Long-run Effects of Government Debt on Interest Rate: Evidence for Bangladesh

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Long-run Effects of Government Debt on Interest Rate: Evidence for Bangladesh

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Abstract: This paper explores the phenomenon that each year a major portion of the government debt in Bangladesh is expended on interest payment, giving rise to more budgetary deficit in the future. Ever-rising government debt is, however, not the only budgetary item that may be responsible for crowding out private borrowing. The paper empirically investigates the long-run effects of government debt on long-term nominal interest rate and explores the short-run dynamics in the context of capital market in Bangladesh. Using time-series data on Bangladesh and applying vector error correction model (VECM), this study finds a single cointegrating equation depicting long-run stable relationship between long-term nominal interest rate and the explanatory variables in the model. The study also finds convergence of short-run dynamics of government debt towards statistically significant long-run equilibrium and concludes that government debt has a positive impact on the long-term nominal interest rate in the capital market of Bangladesh.

Keywords: Government Debt, Interest Rate, Time-series data, VECM, Bangladesh
JEL Classification: E43, H63, C22

1. Introduction

In recent years, the main government budgetary focus across the globe has been on the large government debt and deficit, along with their impact on the economy including that on interest rates. The government debt and budgetary deficit has, therefore, been studied extensively both in the developed and developing countries (Habibullah, et. al., 2011). Government debt at the end of current period is the sum of the budget deficit during the current period plus the government debt at the end of the previous period. In addition, domestic currency is devalued with a view to supporting the debt payment of excessive principal and interest. For external debt, again, foreign reserve dwindles due to foreign debt payment. The dual effect is generally responsible for devaluation of home currency which, in turn, increases government spending and induces debt to meet rising budgetary deficit.

A bank's balance sheet is made up of liabilities, including demand deposits and assets that include loans and reserves (Blejer and Adrienne1991). When the government borrows from the banking sector to finance its deficit, government debt reduces the bank's loanable funds that may put a greater upward pressure on (nominal) the interest rate. It also puts an upward pressure on real interest rate, thereby crowding out private investment (Dornbush and Fisher, 1990; Blanchard, 1990). In addition, it increases demand for servicing debt payment, reducing the

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government's capacity for investment. Persistent deficits can thus affect the growth of deposit for investment, thereby economic growth. Alper and Lorenzo (2011), however, suggest that deficit is not the only budgetary item that may be responsible for *"crowding out"* private borrowing and investment.

The impact of governmentdebt on loanable funds in the capital market and interest rates is not measured by budget deficit. The net absorption of loanable fund by the government may be greater or smaller than the deficit. And in reality, a budget can put an upward pressure on interest rates even without government debt. Aguia and Gopinath (2006) showed that savings and loan crisis contributed to high real interest rate in the past decades in developing nation. The relevant governmental demand for loanable funds is not budget deficit; it is the budget deficit raised or reduced by loanable funds components of government expenditure. This expenditure has just as effective in reducing the supply of loanable funds and raising interest rates as if it were caused by the deficit. Interestingly, in the case of United States, no relationship has been found between actual/expected budget deficit and interest rate (Dell'Erba and Sola, 2013).

Supply of the loanable funds is also affected by government debt and other general macroeconomic factors - interest rate, inflation rate and disposable income. Each instrument of government's fiscal activity — expenditures, revenues and debt—is considered for its impact on consumption and interest rates (Doi, Hoshi and Okimoto, 2011; Kormendi, 1983). This is, however, not necessarily the case in all societies at all times. As a consequence, a high level of current government spending is likely to create budget deficit which, in turn, would be driving the growth of the debt. The change in government debt, or the budget deficit, is expected to affect the change in the real interest rate, but not necessarily the level of the interest rate (Laubach, 2009).

This paper briefly reviews and explains relevant empirical issues in modeling and estimating the effects of government debt on interest rates for Bangladesh and provides some additional perspectives not covered in other reviews. The objectives of this research are to empirically examine the long-run effects of government debt on interest rates and to explore the short-run dynamics (i.e. stability and the speed of adjustment to the long-run equilibrium) in the case of Bangladesh. The remainder of this paper is organised as follows. Section II is review of the literature. Section III discusses debt financing in Bangladesh. Section IV describes the method and data, particularly highlighting the empirical model specification used for the present study as well as the data. Section V shows the causal relationship between interest rates and the budget deficit, and presents the results of the empirical analysis of the augmented model. Finally, Section VI summarizes the conclusions of the study in.

2. Debt Financing and Debt: Bangladesh Perspective

Budget deficit and it's financing in Bangladesh, like in many other developing countries, are important parameters for analyzing fiscal and monetary effects on the overall economic development of the country. Debt burden is sharply increasing over time due to widening of the budget deficit. Over the past forty years, the overall budget deficit registered an increasing trend that rested serious pressure on the total debt of Bangladesh. Apparently, it is observed that over time the trend of deficits might increase and stay around 4 to 5 percent of GDP earnings. To cover this deficit, each year the government needs to borrow from domestic and external sources

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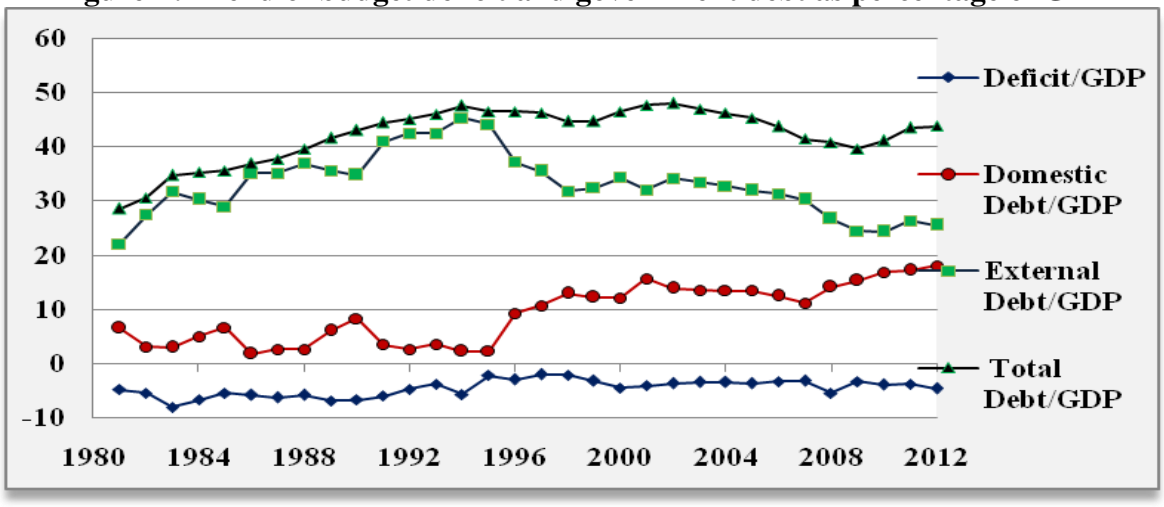
and a major portion of its budget expenditure is expended on interest payment. In the FY 2012, for example, the government has had to spend around15 percent of the total non-development budget as interest payment.

In the early (FY) 1980s, the total debt-GDP ratio in Bangladesh, on average, rose sharply from 28.65 percent to 44.56 percent during the period FY1980 — FY1990. During this time, total domestic debt, as percentage of GDP, has showed a declining trend from FY 1980 up to FY 1987, but exhibited an inclining trend from FY 1988 to FY 2012. Total domestic borrowing has been 13 percent of GDP, on an average, over the last ten years. On the contrary, total external debt of the country, as percentage of GDP, has showed a rising trend from FY 1980 up to FY 1987, and in the following period (FY 1988 to FY 2012) it exhibited a declining trend (World Bank, 2015). It is noteworthy that the total external debt of Bangladesh as percentage of GDP has been 30 percent, on average, over the last ten years. Figure 1 vividly portrays the situation explained.

Figure-1: Trend of budget deficit and government debt as percentage of GDP



Sources: Economic Trend, Statistics Department, Bangladesh Bank.

According to Bangladesh Bank (2013), in FY 2012, the overall budget deficit is estimated at 5 percent of GDP, which is 0.6 percent higher than that of the previous year. To finance the deficit, the government borrows from both Bangladesh Bank and the commercial banks. The borrowing from banks, as percentage of GDP, has been increasing over time. For example, the total outstanding domestic debt as percent of GDP has increased, on average, from 6.52 percent to 18.12 percent during the period FY1980 — FY2012. Over the period, the nominal value of domestic debt grew at the rate of 13.4 percent per year.

Government borrowing from commercial banks generally affects private credit subject to liquidity position (Bangladesh Bank, 2014). In the FY 2011, the government borrowing from the banking sector was 1.43 percent of GDP, while it was 0.45 percent from the non-banking sectors. In the FY 2002, however, government borrowing from the banking sector amounted to 0.93 percent of GDP, while from the non-banking sector it totaled 1.72 percent. In FY 2011, government's borrowing from the banking sector has been 4.43 times higher as compared to that of FY 2002, indicating a sharp crowding out effect that has allegedly dampened private

investments (Kumar and Woo, 2010). As a consequence, the government has become more dependent, over time, on the banking sector other than the non-banking sector for domestic financing.

In FY 2012, the external debt as percent of GDP has remained at 25.57 against 22.12 in the FY 1980 (Bangladesh Bank, 2014). The trend of external debt and GDP ratio between FY 1991 and FY 2012 indicates that the ratio has diminished over time. External debt and investment ratio has reduced from 192.5 in FY 2001 to 81.86 in FY 2011, but it is still very high. The potential level of investment will, therefore, be declining due to having a high level of external debt burden.

Bank deposit is experiencing a sluggish growth due to high government debt (as percentage of GDP) and the banks are falling into a situation of liquidity shortage (Ghosh, et. al., 2011). It enhances the demand for servicing debt payment, dwindling the government capacity for investment. In FY 2012, the government and private investment have been 5.3 percent and 19.5 percent of GDP, respectively. In FY 2002, however, government investment was 7.2 percent and private investment was 15.8 percent of GDP. The total debt as percentage of GDP, therefore, indicates that the government of Bangladesh is currently much dependent on domestic debt and the domestic debt burden might increase in the coming years. In addition, Bangladesh is an interesting case to study since the country, similar to other developing economies, has experienced large fluctuations in the public budget deficits and in the long- and short-term nominal interest rates overall from the beginning of the 1980s.

3. Theoretical Framework

A good number of empirical and theoretical analyses have been conducted so far on examining the link between budget deficits and interest rates, yet no general consensus could be reached on the results and opinions (Jeanne, 2000). Conventional models predict an increase in the interest rate, in response to an increase in budget deficit, arising out of the stimulation of private demand or the depressive effect on aggregate saving.

Evans (1985), following a conventional macroeconomic IS–LM approach for a closed economy, derived a linear relationship between long-term nominal interest rate and a number of variables, namely: budget deficit (D), public spending (G), real money supply (M/P) and expected inflation rate π^e. This relationship can be expressed in a linear regression model (equation 1) where u_t the error term that is assumed to be unobservable and random:

$$i_t = \alpha_0 + \beta_1 D_t + \beta_2 G_t + \beta_3 \left(\frac{M_t}{P_t} \right) + \beta_4 \pi_t^e + u_t \qquad (1)$$

Being critical of this approach, Hoelscher (1986) explained any possible results, which might be favourable to the Ricardian Equivalence Hypothesis (REH), as objects of theoretical deficiencies in the model and of the data used. He emphasized on the long-term relationship between public deficit and interest rates, with equality between the demand for and supply of loanable funds determining the equilibrium interest rate. In the model proposed by Hoelscher (equation 2), π_t^e is the expected inflation rate, r_t^e is the expected real short-term interest rate, and y_t is the economy's growth rate:

$$i_t = \alpha_0 + \beta_1 D_t + \beta_2 \pi_t^e + \beta_3 r_t^e + \beta_4 y_t + u_t \quad (2)$$

A similar model was used by Correia-Nunes and Stemitsiotis (1995), who brought a change to the Hoelscher's model by adding a variable — public debt to GDP ratio. , They argued that long-term interest rates might be influenced not only by budget deficit but also by accumulated public debt, which could be considered as a proxy for specific country-risk. In addition to previous variables, the public debt to GDP ratio was included as variable B in the following augmented equation:

$$i_t = \alpha_0 + \beta_1 D_t + \beta_2 \pi_t^e + \beta_3 r_t^e + \beta_4 y_t + \beta_5 B_t + u_t \quad (3)$$

If in the estimation, the coefficient turns out to be statistically significant, there is empirical support for the hypothesis of a link between long-term interest rate and budget deficit, implying that REH is not supported by the data.

The purpose of this present study is to complement early results concerning the REH, through the analysis of Spanish private consumption approach (Garcı´a and Ramajo, 2004; Cline, 2014), using an alternative route — the relationship between budget deficit and interest rates. A significant effect would indicate that the private sector does not adequately compensate the action of the public sector. Finding a positive effect of public deficit on interest rates would, therefore, imply rejection of the Ricardian Equivalence Hypothesis (REH).

4. Method and Data

4.1 Empirical Model

In our study, we have followed *Correia-Nunes and Stemitsiotis (1995)* to estimate the long-run effects of government debt on interest rates for Bangladesh. The log-log model to be estimated can be expressed as the following equation:

$$\ln(i)_t = \alpha_0 + \beta_1 \ln(lf)_t + \beta_2 \ln(\pi)_t + \beta_3 \ln(r)_t + \beta_4 \ln(B)_t + u_t \quad (4)$$

Equation 4 represents a standard econometric model involving time series, where the disturbance term u_t is assumed to be white-noise process. . In the equation, i_t is the long-term nominal interest rate as opportunity cost variable, lf_t denotes the total deposit (relative to GDP) as a proxy of supply of loanable funds in year t, π_t is the inflation rate at the base year 1995-96, r_t is the real short-term interest rate, and B_t denotes the government debt (relative to GDP). Equation (4) outlines the long-run relationship between the endogenous variable 'long-term nominal interest rate' and the variable, among others, 'government debt as percentage of GDP' as *exogenous*. The short-run dynamics has been incorporated by specifying equation (4) in an error-correction modeling format, including the exogenous variable.

In the model, the behavioral assumptions about the variables require that the coefficients $\beta_1 < 0$, $\beta_2 > 0$, $\beta_3 > 0$, $\beta_4 > 0$ and that the u_t sequence in equation (5) is stationary, so that for any deviations from the long-term nominal interest rate the equilibrium is temporary in nature.

$$u_t = \ln(i)_t - \alpha_0 - \beta_1 \ln(lf)_t - \beta_2 \ln(\pi)_t - \beta_3 \ln(r)_t - \beta_4 \ln(B)_t \quad (5)$$

We have argued that long-term nominal interest rate, supply of loanable funds, inflation rate, real short-term interest rate and government debt are most likely integrated of order one, so that their changes are stationary. However, stationarity in u_t would establish (5) as a plausible long-run relationship, with the short-run dynamics incorporated in u_t, usually referred to as the *equilibrium error*. Then the integrated variables $i_t, lf_t, \pi_t, r_t \,\&\, B_t$ are said to be cointegrated and equation (5) is referred to as the cointegrating regression, as in Johansen (1988).

The cointegration and error-correction frameworks have proved to be successful tools in the identification and estimation of long-term nominal interest rate functions. This type of approach to the long-term nominal interest rate captures the long-run equilibrium relationship between government debt and its determinants as well as the short-run variation and dynamics (Poghosyan, 2012). In fact, there may be disequilibrium in the short run. To investigate the short run dynamics among the concerned time series variables, Vector Error Correction Model (VECM) should be developed. Therefore, an unrestricted VECM considering up to σ lags for deposit functions is respectively as follows:

$$\begin{aligned}\Delta \ln i_t = \delta_0 + \sum_{j=1}^{\sigma} \theta_k \Delta \ln lf_{t-j} + \sum_{j=1}^{\sigma} \eta_k \Delta \ln \pi_{t-j} + \sum_{j=1}^{\sigma} \phi_k \Delta \ln r_{t-j} + \sum_{j=1}^{\sigma} \psi_k \ln B_t \\ + \lambda\left[\ln i_{t-1} - \hat{\alpha}_0 - \hat{\beta}_1 \ln lf_{t-1} - \hat{\beta}_2 \ln \pi_{t-1} - \hat{\beta}_3 \ln r_{t-1} - \hat{\beta}_4 B_{t-1}\right] + \varepsilon_t\end{aligned} \tag{6}$$

Where Δ is the first difference operator, λ depict the speed of adjustment from short run to the long run equilibrium, ε_t is a purely white noise term. In particular, if the variables are integrated and cointegrate, then there is an error-correction representation that enables the estimation of long-run equilibrium relationships without simultaneously having to take a strong position on how to model short-run dynamics.

4.2 Data

A definition of nominal deposit rate as proxy for long-term interest rate that is a better than the short-term interest rate to measure the opportunity cost of holding money in considering the long-run economic impacts of changes in monetary policy in developing country. After compilation of the all data series were transformed into natural log form. That can reduce the problem of heteroskedasticity because it compresses the scale in which the variables are measured, thereby reducing a tenfold difference between two values to a twofold difference.

The data used to estimate the model consist of annual observations for Bangladesh for the period 1981-2012. The data employed in this paper are obtained from the Bangladesh Bank, Bangladesh Economic Review of Bangladesh Ministry of Finance, and Sixth Five Year Plan of Planning Commission. The paper outlines long-term nominal interest rate determining by the four indicators- supply of loanable funds, inflation rate as proxy for consumer price index (1995-96), real short-term interest rate and government debt as percentage of GDP is assumed to *exogenous* variables respectively for the over three decades.

5. Empirical Results[3]

The standard practice is to begin the empirical analysis by examining the time-series properties of the data. It starts with the test of stationarity of variables of the model (4), using unit root test procedures. The reason for knowing whether a variable has a unit root (that is, whether the variable is nonstationary) is that under the alternative hypothesis of stationarity, variables exhibit mean reversion characteristics and finite variance, and shocks are transitory and the autocorrelations die out as the number of lags grows, whereas under nonstationarity they do not. The standard ADF (Augmented Dickey-Fuller) test has been used to perform the unit root test to the i_t, lf_t, π_t, r_t & B_t series separately of the model and examine their *order of integration* (Dickey and Fuller, 1981; Philips and Perron, 1988).

The ADF test used here includes a constant and constant with a linear trend in the test regression since it has more general specification. The test has employed automatic lag length selection using a Schwarz Information Criterion (SIC) and a maximum lag length of 7. SIC is considered to be more appropriate because of small numbers of observations in the study (32 observations). The estimated statistic for all the variables *at level* does not exceed ADF test statistics. It shows that the null hypothesis of unit root cannot be rejected at 5 per cent level of significance for all variables at level. To test for the presence of more than one unit root in all these variables, the unit root tests of the variables *at first difference* have to be checked. The results of table 1 show that the unit root hypothesis is rejected at the first differences for all variables without and with a time trend and intercept respectively.

Table-1: ADF Statistics for Testing for Unit Roots for Period 1981 to 2012

Variables	Levels		First Differences	
	t-ADF, I()	*P-Value*	*t-ADF, I()*	*P-Value*
Intercept				
lni	-2.586 (1)	0.106	-4.328 (1)	0.002
lnlf	-0.806 (2)	0.802	-3.098 (1)	0.037
$ln\pi$	-2.988 (1)	0.047	-5.861 (1)	0.000
lnr	-2.651 (1)	0.094	-3.632 (1)	0.011
lnB	-2.841 (1)	0.064	-2.968 (1)	0.045
Intercept and Trend				
lni	-3.522 (1)	0.055	-4.185 (1)	0.013
lnlf	-6.974 (1)	0.000	-4.746 (1)	0.003
$ln\pi$	-1.360 (2)	0.851	-5.938 (1)	0.000
lnr	-2.792 (1)	0.210	-3.587 (1)	0.043
lnB	-2.581 (1)	0.290	-4.296 (1)	0.001

Note: (i) ADF statistics at *level* indicate acceptation, *first differences* indicate rejection of the unit root hypothesis at the 1%, 5% and 10% level of significance respectively (figures in the parentheses represent the optimal lag length as determined by Schwarz information criteria). (ii) *p-value* indicate lag length chosen by Schwarz Information Criteria (SIC), but MAXLAG =7.

[3] After operating analysis in software *EViews* version 7, we got the result significant and observing the obtained result.

This result from unit root tests provide strong evidence of non-stationarity *at levels* and stationarity *at first difference* for all variables, these series are integration to degree one, *I (1).* The residuals are also found stationary using a Schwarz Information Criterion (SIC) and a maximum lag length of 7 and 32 observations. The result provide the basis for the test of long-run relationship among all variables, that is *p-value* statistically highly significant at 1%, 5% and 10% level, are stationary.

The cointegration between variables reveals the existence of the stable long-run (equilibrium) relationship. To test for cointegration among the variables, Johansen Maximum Likelihood procedure has been applied to a vector error correction model. The results show that λ_{trace} and $\lambda_{\max}$ both indicates 1 cointegrating in the equation at the 1 percent and 5 percent level of significance. The results provide evidence that the null hypothesis of no cointegration, i.e., r = 0, is rejected for long-term nominal interest rate function of Bangladesh. So there is at least one cointegrating vector relationship among the variables of equation (4) at the 1 percent and 5 percent level of significance, presented in table 2.

Table 2: The Cointegration Analysis

Trend assumption: Linear deterministic trend (non restricted constant)
Included observations: 30 after adjustments (1983 - 2012)
Exogenous series: *lnB;* Series*: lni lnlf lnπ lnr*
Lags interval (in first differences): 1 to 1

Hypothesized No. of CE(s)	Eigen value	Unrestricted Cointegration Rank Test *(Trace)*				
		λ_{trace}	0.01 Critical Value	Prob.**	0.05 Critical Value	Prob.**
None	0.709	61.707	54.681*	0.001	47.856*	0.001
At most 1	0.411	24.673	35.458	0.173	29.797	0.173
At most 2	0.233	8.751	19.937	0.388	15.494	0.388
At most 3	0.025	0.767	6.634	0.381	3.841	0.381
Hypothesized No. of CE(s)	Eigen value	Unrestricted Cointegration Rank Test *(Maximum Eigen value)*				
		$\lambda_{\max}$	0.01 Critical Value	Prob.**	0.05 Critical Value	Prob.**
None	0.709	37.034	32.715*	0.002	27.584*	0.002
At most 1	0.412	15.922	25.861	0.229	21.131	0.229
At most 2	0.233	7.983	18.520	0.380	14.264	0.380
At most 3	0.025	0.767	6.634	0.381	3.841	0.381

Note: Trace test and Max-eigenvalue indicates 1 cointegrating eqn(s) at the 1% level and 5% level of significance, *denotes rejection of the hypothesis at the 0.01 and 0.05 level, **MacKinnon-Haug-Michelis (1999) p-values.

The parameter estimates representing the cointegration between the long-term nominal interest rate *(i)* and the endogenous factors in the model, is specified as:

$$\ln(i)_t + 0.27\ln(lf)_t - 0.34\ln(\pi)_t - 0.74\ln(r)_t - 4.95 = 0 \quad (7)$$

$$\ln(i)_t = 4.95 - 0.27\ln(lf)_t + 0.34\ln(\pi)_t + 0.74\ln(r)_t$$
$$(4.27) \quad (-7.91) \qquad (5.98) \qquad (4.26)$$

With the existence of cointegration established, equation (4) is re-parameterised as an vector error correction model (VECM) to estimate a model for improved forecasting, including the effects of exogenous variables. The cointegrating equations are generally interpreted as the long run equilibrium relationships characterising the data, with the error correction equations representing short-run adjustment towards such equilibria. The error correction model alone also can make direct inference both about the long-run and short-run relationships. Since there is a single cointegrating equation, the VEC model needs to include an error correction term involving levels of the series, and this term appears on the right-hand side of each of the VECM equations, which otherwise will be in first differences. The error correction model for the long-term nominal interest rate (i) is including the effects of government debt on long-term nominal interest rate of Bangladesh.

The estimated equation of the model in error correction form for long-term nominal interest rate *(i)* is:

$$\begin{aligned}\Delta \ln(i)_t = & \underset{(-2.12)}{-0.02\ln(i)_{t-1}} + \underset{(3.19)}{0.05\ln(i)_{t-2}} - \underset{(-2.25)}{0.06(i)_{t-3}} \\ & + \underset{(3.19)}{0.07\ln(lf)_{t-1}} - \underset{(-3.13)}{0.05\ln(lf)_{t-2}} - \underset{(-2.77)}{0.51(lf)_{t-3}} \\ & - \underset{(-4.54)}{0.20\ln(\pi)_{t-1}} + \underset{(5.27)}{0.17\ln(\pi)_{t-2}} + \underset{(2.94)}{0.08\ln(\pi)_{t-3}} \\ & + \underset{(4.31)}{0.63\ln(r)_{t-1}} + \underset{(2.37)}{0.34\ln(r)_{t-2}} + \underset{(3.22)}{0.03\ln(r)_{t-3}} + \underset{(4.29)}{1.20\ln(B)_t} \\ & - 0.81[\ln(i)_t + \underset{(-5.85)}{0.27\ln(lf)_t} - \underset{(-7.91)}{0.34\ln(\pi)_t} - \underset{(5.98)}{0.74\ln(r)_t} - \underset{(4.26)}{4.95}] \quad (8)\end{aligned}$$

In equation (8) parentheses represents the *t-statistics* for the respective sign of the estimated coefficients. In the short-run the sign of the estimated coefficients of the supply of loanable funds *(lf)* at 2 and 3 period time lag both are negative and 5% level of significant, which shows decrease of the long-term nominal interest rate at both period lag, except 1 period time lag. On the contrary, coefficients of the inflation rate *(π)* at 2 and 3 period time lag both are positive and 5% level of significant, which shows the effect of changes in inflation rate on the long-term nominal interest rate of Bangladesh is positive at both lag periods, except 1 period time lag. This implies that effect of changes in inflation rate on the long-term nominal interest rate of Bangladesh decrease immediately after the decrease in their income, which is consistent with the idea of the inflationary approach and later it reverses.

In the short-run the sign of the estimated coefficients of the real short-term interest rate *(r)* at 1, 2 and 3 period time lag both are positive and 5% level of significant. As a consequence, the positive effect of the increase in real short-term interest rate on long-term nominal interest rate of Bangladesh is consistent. It measure the opportunity cost of holding money in considering the long-run economic impacts of changes in monetary policy in developing country.

The key finding from the short-run dynamics above is that of a negative and statistically significant speed of adjustment coefficient (the error correction term). This means that the speed at which the rate of variation of the long-term nominal interest rate $\Delta ln(i)$, the dependent variable in the first equation of the vector error correction system, adjusts towards the single long-run cointegrating relationship differs from zero. According to the estimates, in the short-run the long-term nominal interest rate disequilibrium is corrected at the rate of 81 percent per annum. The speed of adjustment coefficient indicates that long-term nominal interest rate convergent to the equilibrium and their convergent sign indicate that statistically significant in the long run.

The long-run cointegrating relationship

Solving equation (8) the long-run relationship between the variables in the model can be written as (while all the Δ's equal zero at equilibrium):

$$\underset{}{\ln(i)_t} = \underset{(4.27)}{4.02} - \underset{(-\ 7.91)}{0.22}\ln(lf)_t + \underset{(5.98)}{0.28}\ln(\pi)_t + \underset{(\ 4.26)}{0.60}\ln(r)_t + \underset{(4.29)}{1.20}\ln(B)_t$$

At this point government debt *(B)* enters in the equation as an *exogenous* variable. The equation reveals that the estimated coefficient of the supply of loanable funds *(lf)* has a negative sign with high level of significance. Accordingly increase the supply of loanable funds of Bangladesh leads to decrease in the long-term nominal interest rate *(i)*. The resulting estimate of β_1 is -0.22, with a *t-value* of -7.91. It indicates that a one basis point (percent point) increase in the loanable funds, *ceteris paribus*, leads to an average 0.22 basis point decrease in the long-term nominal interest rate. That is, the point estimate suggests that a change in supply of loanable funds is associated with decrease in the long-term nominal interest rate.

Accordingly Fisher equation, nominal interest rate is the combination of real interest rate and inflation rate. The significant positive effect of the change in inflation rate *(π)* on the change of long-term nominal interest rate *(i)* is consistent in the long run. The resulting estimate of β_2 is 0.28, with a *t-value* of 5.98. In the long run, long-term nominal interest rate speeds up by the influence of inflation rate. Similarly, the positive effect of the estimated coefficient for the real short-term interest rate *(r)* on the change of long-term nominal interest rate *(i)* is consistent with the monetary view and statistically significant in the long run. The resulting estimate of β_3 is 0.60, with a *t-value* of 4.26. This implies that in the long-run capital inflows and outflows depends on interest differential, and coefficient of real short-term interest rate indicating that the long-term nominal interest rate is more sensitivity.

The sign of the estimated coefficient of government debt *(B)* is positive and statistically significant and suggesting that the ever-rising government debt has been associated with raises of the long-term nominal interest rate *(i)* of Bangladesh. The resulting estimate of β_4 is 1.20, with a *t-value* of 4.29. It indicates that a one basis point increase in the government debt, *ceteris paribus*, leads to an average 1.20 basis point increases in the long-term nominal interest rate. As a consequence this interaction suggests that sluggish growth of economy is causes and concern of government debt.

6. Summary and Conclusion

Debt sustainability is an essential condition for macroeconomic stability and sustainable economic growth. Debt sustainability has been considered as the ratio of debt service payments to GDP (Romer, 2012). Debt condition of Bangladesh, however, is sustainable because growth rate of budget deficit of Bangladesh is stable in the last decade. Adding up to the different approaches, there are two main criteria to assess debt sustainability. First criterion is to look at the external sustainability of a country's debt and the other is to look at the fiscal sustainability of a country's debt. Government debt from domestic has been increasing further and banks and nonbanks have been becoming supply of loanable funds shortage for private investment over the time. Each year a major portion of its budget expenditure gets expanded on interest payment and in future create more budgetary deficit. Ever-rising government debt and deficit is crowding out private investment when the government finances through banks and nonbanks that brings about the investment to fall. Debt, either domestic or external debt, does present a burden for Bangladesh, since it represents claims on future country's production.

The model is estimated using standard time series econometric techniques, the vector error correction model after testing the stationary of the data series and cointegration among variables of the model. The estimation results show that increase in government debt (relative to GDP) leads to raises in the long-term nominal interest rate of Bangladesh and statistically significant long-run relationship. One major policy implication of the result is that when a country draws loanable funds from domestic and abroad for government debt, one of two results might follow: interest rates might rise, reducing domestic and foreign investment or the value of the foreign currency might increase (e.g. appreciate dollar or euro value). As a consequence actual output will be less than the potential level.

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