Does Fiscal Deficit Affect Interest Rate in India? An Empirical Investigation

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Abstract

Fiscal deficit above a certain limit is not good for the country because high government borrowings raise the interest rate and crowd out private investment. This article is an attempt to analyze the impact of fiscal deficit on real interest rate in India over the time period of 1980–1981 to 2013–2014. Autoregressive distributed lags bound testing approach for cointegration and vector error correction model for Granger casualty are used in a multivariate framework in which money supply and inflation are included as additional variables. Bound test results confirm the long-run equilibrium relationship among the competing variables. Further, the rate of interest and fiscal deficit are positively related with each other in long run, whereas money supply and inflation are found to be negative and statistical significant. In addition, results of vector error correction model showed that there is unidirectional causality running from inflation to real interest rate in short run. Based on the findings, it is suggested that that proper fiscal consolidation is required to control high fiscal deficit and burgeoning interest rate in India. Further, government should move from market borrowing to tax revenue to offset fiscal deficit.

Keywords

Fiscal deficit, money supply, inflation, government expenditure, market borrowing

Introduction

In the recent years, many developed and developing countries have experienced high fiscal deficit and it is widely believed that fiscal deficit raises the real interest rate. According to IMF and World Bank directions, fiscal deficit above a certain ratio of GDP is not good for the health of the country because it raises interest rate, hence reduces the private investments in the country. Therefore, fiscal deficit has to be kept up to certain limit. But, the prevailing orthodox based on Keynesian demand management theory

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that increases in government expenditure is the key instrument of expansionary policy to increase the aggregate demand in the economy. On the basis of this belief, if government expenditure crowd out private investment, then the whole idea of increasing government spending to increase demand, reduce unemployment, and increase national income is questionable. So there is need to investigate the relationship between fiscal deficit and real interest rate. Theoretically, fiscal deficit can influence interest rate in three ways. First, according to Keynesian IS-LM framework, IS curve shift rightward as a result of increase in government expenditure. This leads to increase the interest rate. Moreover, it is important to note that persistent fiscal deficit as a result of tax cut or increase in government expenditure leads to increase the aggregate demand. Although it improves private saving, the net effect is less than the tax cut and this reduces the desired national saving. As a result, real rate of interest will rise to restore equality between national saving and demand for investment. This will crowd out private investment. In addition, financing of fiscal deficit through market borrowing may raise interest rate which crowd out private investment. Second effect is within the parameter of loanable funds approach which advocates that increased government deficit increases the supply of government securities reduces their price, results in rise in interest rate (Burney & Yasmeen, 1986). Finally, Ricardian equivalence theorem states that a budget deficit or public dis-saving leads to increase the private saving and thereby offsets the effects of deficits. This will neutralize the impact of government borrowing and interest rates (Barro, 1974).

Theoretical Framework of Rate of Interest Model

The theoretical framework, which is commonly used to describe the potential effects of fiscal deficit on interest rates, has several important implications for empirical analysis of those effects. The change in the interest rate is affected by fiscal deficit. Keynesian theory with IS-LM framework suggests that deficits affect the level of the interest rate. Deficits not only stimulate aggregate demand and raise output, but also crowd out private investment. However, an impact of increased interest rates in the short run is quite different from long-run effect, that is, crowding out private capital (Engen & Hubbard, 2004).

There are many factors other than fiscal deficit that can influence the determination of interest rates in credit markets. Generally in developing economy, government intervene in market to stabilize interest rate by purchasing and sale of government securities. Purchase of government securities from the market increases the money supply and sale of government security reduces the money supply in the economy. Apart from this, the other factor that affects the interest rate is price level of the country. When inflation is high in the economy, people spend more that leads to decrease their disposable income and reduce national saving. To control inflation, government reduces money supply through increase in interest rate. But in developing countries like India, situation is quite different. Inflation in developing economy is mainly caused by supply shocks. In such a situation in order to improve supply of goods, government reduces interest rate to induce private players to make investment. As interest rates are lowered, more people are able to borrow more money. The result is that consumers have more money to spend, causing the economy to grow and inflation to increase.

Barro and Sala-i-Martin (1990) and Barro (1992) investigated the effects of fiscal and monetary policy variables on expected real-world interest rates across 10 major developed economies. By using structural approach, they found that world interest rate is determined by investment demand and desired saving. They also concluded that current fiscal deficits do not play a significant role in the determination of real expected interest rates in these countries. Elmendorf and Mankiw (1999) stated that their findings supported the Ricardian view that budget deficits have no effect on interest rates. The Ricardian Equivalnce Hypothesis (REH) considers that all government spending must be financed by taxation either now or by putting taxes on future generation. Chakraborty (2002) investigated the empirical link

and concludes that deficit does not induce rise in rate of interest in India. Chakraborty (2007) found that the rate of interest is a significant determinant of private corporate investment. If increase in fiscal deficit increases the rate of interest, it would imply financial crowding out. Evans (1985), Tanzi (1985), Dalamagas (1987), Ahamad (1994), and Kulkarni and Lee (1995) found no positive link between rate of interest and deficit. While Cebula (1990), Correia and Stemitsiotis (1995), and Ostrosky (1979) did find evidence for the link between fiscal deficit and rate of interest. Cebula (1997) examined the direction of causality between long-term interest rates and structural budget deficits in the US for a period between 1973 and 1991 and found that there is bi-directional causality between rate of interest and the deficit. Das (2010) found that there is enough potential within the banking system to control rise in interest rate by accommodating extra liquidity demand of commercial banks.

Loanable Funds Approach

It is widely believed that there is always a trade-off between deficits financed public expenditure and private investments because there is limited pool of resources available in the economy. As a result of expansionary fiscal policy, government takes away the larger proportion from this pool and smaller portion will be left for private sectors borrowings (Das, 2010). Loanable fund model helps in determining interest rate by examining the relationship between high fiscal deficit (leads to increase borrowings) and interest rate in the economy. It is well known that the loanable funds approach and IS-LM model are formally equivalent and contain identical information about the macro economy.

Figure 1 describes a comparative-statics equilibrium model that employs a supply and demand curve to locate a market-clearing equilibrium price. The price in this model is the cost of credit known

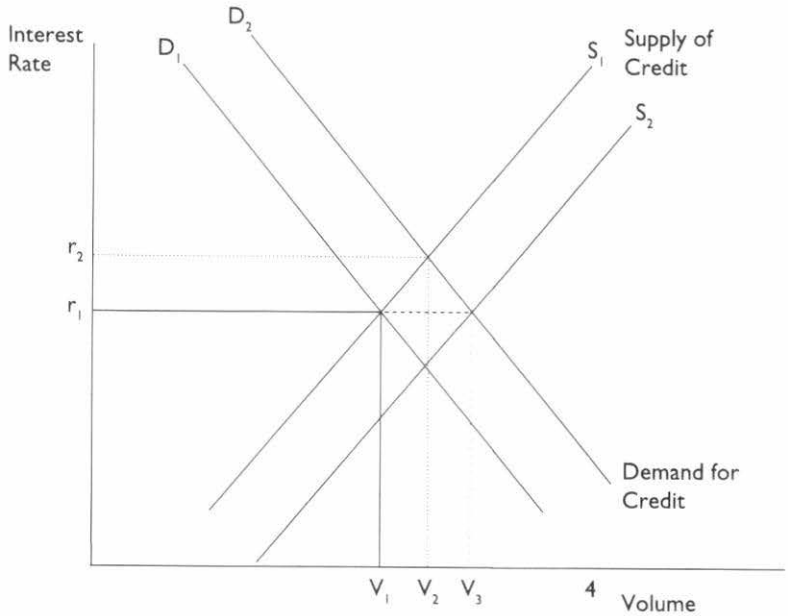

Figure 1. Interest Rate Determination in Loanable Funds Approach

Source: Authors' own calculation following Evans (1997).

as interest rate. Further, demand curve shows the demand for credit by borrowers and the supply curve represents the supply of credit by lenders. Borrowers include consumers, business, and government. On the other hand, lenders or supplier of credit includes banks, mortgage companies, credit card companies, and the purchasers of the interest-bearing financial assets such as bonds, treasury bills, securities, and stocks. When the government runs a budget deficit, the difference can be financed through sale of bonds and treasury bills in the market results; this increases the demand for credit, thereby shifting the initial demand curve D_1 to D_2. This could mean disequilibrium in the money market, subsequently causing interest rate to rise. In order to restore the economy, central bank has the ability to increase the amount of credit available to the economy through an expansionary monetary policy called as open market operations. This is reflected in Figure 1 that expansionary monetary policy shifts the supply curve from S_1 to S_2 and also reduced the rate of interest. It will also increase the volume of total credit in the economy. Thus, in order to stimulate the economy, government needs a combination of fiscal and monetary policy.

Figure 2 reveals that out of total liabilities, government dependence on market borrowing in India was 26.02 percent which came down to 16.99 percent in 1992–1993. It showed an increasing trend thereafter and reached at 33.17 percent in 2000–2001 and 58.73 percent in 2013–2014. However, heavy dependence on market borrowings in the domestic credit market takes away larger proportion from the limiting pool and smaller proportion is available for private players could be reason for crowding out of private investment in India.

Figure 3 reveals the declining trend of financing fiscal deficit through 91-day treasury bills in India since 1980. The share of 91-day treasury bills in total government liabilities was 21.50 in 1980–1981, sharply came down to 3.66 percent in 1987–1988. It increased to 8.23 in 1989–1990 but subsequently came down to 1.99 percent in 1990–1991. Dependence on treasury bills was less than 1 percent between 1997–1998 and 2005–2006. However, it increased thereafter and reached at 2.14 in 2013–2014. On the other hand, government started using 182/364-day treasury bills from 1988–1989. The share of 182/364-day treasury bills was only 0.21 percent in 1988–1989. It reached at 1.83 in 1992–1993 but came down to 0.26 percent in 1995–1996. It was less than 2 percent till 2010–2011 but increased to 3.72 percent in 2012–2013.

It is reflected in Figure 4 that prime lending interest rates in India is very high in comparison to largest economies of the world, which is a big obstacle for manufacturing sector. The recent data of

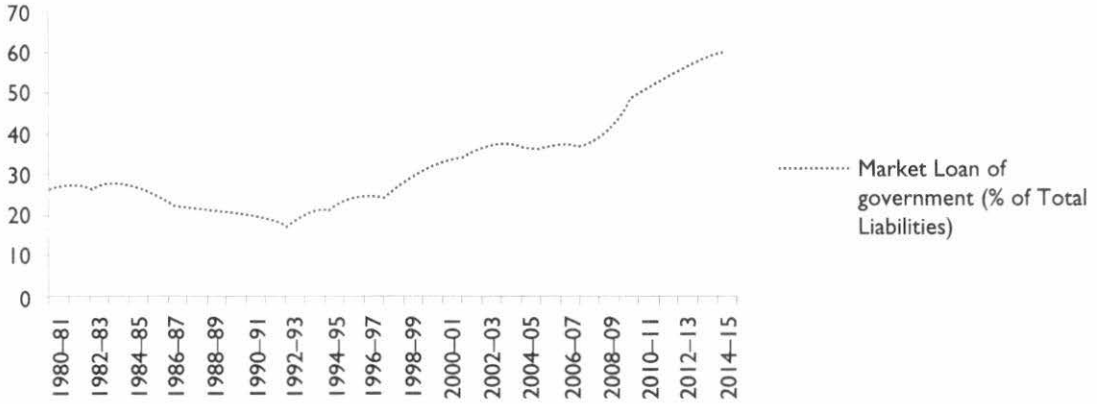

Figure 2. Trends in Money Market in India

Source: Reserve Bank of India (2015).

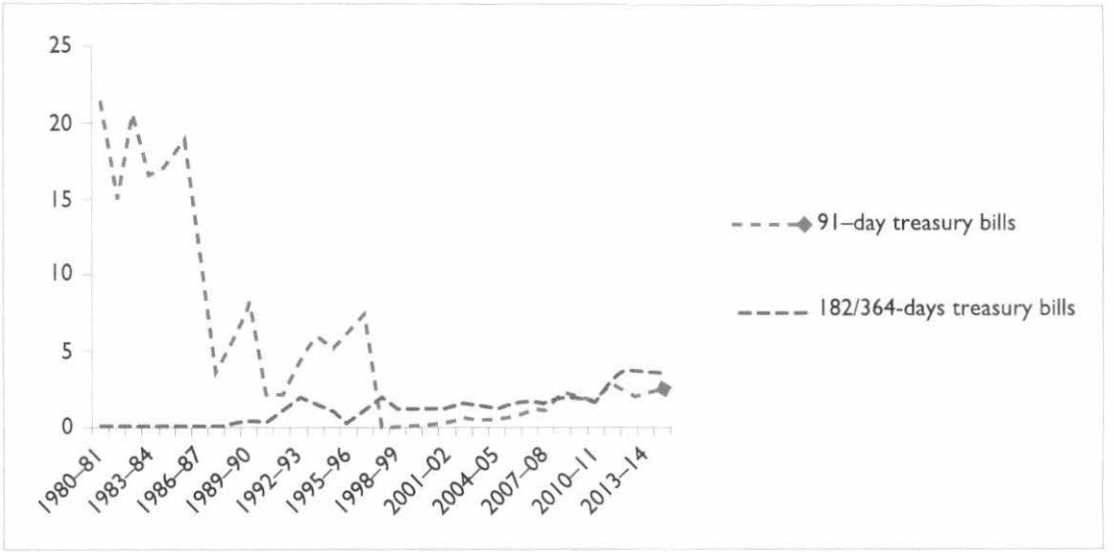

Figure 3. Trend and Pattern of Treasury Bills (91 days and 182/364 days) as the Percentage of Total Government Liabilities

Source: Reserve Bank of India (2015).

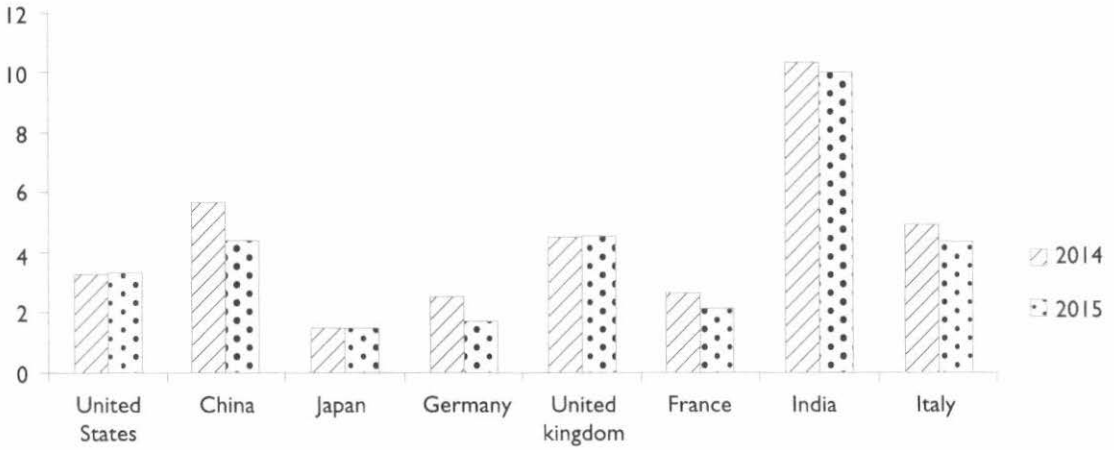

Figure 4. Commercial Banks Prime Lending Interest Rates (top economies in the world)

Source: World Bank Database (2015).

World Factbook show that prime lending interest rates in the United States were 3.25 percent in 2014 and 3.3 percent in 2013. China, Japan, Germany, United Kingdom, France, and Italy also have lower rate of interest. The above figure shows that prime lending interest rate in India was 10.25 in 2014 that decreased to 9.9 percent in 2015. High interest rates in India make fiscal and monetary policy ineffective and crowd out private investment. Although India is one of the fastest growing economies in the world in terms of nominal GDP and holds seventh position in the world but still depend on agriculture (16 percent), in comparison of western countries. However, the services sector has picked up in recent years and now

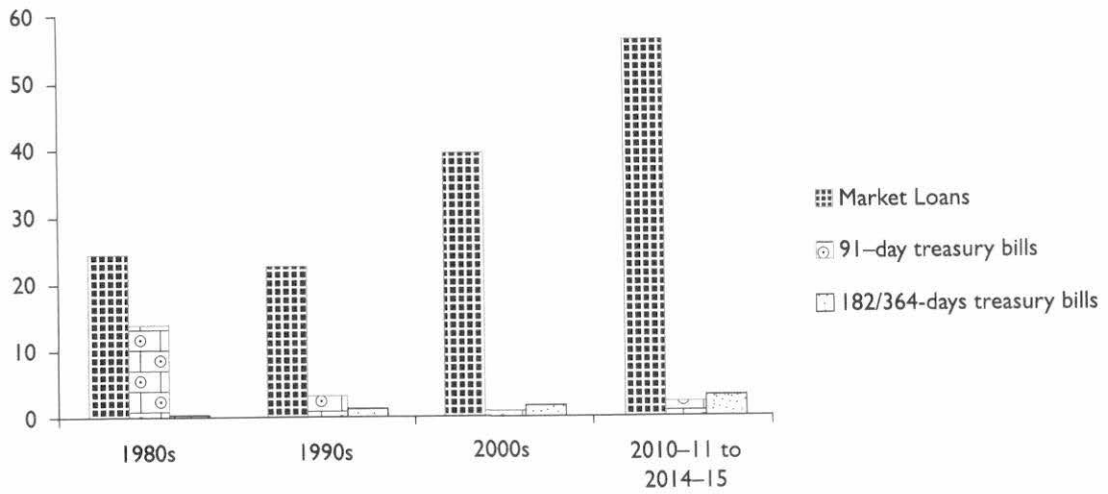

Figure 5. Decade-wise Analysis of Government Liabilities

Source: Reserve Bank of India (2015).

accounts for 54.4 percent of the GDP, while industry contributes only 29.5 percent. Chinese economy is strength with a high contribution from manufacturing and services about 45 percent each and 10 percent contribution from agriculture (according to The *World Factbook*, 2015). However, the huge difference between these economies is due to slow growth of manufacturing sector in India. Further, it can also be stated that high interest rate is the reason for sluggish growth of private investment in India.

Figure 5 shows that high government expenditure over its revenue in India is mainly financed through market borrowing, which results in contracting funds for private players. It is reflected in the above figure that in 1980s (average), out of total liabilities of central government, 24.48 percent is financed through market loans, 13.8 percent from 91 days treasury bills and 0.04 percent through 182/364-day treasury bills. Dependence on market loans showed upward trend since 1980–1981. The average share of market loan and 91 days treasury bills decreased to 22.68 and 3.33, respectively, in 1990s, but the share of 182/364-day treasury bills increased to 1.12 during this period. In next decade, the average share of market loans increased to 39.51 percent, but the share of 91 days treasury bills decreased to 0.89 percent. However, the dependence on 182/364-day treasury bills increased to 1.49 percent during this decade. Furthermore, the average dependence of market loans, 91 days treasury bills and 182/364-day treasury bills between 2010–2011 and 2014–2015 increased to 56.16, 2.21, and 3.09 percent, respectively. Heavy dependence on market borrowings is the reason for crowding out of private investment in India.

Figure 6 demonstrates the real interest rates and inflation (deflator) in India since 1980. Real interest rate is the inflation adjusted interest rate. Both the variables do not show any specific trend. It is depicted in the above figure that when inflation is high, interest rate is low and vice versa. It also shows that inflation reduces the real interest rate in the economy. In 1980–1981, inflation was about 10.8 and real interest rate was 5.1. In order to control high inflation, government increases the interest rates to 7.8 percent in 1981–1982, further increased to 9.1 in 1985–1986. Thus, as a result of tight monetary policy, government is able to control high inflation and it reached at 6.8 percent in 1985–1986. In next year, government adopted expansionary monetary policy and reduced the interest rate to 6.6 percent and further reduced to 3 percent in 1990–1991. But this leads to take inflation at a peak level (13.8 percent)

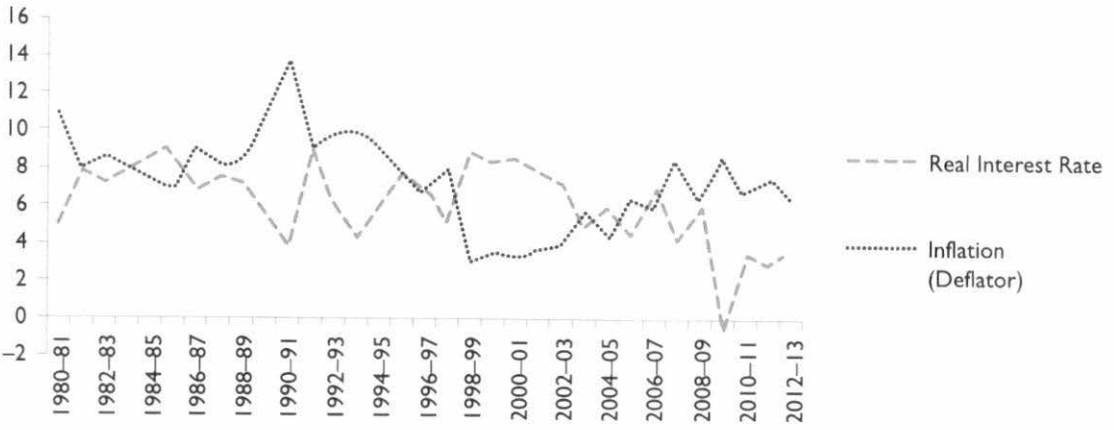

Figure 6. Trend and Pattern of Real Interest Rate and Inflation (Deflator) in India

Source: Reserve Bank of India (2015).

in 1990–1991. To control high rate of inflation, RBI increased the interest rate to 9.1 percent and able to bring it down to 9 percent in 1991–1992. As a result of tight monetary policy, government is able to control high rate of inflation and it came down to 3 percent approximately in the end to 1990s. But after economic crisis of 2007, in order to increase the sluggish demand, RBI adopted expansionary monetary policy and reduced the interest rate to 2.8 percent in 2011–2012. Simultaneously, it leads to increase the inflation and again it reached at 9 percent in 2009–2010 and 7.6 percent in 2011–2012. Thus the above facts explain that when inflation is high, government adopts tight monetary policy and able to control over inflation.

Average prime lending rates were 16.2 percent in 1980–1981 and further reached at 19 percent in 1992–1993. The reasons for the high prime lending interest rates were high Cash Reserve Ratio (CRR) (15 percent) and high SLR (Statutory Liquidity Ratio) (38.5 percent) in 1981 and remain high till 1997. RBI reduced CRR to 9.50 percent and SLR to 25 percent in 1998. Then government is able bring down prime lending interest rate to 11 percent in 2004–2005. During this period CRR reduced to 4.5 percent (2003). However, average prime lending interest rates increased in 2005–2006 and reached at 12.75 percent as RBI increased CRR to 9 percent in 2008. Further PLR rose to 16.75 percent in 2008–2009. As a result of reducing CRR to 5 percent in 2009 and 4 percent in 2013, RBI is able to reduce the prime lending rate to 9.5 percent in 2010–2011 and 10.25 in 2012–2013 (Reserve Bank of India, 2015).

Interest Rate and Effectiveness of Fiscal Policy

In order to get the result of increase in government expenditure, differentiate both the equations IS as well as LM (assuming supply of money to be constant or no change in LM curve).

$$\text{IS: } \delta Y = \delta G + c(1-t)\delta Y + I_r \delta r \tag{1}$$

$$\text{LM: } 0 = h\delta Y + l_r \delta r \tag{2}$$

IS represents investment saving equation and LM represents demand for money. I_r represents investment demand for money as a function of interest rate and Y is the national income. h represents the income responsiveness of the demand for money, that is, the function of Y and l_r is the speculative demand for money is a function of rate of interest.

$$\delta r = \frac{-h\delta Y}{l_r}$$

By substituting the value of δr, we will get equation (3)

$$\delta Y = \delta G + c(1-t)\delta Y + I_r(\frac{-h\delta Y}{l_r})$$

$$\frac{\delta Y}{\delta G} = \frac{1}{(1-c(1-t)+\frac{I_r h}{l_r})} \tag{3}$$

It is clearly shown in equation (3) that value of government expenditure will be weaker due to increased interest rate and crowding out of private investments. The value of government expenditure multiplier will be greater if the whole bunch $\frac{I_r h}{l_r} = 0$. Further, it is possible only in two cases:

(1) When $I_r \rightarrow 0$ means private investment does not respond to change in interest rate. So the value of multiplier will be as below

$$\frac{\delta Y}{\delta G} = \frac{1}{[1-c(1-t)]}$$

(2) If interest rate does not change or $\delta r = 0$

$$\frac{\delta Y}{\delta G} = \frac{1}{1-c(1-t)} \tag{4}$$

$$\text{Because } \delta r = \frac{-h\delta Y}{l_r} = 0$$

The above situation is possible when monetary authority control over rate of interest rate by increasing money supply in the economy. Therefore, effectiveness of fiscal policy depends upon proper monetary policy otherwise as per IS-LM model; interest rate will increase as a result of increase in government spending.

The Model

Although the focus of the present study is to analyze the relationship between fiscal deficit and interest rate, an appropriate model specification is extremely important as some other macroeconomic variables may also affect the movement of rate of interest. So, multivariate framework is designed to test the relationship between real interest rate, fiscal deficit, money supply, and inflation. The rate of interest is mainly affected by fiscal deficit, money supply, and inflation. Further, interest rate is adjusted to remove the effects of "inflation" to reflect the real cost of funds to the borrower. So the difference between nominal rate of interest and inflation is taken as real interest rate.

The relation between real and nominal interest rates and the expected inflation rate is given by the Fisher equation

$$1+n=(1+r)(1+i)$$

where n = nominal interest rate, r = real interest rate, i = inflation.

Further model specification for real rate of interest rate is explained in equation (5):

$$\text{RINT} = f(\text{FD}, \text{MS}, \text{INFD}) \tag{5}$$

In model, RINT is real interest rate, FD is fiscal deficit as percentage of GDP, MS (broad money) is the money supply as the percentage of GDP and INFD is the inflation (deflator). Data are collected from RBI and World Bank and cover the period between 1980–1981 and 2013–2014. Inflation (deflator) is most accurate indicator to measure the inflation as it covers the entire range of goods and services produced in the economy while the other two indices (WPI and CPI) derive from price quotations for select commodity baskets. These variables have been taken under consideration because as per IS-LM model, interest rate is decided through equilibrium in goods (fiscal policy) and money market (monetary policy). In addition, inflation plays a key role as it affects rate of interest. In addition, the autoregressive distributed lag (ARDL) model is used to find out short-run and long-run coefficients which is introduced originally by Pesaran and Shin (1999), further extended by Pesaran Shin, and Smith (2001). The ARDL approach has the advantage that it does not require all variables to be $I(1)$ as in Johansen cointegration and applicable if variables are $I(0)$ and $I(1)$. To investigate the presence of long-run relationships among the RINT, FD, MS, and INFD bound testing under Pesaran et al. (2001) procedure is used. The bound testing procedure is based on the F-test. The F-test is actually a test based on the hypothesis of no coinetegration among the variables against the existence of cointegration among them. If the computed F-statistic is greater than the upper bound critical value (bound test), then the null hypothesis of no cointegration is rejected (meaning that variables are cointegrated).

$$\Delta RINT_t = \beta_0 + \sum_{i=1}^{k} \beta_1 \Delta \text{RINT}_{t-i} + \sum_{i=0}^{k} \beta_2 \Delta \text{FD}_{t-i} + \sum_{i=0}^{k} \beta_3 \Delta \text{MS}_{t-i} + \sum_{i=0}^{k} \beta_4 \Delta \text{INFD}_{t-i} + \alpha_1 \text{RINT}_{t-1} + \alpha_2 FD_{t-1} + \alpha_3 \text{MS}_{t-1} + \alpha_4 \text{INFD}_{t-1} + e_t$$

The left-hand side in the model is the real interest rate. On the right-hand side α_1, α_2, α_3, α_4 represent the coefficient of long-run relationship. The remaining expressions with the summation sign ($\beta 1 - \beta 4$) represent the short-run dynamics of the model.

$$H_0 \rightarrow \alpha_1 = \alpha_2 = \alpha_3 = \alpha_4 = 0 \qquad \text{(No cointegration)}$$

$$H_1 \rightarrow \alpha_1 \neq \alpha_2 \neq \alpha_3 \neq \alpha_4 \neq 0 \qquad \text{(Cointegration exists)}$$

In addition, the error correction version of ARDL model pertaining to the variables in equation (2) is as follows:

$$\Delta RINT_t = \beta_0 + \sum_{i=1}^{k} \beta_1 \Delta \text{RINT}_{t-i} + \sum_{i=0}^{k} \beta_2 \Delta \text{FD}_{t-i} + \sum_{i=0}^{k} \beta_3 \Delta \text{MS}_{t-i} + \sum_{i=0}^{k} \beta_4 \Delta \text{INFD}_{t-i} + \lambda \text{ECM}_{t-1} + \mu_t$$

where ECM_{t-1} is the error correction term, μ_t is an error term and λ is the coefficient of the error correction term which shows the speed of adjustment of the variables toward equilibrium in long run.

However, the ARDL bounds testing approach is based upon the assumption that the variables are not integrated of order two $I(2)$ which is ensured by applying Augmented Dickey–Fuller (Dickey & Fuller, 1979) unit-root tests.

Results and Discussions

Unit Root Test

The first practice in applying any cointegration technique is to determine the degree of integration of each variable. The results of Augmented Dickey–Fuller test are presented in Table 1 which shows that fiscal deficit, money supply and inflation are stationary at first difference (the null hypothesis of the presence of unit root is rejected once the series are in the first difference). On the other hand, real interest rate is stationary at level.

Long-run and Short-run Elasticity Estimates

The long-run elasticity of real interest rate with respect to fiscal deficit, money supply and inflation is estimated using the underlying ARDL model is shown in Table 2. According to Table 2, fiscal deficit elasticity is 0.33 percent at lag 2. It indicates that 1 percent increase in fiscal deficit would increase the real interest rate by 0.33 percent (supported by IS-LM model). Further, money supply elasticity is −0.18 at lag 2 shows that when government increases money supply by 1 percent (adopts expansionary monetary policy), this would decrease the interest rate by 0.18 percent.

An interesting part of long-run analysis is that inflation elasticity is −0.73 percent in current year indicates that 1 percent increase in inflation would decrease the real rate of interest (i.e., nominal interest inflation) by 0.73 percent or inflation is the reason for decline in the real return on deposits with banks. Further, it is also observed that supply shocks are the main cause of inflation in India. Hence, in order to control inflation, government reduces interest rate to induce private players for making investments. But inflation found positive sign at lag one meaning that any increase in inflation from the previous period positively affects rate of interest. Indeed, as a result of inflation, government would keep control on rate of interest by increasing it in next year for the benefit of investors or to extract excess purchasing power from the market. All the variables are found statistically significant at 5 percent level. In addition, the value of R square is very high (95 percent) that is good for the model. Moreover, the estimated ARDL

Table 1. Unit Root Test by ADF

Variables	Level	At First Difference
RINT	0.0007*	0.0000*
FD	0.1286	0.0000*
MS	0.9800	0.0017*
INFD	0.1267	0.0000*

Source: Authors' computation with Eviews 9.0.

Note: *denotes the rejection of null hypothesis of the presence of a unit-root at 1 percent level of significance.

Table 2. Long-run Elasticities Estimates Selected Model: ARDL (2, 2, 2, 2) for Long-run Relationship among Variables

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
RINT(−2)	−0.52571	0.14044	−3.74342	0.0014*
FD(−2)	0.33905	0.15854	2.13857	0.0457*
MS(−2)	−0.18188	0.08577	−2.12047	0.0474*
INFD	−0.73302	0.07391	−9.91819	0.0000*
INFD(−1)	0.70406	0.16451	4.27984	0.0004*
INFD(−2)	−0.52639	0.15634	−3.36704	0.0032*
C	17.87821	3.19256	5.59996	0.0000*

Source: Authors' own calculations.

Note: *Significance at 5 percent level, Prob. = Probability, *R*-squared = 0.95198, Adjusted *R*-squared = 0.92417, S.E. of regression = 0.61446, Sum squared resid = 7.17363, F-statistic = 34.23935, Prob(F-statistic) = 0.00000, mean dependent var = 6.187097, Akaike info criterion = 2.148495, Durbin–Watson stat = 2.038645, Breusch–Godfrey Serial Correlation LM Test = 0.9496, Heteroskedasticity Test (Prob. chi-square value of Breusch–Pagan–Godfrey) = 0.9580.

model passed the usual diagnostic tests. Breusch–Godfrey Serial Correlation LM Test shows that there is no serial correlation. Further, chi-square value of Heteroskedasticity test is also significant at 5 percent level of significant. The long-run model of the corresponding ARDL (2, 2, 2, 2) for the interest rate (RINT) can be written as follows:

$$\mathrm{RINT}_t = 17.87821 + 0.33905\,\mathrm{FD}_t - 0.18188\,\mathrm{MS}_t - 0.73302\,\mathrm{INFD}_t$$

The above long-run relationship between rate of interest, fiscal deficit, and money supply supports the working of IS-LM model in India. Basically, IS-LM model is used to explain fluctuation in output and interest rate and to examine the effectiveness of fiscal and monetary policy for economic stabilization. According to IS-LM model, increase in fiscal deficit as a result of increased government spending leads to increase the interest rate, hence crowd out private investments. Further, increase in money supply shifts the LM curve to right leads to decrease the interest rate. Thus positive relationship between fiscal deficit and rate of interest confirms that financing of government expenditure (as a result of expansionary fiscal policy) mainly through market borrowings compete creates extra pressure in money market. This results in increase in interest rate. On the other hand, negative relationship between money supply and interest rate indicates that increase in money supply inject extra cash in banks thus lowering the rate of interest.

In Table 3, ARDL bound test confirms the long-run relationship among real interest rate, fiscal deficit, money supply and inflation as computed *F* statistic (7.23) is greater than upper bound (3.67) at 5 percent level of significance. In addition, the long-run stability of the parameters is tested by applying the cumulative sum (CUSUM) and the cumulative sum of squares (CUSUMSQ) tests suggested by Pesaran and Shin (1999) is presented in Figures 7 and 8, respectively. CUSUM and CUSUM square confirm the stability of model in long run.

Table 4 shows the summary of the short-run analysis; fiscal deficit is found positively related with real interest rate and 1 percent increase in fiscal deficit will increase the real rate of interest by 0.43 percent. This depicts that high fiscal deficit is a reason for high interest rate in India. Therefore, government should control on its expenditure. An interesting part of short-run result is that 1 percent increase in money supply will decrease the real rate of interest by 0.19 percent. Besides, inflation is

Table 3. Bound Test Statistic

Test Statistic	Value	K
F-statistic	7.231248	3
	Critical Value Bounds	
Significance	I0 Bound	I1 Bound
I0 percent	2.37	3.2
5 percent	2.79	3.67
2.50 percent	3.15	4.08
I percent	3.65	4.66

Source: Authors' computation with Eviews 9.0.

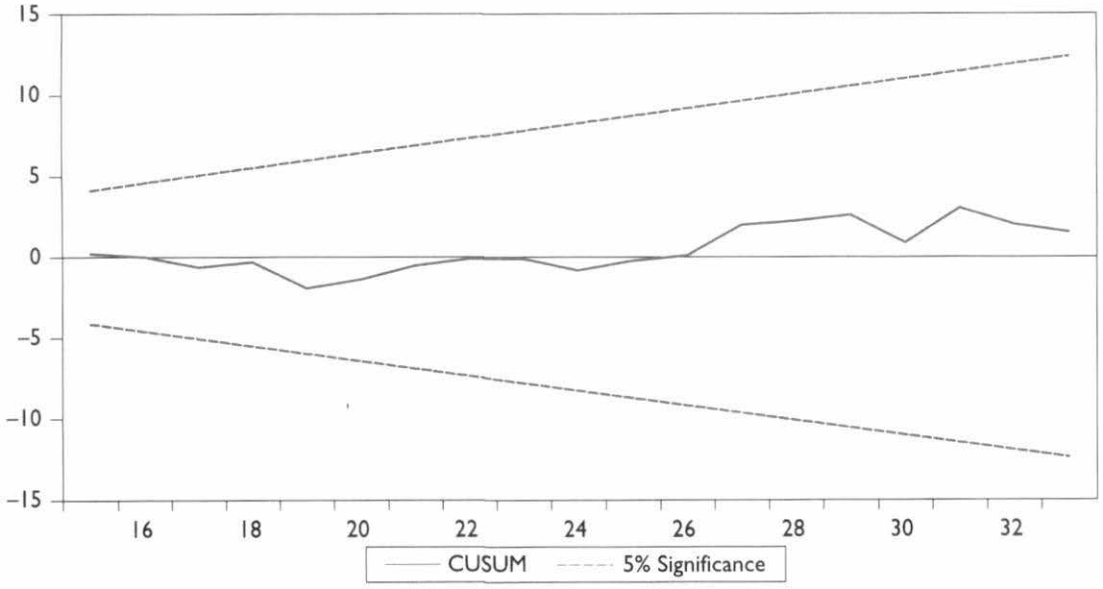

Figure 7. CUSUM Test Results

Source: Authors' own calculations.

found positively related with real interest rate at lag 1. In addition, the value of ECT is negative and significant at 5 percent indicates that the speed of adjustment is −0.57704. This negative coefficient of error correction term indicates that 57 percent disequilibrium in rate of interest will be offset each year by short-run adjustment of explanatory variables (fiscal deficit, money supply, and inflation). Thus, it is important to reduce the disequilibrium in rate of interest over time by implementing adequate fiscal and monetary policy in order to maintain long-run equilibrium.

Granger Causality Analysis

Once cointegration is found among variables, there must be uni- or bidirectional causality between the series (Ohlan, 2015). Such knowledge is worthwhile for formulating appropriate fiscal and monetary

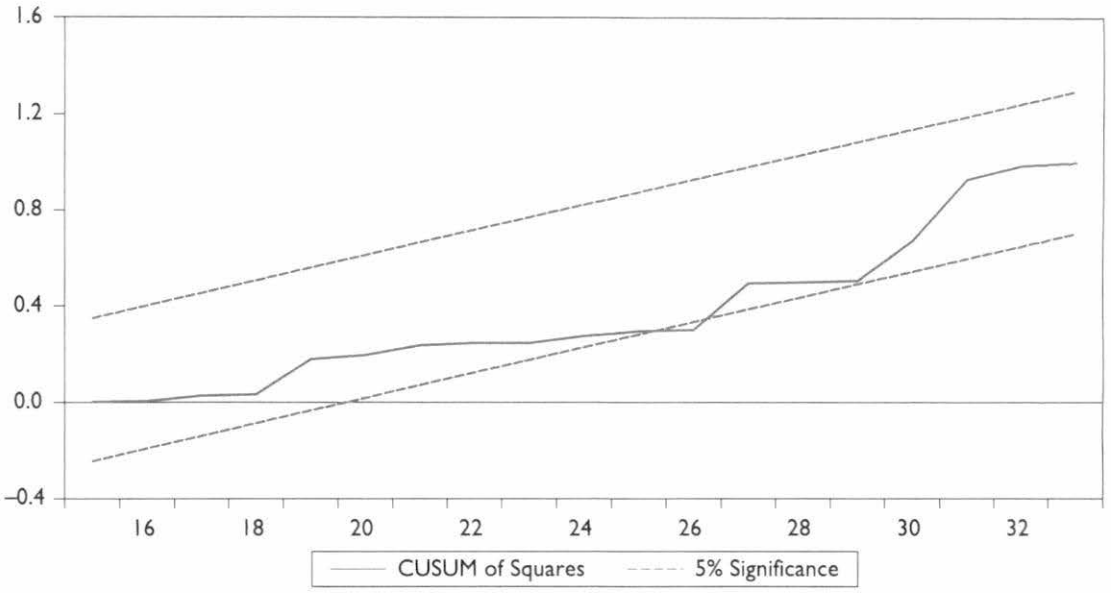

Figure 8. CUSUMSQ Test Results

Source: Authors' own calculations.

Table 4. Error Correction Model for the Selected ARDL (2, 2, 2, 2)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.09442	0.17700	0.53341	0.59890
D(RINT(−2))	−0.35736	0.13270	−2.69302	0.01300
D(FD(−2))	0.41340	0.14380	2.87491	0.00860
D(MS(−2))	−0.19613	0.07380	−2.65751	0.01410
D(INFD)	−0.78347	0.08107	−9.66425	0.00000
D(INFD(−1))	0.38834	0.08629	4.50016	0.00020
ECT(−1)	−0.57704	0.29559	−1.95219	0.00620

Source: Authors' computation with Eviews 9.0.

Notes: *R*-squared = 0.931063, adjusted *R*-squared = 0.910082, S.E. of regression = 0.739649, *F*-statistic = 44.37691, Prob (*F*-statistic) = 0.0000, mean dependent var = −0.009677, Akaike info criterion = 2.452354, Durbin–Watson stat = 1.731599.

policy for economic growth. In the presence of cointegration among the series, the VECM can be presented as given below.

$$(1-L)\begin{bmatrix} RINT_t \\ FD_t \\ MS_t \\ INFD_t \end{bmatrix} = \begin{bmatrix} \lambda_1 \\ \lambda_2 \\ \lambda_3 \\ \lambda_4 \end{bmatrix} + \sum_{i=1}^{k}(1-L)\begin{bmatrix} \delta_{11,i} & \delta_{12,i} & \delta_{13,i} & \delta_{14,i} \\ \delta_{21,i} & \delta_{22,i} & \delta_{23,i} & \delta_{24,i} \\ \delta_{31,i} & \delta_{32,i} & \delta_{33,i} & \delta_{34,i} \\ \delta_{41,i} & \delta_{42,i} & \delta_{43,i} & \delta_{44,i} \end{bmatrix}\begin{bmatrix} RINT_{t-1} \\ FD_{t-1} \\ MS_{t-1} \\ INFD_{t-1} \end{bmatrix} + \begin{bmatrix} \eta_1 \\ \eta_2 \\ \eta_3 \\ \eta_4 \end{bmatrix}(ECT_{t-1}) + \begin{bmatrix} \mu_1 \\ \mu_2 \\ \mu_3 \\ \mu_4 \end{bmatrix}$$

where $(1 - L)$ is showing the difference operator, ECT_{t-1} is the one period lagged error correction term. The statistical significance of ECT_{t-1} is checked by applying t-test statistic, confirms the existence of long-run Granger causality while that of Wald's test chi-square statistic for the combined significance of lagged values of variable exhibits short-run dynamics.

The results of the test on causality are presented in Table 5. The results show that there is no short-run causality between fiscal deficit, money supply and real interest rate. However, there is unidirectional causality running from inflation to real interest rate in short run and the results are significant at 5 percent level of significance. However, real interest rate granger cause fiscal deficit at 10 percent level of significance in short run. The results of long-run causality showed that the p value of η_1 in VECM equation is found to be significant at 5 percent level of significance, implying that granger causality run from fiscal deficit, money supply and inflation to real interest rate in long run. Moreover, value of η_2 in VECM equation is also significant at 5 percent level of significance meaning that long-run causality running from real interest rate, money supply and inflation to fiscal deficit. In addition, the value of η_3 and η_4 in the VECM equation is also significant at 5 percent level of significance implying that causality running from real interest rate, fiscal deficit and inflation to money supply and also from real interest rate, fiscal deficit, and money supply to inflation, respectively. Thus, there is long-run causality running among competing variables.

Conclusions and Policy Recommendations

This study has been motivated by the recent developments in the literature on the relationship between rate of interest, fiscal deficit, money supply, and inflation. In this paper, the ARDL model and error correction model have been used to empirically examine long-run and short-run dynamics of interest rate relationship in India using annual data from 1980–1981 to 2012–2013. The interesting results of ARDL model are that the rate of interest and fiscal deficit are positively related with each other in long run and fiscal deficit elasticity is 0.33 percent at lag 2. Money supply (lag 2) and inflation (at level) have negative relationship with rate of interest in long run. Money supply elasticity is −0.18 at lag 2. This means that 1 percent increase in money supply leads to decrease the real interest rate by −0.18 percent. Inflation elasticity is −0.73 percent in current year indicates that 1 percent increase in inflation would decrease the real rate of interest (i.e., nominal interest inflation) by 0.73 percent. Further, the error correction term indicates that 57 percent disequilibrium in rate of interest will be offset each year by short-run adjustment of explanatory variables. In addition, results of vector error correction model showed that there is unidirectional causality running from inflation to real interest rate in short run. As far as long-run causality is concerned, causality is running from real interest rate, fiscal deficit, and inflation to money supply and also from real interest rate, fiscal deficit, and money supply to inflation. In other words, high interest rate, fiscal deficit, and money supply are the reason for high inflation in India. Furthermore, there is bidirectional causality among variables in long run.

These findings have important recommendation for policy implications in India. Most significantly, it shows that government needs to be aware of the fact that proper implementation of fiscal and monetary policy needs to be carried out carefully. High fiscal deficit is the reason for high interest rates in India and also the reason for slow growth of private sector specially manufacturing sector (supported by equation (3)). Government must control over non-development expenditure to reduce fiscal deficit. Market borrowings of government are very high in India and a most important part of revenue is used for interest payment which should be controlled by increasing revenue from taxes. Hence, government should increase its tax base to meet its expenditure. It will reduce government's borrowings and therefore, more

Table 5. Results of Causality Based on Error Correction Model

	Source of Causation (Independent Variables)				
	Short-run Causality				Long-run Causality
Null Hypothesis	*F* values (Wald Test)				*t*-values
Dependent Variables	ΔRINT	ΔFD	ΔMS	ΔINFD	ECT_{t-1}[P]
Fiscal deficit and/or money supply and/or inflation do not granger cause real interest rate	———	**1.847(0.1823)**	**2.221(0.1334)**	**4.681(0.020)***	**–3.198 (0.004)***
Real interest rate and/or money supply and/or inflation do not granger cause fiscal deficit	**3.319(0.0652)****	———	**2.179(0.1392)**	**2.18(0.1391)**	**2.841(0.001)***
Real interest rate and/or fiscal deficit and/or inflation do not granger cause money supply	**1.612(0.222)**	**1.590(0.2286)**	———	**1.710(0.2054)**	**2.532 (0.0130)***
Real interest rate and/or fiscal deficit and/or money supply and/or do not granger cause inflation	**2.045(0.1546)**	**0.5738(0.5719)**	**1.482(0.2486)**	———	**2.401(0.0187)***

Source: Authors' computation with Eviews 9.0.

Notes: RINT, FD, MS, and INFD indicate real interest rate, fiscal deficit, money supply and inflation. The optimal lag lengths were selected by using AIC criterion mentioned in Pantula, Gonzalez-Farias, and Fulier (1994). The numbers under parenthesis are *P* values. *Rejection of null hypothesis at 5 percent, ** rejection of null hypothesis at 10 percent.

resources will be available for private investments to grow up. Further, the growth of private sector will enhance the revenue from private players in terms of taxes in coming years which results in bringing down fiscal deficit. In addition, prime lending rates in India are very high in comparison of largest economies of the world, is a big obstacle for manufacturing sector; hence crowd out private investment. Monetary authority should make policy to control over rate of interest and inflation (supported by equation (4)). Based on the findings, it is suggested that proper fiscal consolidation is required to control high fiscal deficit and burgeoning interest rate in India.

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