7-18	201 8-19	201 9-20
<b>GFD/GDP</b>	5.99	6.46	4.80	5.91	4.93	4.48	4.10	3.87	3.49	3.46	3.34	3.34
<b>GPD/GDP</b>	2.57	3.17	1.79	2.78	1.78	1.14	0.87	0.66	0.36	0.36	0.25	0.21
<b>MD/GDP</b>	1.12	3.32	5.16	6.12	5.94	6.21	2.90	3.08	4.03	2.77	4.22	4.87

Source: Handbook of Statistics on Indian Economy (2019-20), Reserve Bank of India.

Note: GFD/GDP: Gross Fiscal Deficit as a percentage to GDP, GPD/GDP: Gross Primary Deficit as a percentage to GDP,

MD/GDP: Monetised Deficit as a percentage to GDP.

Table (II): Specific Gravity for Quarterly Data

Caused Variable	Manipulated/Causal Variable	Bi-variate Final Prediction Error	Specific Gravity	Rank
RSI	$\Delta MS$	1.278098	0.7824	3
	$\Delta NCF$	1.077416	0.9281	1
	REER	1.341653	0.7453	4
	GFD	1.138415	0.8784	2
RLI	$\Delta MS$	0.59816	1.6717	1
	$\Delta NCF$	0.668524	1.4958	4
	REER	0.664059	1.5058	2
	GFD	0.665517	1.5025	3

Table (III): Specific Gravity for Annual Data

Caused Variable	Manipulated/Causal Variable	Bi-variate Final Prediction Error	Specific Gravity	Rank
RSI	$\Delta$ GRMS	2.416011	0.4139	3
	GRNCF	1.543399	0.6479	2
	GRFD	0.447717	2.2335	1
	GRPD	0.047993	20.8363	1
RLI	$\Delta$ GRMS	0.247058	4.0476	2
	GRNCF	0.261688	3.8213	3
	GRFD	0.246673	4.0539	1
	GRPD	0.215232	4.6461	1

Table (IV): Specific Gravity for Quarterly Data

Caused Variable	Manipulated/Causal Variable	Bi-variate Final Prediction Error	Specific Gravity	Rank
GFD	RSI	4.502973	0.22208	3
	RLI	4.65939	0.21462	4
	$\Delta$ MS	4.426934	0.22589	2
	$\Delta$ NCF	4.237206	0.236005	1
	REER	4.659743	0.214604	5

Table (V): Specific Gravity for Annual Data

Caused Variable	Manipulated/Causal Variable	Bi-variate Final Prediction Error	Specific Gravity	Rank
GRFD	RSI	2125.226	0.000470	1
	RLI	2143.694	0.000466	4
	$\Delta$ GRMS	2130.691	0.000469	3
	GRNCF	2125.767	0.000470	2
GRPD	RSI	166988.4	0.0000070	2
	RLI	164519.4	0.0000060	1
	$\Delta$ GRMS	173887.7	0.0000058	3
	GRNCF	176455.7	0.0000057	4