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Impact of Debts on Economic Growth of Bangladesh: An Application of ARDL Model

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Abstract

This study attempts to investigate the effects of different types of debts on economic growth in Bangladesh using time series data spanning from 2000 to 2015. In this study, the RDL model has been applied to determine the long run relationship among the selected variables. The result of the ARDL model shows that there exists a long term relationship between economic growth and the debt variables. It was evident from the findings that there exists bidirectional causality between public sector external debt and economic growth. Causality between private external debt and economic growth has been found to be insignificant. However, causality between domestic debt and economic growth showed a unidirectional causality from domestic debt to economic growth and not vice versa. Causality tests suggest that impact of domestic debt on economic growth is more effective compared to external debts.

Keywords: External Debt, Domestic Debt, Economic Growth, Autoregressive Distributed Lag Model, Granger Causality
JEL Classifications: F34, H63, O10, C10

1. Introduction

In broad sense debt includes both external and internal debts where lion part is borrowed by the Government. Besides the Government, private individuals can be the debtors. It is the most powerful financial tool in economy if it is used rightly and accurately in the development of a country. In that case undoubtedly, it can increase the growth in the economy.

When countries have insufficient resources, they may resort to internal and external borrowing to achieve certain goals. Developing countries like Bangladesh have deficiencies in terms of possessing resources that will enable them to achieve economic growth in respect of increasing their production and income. Both financing deficits in fiscal sector and deficits in balance of

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payments push countries to debts. Usually government borrows to fill the vacuum created by the fiscal gaps in the proposed expenditure and expected revenue within a fiscal period. If government does not want to compromise macroeconomic stability by printing more money and if government taxation capability is limited, then debt option becomes the only available avenue that the government can explore to provide social overhead capital for the citizens. The increasing fiscal deficits driven by the higher level of external debt servicing is a major threat to growth of the nation (Ibi and Alfred 2015).

The countries facing current account deficit is encouraged to borrow from international community to boost their economic growth. External debt problem is one of the main challenges faced by the developing countries like Bangladesh. External debt and its repayments act as a hindrance to the economic growth and development of developing countries. Besides fulfilling the investment gap, the external debt has adversely affected the growth of many developing countries and for few countries the effect is positive. The basic reason of adverse effect is the restriction of the creditors.

This study has been divided into six sections. Introduction has been cited in the first section, second section contains the literature review, data and methodology has been discussed in the third section, model estimation and results have been discussed in the fourth section and finally conclusions and policy implications have been discussed in the fifth and sixth sections respectively.

2. Literature Review

The relationship of debts with economic growth is well discussed in the international research studies. Most of the cases relationship between external debt and economic growth has been discussed. Evidences of some articles are given below:

Chowdhury (1994) indicated that the full effect of public and private external debts on GNP are small and in opposite sign, whereas an increase in the GNP level raises substantially the public and private external debt. Fosu (1996) tested the relationship between economic growth and external debt in sub Saharan African countries over the period 1970-1986 using OLS method and he reveals that direct effect of debt on GDP is negatively influenced via a diminishing marginal productivity of capital. Karagol (2002) investigated both short-run and long-run relationship between economic growth and external debt service for Turkey during 1956-1996 and the study revealed that debt service is negatively related to economic growth in the long-run. Clements et al. (2003) examined that external debt affects in low income countries. The results suggest that the substantial reduction in the stock of external debt projected for highly indebted poor countries (HIPC) would directly increase per capita income growth by about 1% per annum. The empirical results of Bakar and Hasan (2008) are based on VAR estimates and it indicates that total external debts affect economic growth positively. Hameed et al. (2008) showed that increase in external debt service causes decline in private investment in Pakistan in the long-run. Amassoma (2011) studied the causal nexus between external debt, domestic debt and the economic growth

in Nigeria between 1970 and 2009 using VEC approach. The findings revealed that there is bidirectional causality between the domestic debt and economic growth while there is a unidirectional causality from the economic growth to the external debt of Nigeria. Atique and Malik (2012) examined the impact of external debt on the economic growth of Pakistan over period of 1980 to 2010. The result shows that external debt amount slows down economic growth. Uzun et al. (2012) analyzed the relationship between GDP per capita growth rate and external debt to GNI between 1991 and 2009 in the transition countries. They found positive relationship between debt and growth rate of the countries in long-run. Shah and Pervin (2012) investigated the Bangladesh economy for the period 1974-2010. Long run significant positive effect of external public debt on GDP growth has been found from this investigation. In short run, the debt stock does not have any significant effect. Rahman et al. (2012) found bidirectional causality between economic growth and external debt in Bangladesh for the period of 1972-2010. Tehereni et al. (2013) studied the impact of foreign debt on economic growth in Malawi using time series data for the period 1975-2003. Their results show a statistically insignificant and negative relationship between foreign debt and economic growth for the case of Malawi. Abdelhadi (2013) explore the relationship between external debt and economic growth in Jordan during the period of 1990-2011. His paper shows that there is a positive and significant relationship between external debt and economic growth. The main findings of their study revealed that external debt has a negative impact on economic growth.

Thus we see that there are a lot of studies related to external debt and economic growth. But there is a limited study which simultaneously dealt with external debt, domestic debt and economic growth. Hence we attempted to study the relationship among government external debt, private external debt, domestic debt and the economic growth.

3. Data and Methodology

We have taken four variables in our consideration to check impact of debts in the economy of Bangladesh. The annual time series growth of Real Gross Domestic Product (GDPR) has been taken as an indicator of economic growth. On the other hand three types of debts have been considered, namely; Government Sector External Debt (GSED), Private Sector External Debt (PSED) and Domestic Debt (DOMD). As the GDP in Bangladesh are calculated on annual basis and data on PSED is not available before 2000 hence the data series has been collected annual basis for the period 2000 - 2015. Our main objective is to oversee interrelationship among variables and to determine impact of debts on economic growth.

Several methods are available to determine long run relationship. The most commonly used methods are residual based Engle-Granger (1987) test, maximum likelihood based Johansen (1991; 1995) and Johansen-Juselius (1990) tests. Due to some problems associated with these methods, the OLS based Autoregressive Distributed Lag (ARDL) approach has become popular in recent years. The main advantage of ARDL modeling is that it can be applied when the variables are different orders of integration (Pesaran and Pesaran 1997).

The cointegration test based on Johansen (1991; 1995) and Johansen-Juselius (1990) require that all variables should be equal degree of integration. Our data sets exhibits that GDPR and GSED are integrated at order 1 i.e., I(1) and PSED and DOMD are integrated at order 2 i.e., I(2). Hence above mentioned technique is not appropriate and hence we adopt ARDL bounds testing approach for cointegration analysis in this study. The equation of the ARDL bounds testing approach is as follows:

$$\Delta y_t = \alpha_0 + \alpha_1 y_{t-1} + \alpha_2 x_{t-1} + \sum_{i=1}^{m} \beta_i \Delta y_{t-i} + \sum_{j=0}^{m} \gamma_j \Delta x_{t-j} + \epsilon_t \quad (1)$$

where is the dependent variable, is the independent variable, is the drift component and is the white noise error term.

Two separate statistics are employed to bounds test for the existence of a long run relationship: an F-test for the joint significance of the coefficients of the lagged levels in equation (1) (i.e., Ho:); and a t-test for the null hypothesis Ho: (Banerjee et al.. 1998). This technique is appropriate in case of finite and small sample size. In addition, in case of bivariate long run relationship, we consider the general form of conditional ARDL(p, q) model as follows:

$$y_t = \alpha_0 + \sum_{i=1}^{p} \alpha_{1i} y_{t-i} + \sum_{i=0}^{q} \alpha_{2i} x_{t-i} + \epsilon_t \quad (2)$$

After determining the existence of long run cointegration relationship, the causal relation issue is tested by bivariate ECM based ARDL model. When and are stationary equation (3) and (4) can be estimated by ECM-ARDL without error correction term using the least squares method in level form. However, if and are non-stationary variables equations (3) and (4) without error correction term in the first difference form can be used.

$$\Delta y_t = \alpha_0 + \sum_{i=1}^{m} \alpha_{1i} \Delta y_{t-i} + \sum_{j=0}^{m} \alpha_{2j} x_{t-j} + \alpha_3 \epsilon_{t-1} + u_t \quad (3)$$

$$\Delta x_t = \beta_0 + \sum_{i=1}^{m} \beta_{1i} \Delta x_{t-i} + \sum_{j=0}^{m} \beta_{2j} x_{t-j} + \beta_3 \epsilon_{t-1} + v_t \quad (4)$$

where is the error correction term. If the summation of in equation (3) is significant without taking into account in equation (4), we get the signal that Granger causes . On the other hand Granger causes , if the summation of in equation (4) is significant without taking into account in equation (3). However, bilateral causal relationship exists between and , if both the summation of and summation of are significant. Coefficient and are referred to as the error correction coefficients.

As per equation (1) using our selected variables our model becomes as follows;

$$\Delta GDPR_t = \alpha_0 + \alpha_1 GDPR_{t-1} + \alpha_2 GSED_{t-1} + \alpha_3 PSED_{t-1} + \alpha_4 DOMD_{t-1} + \sum_{i=1}^{2} \beta_i \Delta GDPR_{t-i}$$

Table 1. Lag Selection Criteria

Lag Length	FPE	AIC	SIC	HQ
0	2.22E+19	53.0593	53.2081	53.0944
1	4.31E+17	49.1065	49.7016	49.2467
2	2.86E+17*	48.6388	49.6802*	48.8841*
3	3.17E+17	48.5954*	50.0832	48.9459

* indicates the minimum value

Table 2. Results of Unit Root Tests

Variable	Constant		Constant & Trend		None		Decision
	ADF	PP	ADF	PP	ADF	PP	
GDPR	-2.5747	-2.4871	5.0244*	-8.0976*	-1.0333	-0.7570	I(1)
Δ GDPR	-5.8023*	11.0246*	5.2814*	13.1880*	-4.1009*	-6.8945*	
GSED	-0.7999	0.4018	-3.5118	-5.0819*	3.9679	7.8409*	I(1)
Δ GSED	-5.3851*	15.8168*	5.2104*	15.0139*	-0.6210	-3.4222*	
PSED	2.4974	3.7706	0.5132	1.3280	2.6185	3.6775	
Δ PSED	-2.0629	-1.4501	-3.3690	-2.7180	0.2337	-0.8688	I(2)
Δ2PSED	3.0150***	-6.2784*	6.4806*	-6.4806*	2.2733**	-6.0914*	
DOMD	4.3976	4.6339	-0.7111	-0.6806	10.0105	10.5487	
Δ DOMD	-0.6633	-1.4376	-2.6099	-5.7449*	1.3259	-0.1942	I(2)
Δ2DOMD	-5.2359*	10.8192*	5.6457*	10.0265*	-5.0825*	-5.1401*	

Note: * Significant at 1% level, ** Significant at 5% level and *** Significant at 10% level

$$+\sum_{j=0}^{1}\gamma_j \Delta GSED_{t-i} + \sum_{j=0}^{1}\delta_j \Delta PSED_{t-i} + \sum_{j=0}^{1}\rho_j \Delta DOMD_{t-i} + ECT_t \quad (5)$$

$$\Delta GDPR_t = \alpha_0 + \sum_{i=1}^{2}\alpha_{1i}\Delta GDPR_{t-i} + \sum_{j=0}^{1}\alpha_{2j} GSED_{t-j} + \sum_{j=0}^{1}\alpha_{3j} PSED_{t-j} + \sum_{j=0}^{1}\alpha_{4j} DOMD_{t-j} + \alpha_5 ECT_{t-1} + u_t \quad (6)$$

4. Estimation of Results

As a logical sequence of data analysis stationarity test has been performed by Augmented Dicky-Fuller (ADF) and Phillips-Peron (PP) Tests. Before applying unit root test the optimal lag length has been selected on the basis of FPE (Final Prediction Error), AIC (Akaike Information Criterion), SIC (Schwarz Information Criterion) and HQ (Hannan-Quinn Information Criterion).

The table 1 shows that although AIC value is the minimum at lag 3, FPE, SIC and HQ are showing minimum value at lag 2. As maximum criteria are showing minimum value at lag 2 and hence lag 2 is selected in our model.

The results of ADF and PP tests shown in table 2 suggests that GDPR and GSED are stationary at first difference i.e. I(1) and PSED and DOMD are stationary at second difference

Table 3. Results of ARDL Bounds Test

F-Statistic: 8.19	Null Hypothesis: No long-run relationship exits	
Level of Significance	Lower Bound	Upper Bound
1%	4.29	5.61
2.5%	3.69	4.89
5%	3.23	4.35
10%	2.72	3.77

Table 4. Long Run Dynamics under ARDL

Dependant Variable: GDPR Selected Model: ARDL(2,1,1,1)

Cointegrating Form				
Variable	Coefficient	Std. Error	t-Statistic	P-Value
GDPR(-1)	-0.21978	0.37166	-0.59134	0.5800
GDPR(-2)	-0.93097	0.40339	-2.30783	0.0691**
GSED	-0.00517	0.00401	-1.28817	0.2541
GSED(-1)	0.00676	0.00308	2.19659	0.0794**
PSED	0.00731	0.00265	2.75381	0.0401*
PSED(-1)	-0.00747	0.00396	-1.88476	0.1182
DOMD	0.00203	0.00087	2.33070	0.0672**
DOMD(-1)	-0.00226	0.00087	-2.59277	0.0487*
C	-10.8394	33.99711	-0.31883	0.7627

Note: *and ** indicate significance at 5% and 10% level respectively

i.e. I(2). As the variables are integrated at different orders, the Autoregressive Distributed Lag Model (ARDL) is expected to be the more reliable model than that of VEC approach. In the first step we carried out the F-test by selecting ARDL model ensuring that there was no evidence of serial correlation as emphasized by Pesaran et al. (2001).

As our sample size is small and data is collected on annual basis and hence optimum lag length 2 is expected to give better result. Result of F-test is presented in table 3 along with corresponding critical values. The critical values are calculated by Pesaran et. al. (2001).

The calculated F-Statistic (8.19) is greater than upper bound critical values at different levels of significance (table-3). So we can reject the null hypothesis and conclude that there exits long run relationship between dependent variable and independent variables. As we have evidence of long run relationship in the first step, we move to the next step of estimating the ARDL model to get the long run and short run dynamics of economic growth and debt relationship. The calculated long run parameters are reported in table 4.

The ARDL lag structure (2,1,1,1) is automatically selected based on Schwarz Bayesian Criteria (SBC) after setting 2 as the maximum lags to be used. However, the lag structures selected by the FPE, AIC and HQ criterion appear the same as those selected by the SBC in this study. From the table 4 we observe that coefficients of GDPR at lag 1 and 2 both are negative sign meaning that economic growth is negatively influenced by its own lag values in long run. By applying Wald test we see that simultaneous influence of GDPR at lag 1 and 2 to itself is statistically

Table 5. Dependent Variable: GDPR

Variable	Chi-sq Statistic	df	Prob.
GSED	4.4014	2	0.1107
PSED	3.9975	2	0.1355
DOMD	8.7558	2	0.0126*
All	31.4724	6	0.0000**

* Significant at 5% level, ** Significant at 1% level

significant.

The coefficient of GSED indicates that the government sector external debt has the long run relationship with the economic growth. The coefficient of GSED is negative at level but positive at lag 1 meaning that response of GDPR has the negative impact in the same year and positive impact at lag 1. As per findings, 1% increase of public external debt, economic growth decreased by 0.52% but 1% increase at lag 1, economic growth increased by 0.68%. However the coefficient of GSED is statistically insignificant and coefficient of GSED (-1) is significant. On the other hand Wald test suggests that combined effect of GSED and GSED (-1) on GDPR is significant at 5% level of significance.

The result of table 4 suggests that unlike public sector external debt, private sector external debt has the positive impact on economic growth in the same year but has the negative impact at lag 1. The result shows that 1% increase of PSED, economic growth increased by 0.73% and 1% increase of PSED at lag 1, economic growth decreased by 0.75%. One remarkable thing is that impact of GSED on GDPR is faster than PSED. Wald test suggests that combined effect of PSED and PSED (-1) on GDPR is statistically significant at 5% level of significance.

The domestic debt has also the long run relationship with the economic growth. The coefficient of DOMD is positive at level but negative at lag 1 meaning that response of GDPR has the positive impact in the same year and negative impact at lag 1. However the coefficient of DOMD and DOMD(-1) both are statistically significant at 10% and 5% level of significance respectively. The result shows that 1% increase of domestic debt, economic growth increases by 0.20% and 1% increase of domestic debt at lag 1, GDPR decreases by 0.23%. On the other hand Wald test suggests that combined effect of DOMD and DOMD (-1) on GDPR is statistically significant at 5% level of significance.

As the coefficient of error correction term has been found as negative so there exists short run adjustment to be equilibrium in long run. The speed of adjustment is found to be 48.6% per year in short run.

Granger Causality Test

Although ARDL model indicates the absence or presence of long run relationship between variables, it does not indicate the direction of causality between the variables. To detect the extent of causation between the variables and to avoid biasness in model specification, unrestricted Vector Autoregressive (VAR) model has been used to determine the direction of causality among our selected variables. The causality result is presented on table 5.

From the table 5 it is clear that influences

of both the public and private external debts on gross domestic product is insignificant but influence of domestic debt on GDP is significant at 5% level of significance. On the other hand simultaneous effect of debt variables is significant at GDP at 1% level of significance. Thus we see that although public external debt, private external debt and domestic debt each has the long run relationship with economic growth, impact of domestic debt on economic growth is significant.

Post Diagnostic Test

To determine existence of serial correlation in the residual terms we applied Breusch-Godfrey LM test. The null hypothesis of no serial correlation is accepted at 5% level of significance. Whether the residuals are normally distributed or not we applied Jarque-Bera normality test. In this case probability of against test statistics is found greater than 5% meaning that residuals are normally distributed. To determine whether error variance is homogeneous or not we applied Breusch-Pagan-Godfrey Test. This test indicates that p-value against test statistic is greater than 5% meaning that error variance are homoscedastic. By applying Cusum and Cusum squares test we found that our data set is within the limits of 5% error meaning that data of our consideration is stable. Thus we see that all post diagnostic tests suggest our applied model is statistically acceptable.

5. Conclusion

The main objective is to specifically examine the long run and short run relationship among different types of debts and economic growth in Bangladesh during 2000-2015. In this study stationarity test was performed using ADF and PP test, which shows that the variables are integrated at different order. So ARDL model was applied to determine the long run relationship among the variables. The result of ARDL model shows that there exits long run relationship among the variables. The coefficient of error correction term found as negative value and hence there exits speed of adjustment to be equilibrium in long run. It was evident from the findings that there exists bidirectional causality between public sector external debt and economic growth. Causality between private external debt and economic growth has been found insignificant. However causality between domestic debt and economic growth showed a unidirectional causality from domestic debt to economic growth and not vice versa, which implies that impact of domestic debt is more effective to economic growth compared to external debt.

6. Policy Implications

The policy implication of this result is that domestic debt rather than external debt will stimulate economic growth in Bangladesh. This is because the repayment of principal and interest on such internal debt is a reinvestment in the domestic economy which would usually have a chain investment effect on the domestic economy. But with respect to external debt, more resources will be needed to repay and service the debt and this would impair the positive effect of this debt on economic growth. Thus government should

rely more on domestic debt in stimulating growth rather than external debt.

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