External Public Debt and Crowding Out Effect: A Time Series Analysis for Bangladesh

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ARTICLE INFO	ABSTRACT
Published Online: 14 January 2019 Corresponding Author: **Nazmullah Bin Tariq**	This work tries to analyze the effect of external public debt on the economy of Bangladesh with the help of crowding out effect. The data set used for this purpose ranged from 1982-2016. For the case of crowding out effect, there are two popular views, the classical view and the Keynesian view. The finding of this work shows existence of the crowding out effect for the case of external public debt for Bangladesh. This is a time series work. Firstly the unit root property of the variables are checked followed by determining appropriate lag and Johansen cointegration test. Based on cointegration test results, VECM has been used.
KEYWORDS: Unit root, cointegration, VECM, OLS, crowding out, Bangladesh.	

1. Introduction

External debt can be defined as a part of the total debt in a country that owed to lenders outside the country. Government of other countries, international organizations or international financial institutions can be the creditors. External debt can be an important tool if it is invested efficiently for the development of a country. When the returns of investment from the external debt is higher than the debt servicing cost then it can increase growth rate in an economy. On the other side, if returns from investment is lower than debt servicing cost then it can adversely affect growth.

Generally the developing countries are facing deficit in financing their development programs, which force them to borrow from domestic and international sources.

In general, domestic sources are not sufficient to fulfill the deficit and the concern country has to borrow from outside sources like developed countries, international organizations and financial institutions. This study covers the part of external borrowing taken by the public sector. Debt from the external sources are generally used to stimulate economic growth by reducing the deficit and investing in more development programs like education, health, infrastructure, etc.
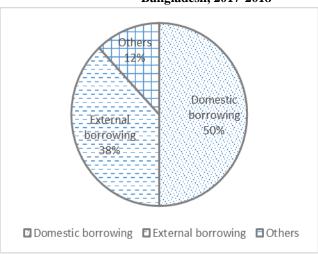
On the other side, external debt can also affect economic growth and other economic variables adversely if debt burden is very high. This high debt burden work as a constraint for government to take its planning properly. Also there are restrictions from the debt providing institutions.

1.1 Background

Like other developing countries Bangladesh is no exception. Bangladesh is also facing huge deficit on her development program. There are two broad sources of financing the deficit: (i) domestic sources and (ii) external sources.

Domestic sources are not sufficient for Bangladesh. In that case Bangladesh have no other option then to take loan from the external sources. In Fiscal Year 2017-2018, overall deficit of Bangladesh government is 1122.74 billion taka (local currency) in which 464.20 and 603.52 billion taka (local currency) is expected to be financed by external borrowing and domestic borrowing respectively.
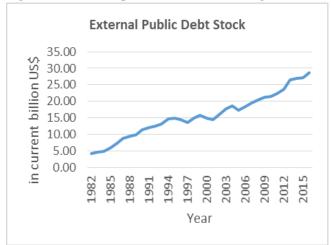
Figure 1.1: Deficit financing of the Government of Bangladesh, 2017-2018

Source: Ministry of Finance, Bangladesh

External public debt stocks from 1982 to 2016 can be shown by the following graph:

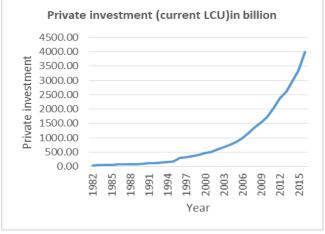**Figure1.2: External public debt stock of Bangladesh**

Source: World Development Indicators

It is also important to take a look at the private investment condition in Bangladesh because this thing is closely related with external debt stock and will be used to measure the crowding out effect. Private investment is very important in the sense that external public borrowing may affect positively or negatively towards the private investment.

How it might affect the private investment is discussed in the theoretical framework. Following figure shows the private investment in Bangladesh for the last thirty five years:

Figure1.3: Private investment of Bangladesh

Source: World Development Indicators, Bangladesh Economic Review, Statistical Yearbook of Bangladesh

1.2 Objective of the Study

Debt is very important in the sense that it helps a thriving economy or struggling economy to reduce the gap the country is facing in financing various development programs. Here this study is only concerned with the part of public debt which is taken from the external sources. By financing various development program from the external debt may help the economy of Bangladesh but it will not be a complete picture if we do not measure the crowding out effect. External public debt may affect the other sectors of

the economy adversely. That is the reason this study tries to analyze the crowding out effect.

The logic behind including crowding out effect is to see the effect of external public debt on private investment. It is quite possible that there is a positive relationship between external public debt and GDP but if the crowding out effect exists then this relationship may not be sustainable in the future. On the other side it is also possible that apparently there is a negative relationship between external public debt stock and GDP but if there is crowding in rather than crowding out then this negative relationship will turn into positive relationship in the future. From this discussion our main research question is to find whether there is any existence of crowding out.

2. A Brief Literature Review

There are works which show the effect of public debt on economic growth but not much work to measure the effect of crowding out. Some of the literature findings are given below.

Fatai (2016), by using VECM, Granger causality for the case of Nigeria has found bi-directional causality going from external debt stock and economic growth which is positive, and external debt service payments and economic growth which is negative. Jelinga et al. (2016) used ARDL model, Co-integration test for the case of Tanzania and found that in the long-run debt promote economic growth, however FDI exhibits a negative impact on economic growth. Kasidi and Said (2013) for the case of Tanzania found positive effect of external debt stock on economic growth. Shah and Pervin (2012) for the case of Bangladesh found positive effect of external public debt stock on GDP growth. They used OLS and co-integration test. Hasan and Akhter (2012) for the case of Bangladesh found positive effect of external debt on investment and government reserves.

Farhana and Chowdhury (2014) used ARDL model for the case of Bangladesh and found significant adverse effect of external debt on growth which is different from other study. Atique and Malik (2012) for the case of Pakistan found that external debt has negative impact on economic growth.

One of the major sources of government deficit financing comes from borrowing. This borrowing can put pressure on interest rate. This pressure may increase the interest rate. Higher interest rates reduce or "crowd out" private investment.

Khan and Gill (2009) used co-integration test for Pakistan and found no crowding out effect rather crowding in effect was found. Majumder (2007) used Co-integration test for the case of Bangladesh and found that there is no crowding out effect rather crowding in effect was found.

3. Theoretical Framework

Most of the developing countries are facing deficit in financing its budget and take external debt to finance a significant part of deficit. The effect of external public debt on private investment can be measured by crowding out effect which is discussed in the next section.

3.1 The Crowding-out Effect

There are two popular views regarding the crowding out and crowding in effect. According to the classical view an expansion of the government sector reduces the private investment. An expansion of the government sector increases production, income and transaction demand for money. When the money supply remains unchanged it creates shortage of money supply for the private sector which increases the interest rate. This higher interest rate reduces private investment. The brief summary of the crowding out hypothesis is that expansion of the government sector reduces private investment unless there is an increase in money supply.

However, there may not be any crowding-out phenomenon if interest rate declines or remain unchanged. According to the Keynesian view when higher amount of unemployment exists in the society and interest rate does not react or insignificantly react due to lower demand and in that case expansion of the government sector will not affect the interest rate much. Furthermore as a result of expansion of the government sector may increase the private investment due to the overall positive effect of government sector expansion. In that case it may increase private investment instead of reducing it and this is called crowding in effect.

Model Specification

The theoretical framework has enabled us to understand the relationship between private investment, and public borrowing, GDP, interest rate and government expenditure.
It may be expressed in the following function,

$$PI = f (PB, GDP, IR, GEX) \ldots\ldots\ldots\ldots (1)$$

Where, PI = Private investment, PB = Public borrowing from external sources, GDP = Gross domestic product, IR = Interest rate (Lending), GEX = Government Final Consumption Expenditure.
Following regression equation can be applied for testing the "crowding out" hypothesis:

$$PI_t = \alpha + \beta X_t + u_t \qquad \ldots\ldots\ldots\ldots (2)$$

Where, PI_t is the dependent variable (Private Investment), X_t represents the set of explanatory variables mentioned above. In order to escape the influence of inflation, data for all variables will be taken in real terms. For analytical convenience variables will be taken in natural log level.

4. Data and Methodology

The effects of external debt on the economy of Bangladesh will be measured in this work by crowding out effect. For this purpose time series econometric tools will be used. The sample period of the study will be 35 years from 1982 to 2016. Annual Data will be used in this study and is collected from secondary sources.

Nature of the Variables: In this study different variables will be used to measure the crowding out effect. These variables are PI = Private investment, PB = Public borrowing from external sources, GDP = Gross domestic product, IR = Interest rate (lending) and GEX = Government final consumption expenditure will be used.

Data Sources: Sources of data are Bangladesh Economic Review (various issues), Statistical Year Book of Bangladesh (various issues), World Development Indicators (WDI) and World Economic Outlook by IMF.

4.1 Research Methodology

The theoretical framework has enabled us to understand the relationship between private investment, and public borrowing, GDP, interest rate and government expenditure. It may be expressed by the function,

$$PI = f (PB, GDP, IR, GEX)$$

We got the following regression equation from the theoretical background which can be applied for testing the "crowding out" hypothesis:

$$PI_t = \alpha + \beta X_t + u_t$$

Where, PI_t is the dependent variable (Private investment), X_t represents the set of explanatory variables of PB = Public borrowing from external sources, GDP = Gross domestic product, IR = Interest rate (lending) and GEX = Government final consumption expenditure. In order to escape the influence of inflation, data for all variables will be taken in real terms. For analytical convenience variables will be taken in natural log level.

As we know most of the macroeconomic time series are non-stationary. By using unit root test, stationarity of a variable can be checked. If a series is non-stationary in a regression, then all the regression results suffer from spurious regression problem (Granger and Newbold 1974). To avoid this problem, it has now become a standard practice to begin the analysis with prior determination of unvaried properties of the time series. If the series follow the same order of integration, then there can be a meaningful long-run relationship among them which can be explored by identifying a combination of the non-stationary series that gives a stationary combination through co-integration techniques.

Testing for co-integration involves two steps. In the first stage time series are tested for the presence of unit roots or non-statoinarity. In the second stage, co-integration test is performed to identify the existence of a long-run relationship. To test the stationary properties of the series the standard Augmented Dickey-Fuller (ADF) test can be applied.

The general Augmented Dickey-Fuller equation is:

$$\Delta X_t = \alpha + \delta X_{t-1} + \sum_{i=2}^{p} \beta j \Delta X_{t-j} + \epsilon_t \ldots\ldots\ldots\ldots(3)$$

To test the presence of co-integration among the variables, procedure developed by Johansen (1988), Johansen and Juselius (1990) can be used.

The purpose of co-integration test is to determine whether a group of non-stationary series is co-integrated or not. The method comprised of maximum likelihood procedure for the estimation and determination of the presence of co-integration. Johansen co-integration test can be used with a view to estimating the long-run impact of public external borrowing on private investment. The vector error correction method (VECM) can be applied to find out the speed of adjustment of the variables follow towards the long-run equilibrium path in response to any divergence occurred in the short-run.

Initially we may start with OLS but as we expect that the variables may be non-stationary. If the variables are found stationary we can use the OLS method but if they are non-stationary and we run OLS then the result will give spurious result which is not true. In time series, regression model required all variables to be I(0) to apply OLS.

When in the regression model all variables are nonstationary but integrated in the same order and error term is stationary, in that case variables are cointegrated. We can regress variables and no spurious regression problem.

Johansen Co-integration test

Unit root tests are used to find out the order of integration of variables and if the variables are found non stationary, then to check the long run relationship between variables by Johansen co-integration method (Johansen, 1988; Johansen and Juselius, 1990). The Johansen co-integration approach in a multivariate framework provides a clear picture than other tests like Engle-Granger co-integration method in some aspects.

The simplest form of Johansen co-integrating regression equation is as follows:

$$\Delta Y_t = \pi Y_{t-1} + \sum_{i=1}^{p-1} \lambda i \Delta Y_{t-i} + u_t \ \ldots\ldots\ldots\ldots(4)$$

The number of co-integrating vectors is presented by the rank of the coefficient matrix π. Johansen's method is to estimate the π matrix in an unrestricted form, then test whether one can reject the restriction implied by the reduced rank of π. If the two relevant series are co-integrated then there is a long run relationship between them.

Firstly we will check whether the series are stationary or not. If stationary then we can run OLS if not then we have to check the order of integration and cointegration test to see the long run relationship. If long run relationship exists then we can apply VECM.

Hypotheses in Crowding-out model:

H_{01}: External Public Debt has no significant effect on private investment
H_{02}: GDP has no significant effect on private investment

H_{03}: Interest rate has no significant effect on private investment
H_{04}: Government final consumption expenditure has no significant effect on private investment.

Expected sign of the coefficients: Positive relationship between external debt and private investment indicates the absence of crowding out effect and negative sign shows the presence of crowding out effect. Expected sign of GDP is positive because an increase in GDP enhances private investment. Rate of interest is negatively related to private investment. So its expected sign is negative. Effect of government consumption expenditure can be negative or positive on private investment.

5. Empirical Result

All the variables used in these models are in real terms. The nominal values of the variables have been changed to real values by dividing by deflator. For crowding out model, five variables have been used. These are real private investment, real GDP, real external public debt, lending interest rate and real government final consumption expenditure. For analytical convenience natural log has been taken for every variables. The data period is ranging from 1982 to 2016.

5.1 Long run relationship
5.1.1 Unit Root Test

Firstly the stationary property of the variables of the crowding out model will be checked. To check the stationarity property, Augmented Dickey Fuller unit root test will be used. For analytical convenience natural log has been taken for every variable of crowding out model.

Table 5.1: ADF Unit Root Test Result for crowding out model variables

Variables	At level	At first difference	Remarks
	ADF statistics	ADF statistics	
lpi	-2.905	-4.722***	Integrated of order 1
leds	-2.543	-4.755***	Integrated of order 1
lgdp	-0.085	-5.065***	Integrated of order 1
lir	-1.067	-3.555**	Integrated of order 1
lgex	-2.187	-4.617***	Integrated of order 1

** (***) denotes rejection of the hypothesis at 5 % (1%) significance level respectively

Here from the table 5.1 it can be seen that although the variables of crowding out model are not stationary at level but they are stationary at first difference. So, all these variables are integrated of order 1. Therefore it is possible

that there may be a long run relationship among these variables.

5.1.2 Cointegration Test

For crowding out model VECM model can be used if cointegration exists. For this purpose, firstly the appropriate number of lag will be determined then it will be checked how many cointegration equation exists in this model by comparing the trace statistics with 5% critical value. If trace statistics is higher than the 5% critical value then we can conclude that there exist cointegration among these variables.

Table 5.2: Determining appropriate lags for crowding out model

lag	AIC	HQIC	SBIC
1	-19.13	-18.68	-17.75*
2	-19.46	-18.63	-16.91
3	-20.36	-19.16	-16.67
4	-20.84*	-19.26*	-15.98

Endogenous: lpi leds lgdp lir lgex

AIC and HQIC criterion suggesting about using lag 4 and SBIC suggesting using lag 1. For the case of crowding out model lag 1 will be used according to SBIC to determine the number of cointegrating equation and to determine the target cointegrating equation.

The number of cointegration equation in the crowding out model can be determined by trace statistics comparing with critical value which is known as Johansen tests for cointegration. For the crowding out model the results are given in the next table.

Table 5.3: Johansen tests for cointegration for crowding out model

Maximum rank	Trace statistics	5% critical value
0	85.1	68.52
1	38.0*	47.21
2	22.66	29.68
3	8.68	15.41
4	2.16	3.76

From table 5.3 it can be seen that the trace statistics is higher than 5% critical value when rank is 0 means at least 1 cointegration equation exists in the model. When maximum rank is 1 the trace statistics is lower than the critical value means in crowding out model one cointegration equation exists.

5.1.3 VECM for crowding out model for long run relationship estimation

As it is already seen from the Johansen cointeration test that for crowding out model cointegration equation exist so VECM can be used to determine the long run relationship of

crowding out model. The results are as follows for the crowding out model:

From the VECM, estimated β are (1, -9.71, 1.3, 4.15, 4.89). The long run relationship can be written as:

$$lpi = 9.71^{***} lgdp - 1.3 leds - 4.15^{***} lir - 4.89 lgex$$
$$\quad (3.6) \qquad (0.88) \qquad (1.6) \qquad (3.39)$$

$$Chi2 = 118.2^{***}$$

Given that leds and lgex are accepted at 15% significance level.

This long run equation shows the effect of explanatory variables on dependent variable private investment. Firstly, the target variable in the model means effect of external public debt stock on private investment will be discussed then the other control variables will be discussed.

For the case of public external debt stock, it has a negative coefficient which implies the existence of crowding out effect. From the equation it can be seen that 1 % increase in public external debt stock will decrease the private investment by 1.3%. This result is only acceptable at 15% significance level. If not accepted then public external debt stock does not have any effect on private investment.

From the cointegrating equation it can be seen that 1% change in gross domestic product increased the private investment by 9.71%. This sign is expected from the theory because overall increase in gross domestic product shows a growing economic condition which helps private investment positively.

For the case of interest rate, it has a negative coefficient which typically shows the negative relationship between interest and investment. From the long run relationship it can be seen that 1 % increase in interest rate will decrease the private investment by 4.15%. This is also an expected result.

From the cointegrating equation it can be seen that 1% change in government final consumption expenditure decreases private investment by 4.89%. This result also indicates that government expenditure crowds out private investment and supports the classical view of government expenditure.

6. Conclusion

The main purpose of this work is to see the effect of external public debt on private investment by crowding out effect. For the case of crowding out model the main target variable shows that external public debt stock has a negative impact on private investment which means external borrowing crowds out private investment. It also helps us to understand the overall effect of public external debt stock on the economy.

As this crowding out effect means negative effects on private investment which reduces part of capital formation which ultimately effects GDP negatively.

Apparently it can be thought that external public debt may have a positive effect on economy but this work shows that external public debt's one effect is negative in terms of private investment.

In Bangladesh, the lending interest rate is pretty high compared to other countries. The percentage of classified loan is also very high in Bangladesh. This study shows the negative impact of lending interest rate on private investment. This also implies lower lending interest rate will increase private investment. So, if interest rate is high then it will not only discourage private investment but also has a tendency to create more classified loan. Bangladesh is a developing country and has high demand for money for private investment. So, to boost up private investment in the country the central bank of Bangladesh and other commercial banks of Bangladesh should work together so that the lending interest rate can be reduced to at least single digit.

Government expenditure also has a negative impact on private investment. This actually conforms to the classical view in economics. This implies focus should be in market economy rather than control economy.

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