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EXTERNAL DEBT AND GROSS DOMESTIC PRODUCT IN BANGLADESH: A CO-INTEGRATION ANALYSIS

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Abstract
External Debt (ED) is considered as a significant source of income for developing countries. Bangladesh relied on foreign debt to finance its balance of payments deficit and saving investment gap. Primary objective of this paper is to explore the relationship between external debt and Gross Domestic Products in Bangladesh for the period of 1972-2010, using time series econometric technique. We took a point of glance of external debt and economic performance of Bangladesh. The results show that there is a positive significant correlation between Gross Domestic Products (GDP) and External Debt (ED). The empirical results suggest the existence of long-run relationship between GDP and ED. The result of Granger's Causality test implies that there is bi-directional causality runs through GDP to ED as well as ED to GDP.
Keywords*:* External Debt (ED), Gross Domestic Product (GDP), Unit Root, Granger Causality, Johansen Co-integration.

1. INTRODUCTION

Foreign aid and external debt was considered a significant source of income for developing countries. From the late 1950's current account deficit was considered normal. The countries facing current account deficit were encouraged to borrow from international community to boost their economic growth. During the last fifty years the 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. In the past three decades it has been observed that external debt has been the main cause of decline in investment and the growth performance of many nations. This external debt is like an unfavorable tax on future generations, which they have to pay for nothing. According to Chenery (1996) the basic reason of external debt in developing counties is to fulfill lack saving investment gap. Foreign debt affects not only investment but also economic growth. The literature shows that besides fulfilling the saving investment gap, the external debt has adversely effect the growth of the many developing countries and for few other countries the effect is positive. The basic reason of adverse effect is the restrictions of the donor agencies.

Management Research and Practice
Volume 4, Issue 4 / December 2012
ISSN
2067- 2462

The objective of the paper is to examine the impact of External Debt on Economic Performance of Bangladesh for the period 1972-2009. The organization of the paper is as follows. Next session has brief explanation of external debt and economic growth in Bangladesh. Section III deals with the related work towards the topic. Section IV deals with Data and Methodology. Results of the estimations are reported and discussed in section V. Final section deals with concluding remarks and some policy suggestions based upon the study.

2. RECENT LITERATURE

The relationship of external debt with economic growth is well discussed in the international research studies but the relationship between external debt and economic growth is not very much focused in Bangladesh.

Qureshi and Ali (2010) analyzed the impact of high public debt burden on the economy of Pakistan by using time series data for a period 1981 to 2008. They found that there is vast negative impact of public debt on the economy of Pakistan.

Malik, Hayat and Hayat (2010) studied the relationship between external debt and economic growth in Pakistan for the period of 1972-2005, using time series econometric technique. They found that external debt is negatively and significantly related with economic growth. They also found that debt servicing has significant and negative impact on GDP growth.

Hameed, Ashraf and Chaudhary (2008) analyzed the long-run and short-run relationships between external debt and economic growth of Pakistan. By fitting production function model to annual data for the period 1970-2003, the study examines the dynamic effect of GDP, debt service, capital stock and labour force on the economic growth of the country. They concluded that debt servicing burden has a negative effect on the productivity of labor and capital, and thereby affect economic growth adversely. Results also show that debt service ratio tends to affect negatively GDP and thereby the rate of economic growth in the long-run, which, in turn, reduces the ability of the country to service its debt.

Adesola (2009) reviewed and analysed the effect of external debt service payment practices on sustainable economic growth and development with particular emphasis on Nigeria. The study concluded that there is a negative significant relation between GDP and external debt.

Frimpong and Oteng-Abayie (2006) examined empirically the impact of existence of external deconomic growth in Ghana to determine the existence of a 'debts overhang' and/or 'crowding out' effects for the period 1970 to 1999. They used ADF, PP and KPSS tests for unit roots and Johansen-Juselius multivariate approach to co-integration to test for stationary and long-off relationship among variables. A VECM was used

ISSN
2067- 2462

to estimate short run impacts. The results indicate that GDP growth is influenced positively by external tit inflows and negatively by debt servicing revealing the presence of a "crowding out effect".

Cholifihani (2008) analyzed long term and short term relationships between public debt service and GDP in Indonesia by applying co-integration analysis of time series model from 1980-2005. The result show that Indonesia faces a debt overhang problem in the long run since increasing the public external debt service slows economic growth.

Siddiqui and Malik (2001) examined the impact of external debt on economic growth in South Asian countries. They found that the impact of foreign debt on economic growth is positive and statistically significant.

Ayadi and Ayadi (2008) investigated the impact of the huge external debt, with its servicing requirements, on economic growth of the Nigerian and South African economies. The external debts of Nigeria and South Africa are analyzed in a new context utilizing traditional, but innovative, models and econometric techniques. The Neoclassical growth model, which incorporates external sector, debt indicators, and some macroeconomic variables, was employed to explore a linear, as well as non-linear, effect of debt on growth and investment. Both ordinary least squares (OLS) and generalized least squares (GLS) are employed in the analysis. Among other test results, the negative impact of debt (and its servicing requirements) on growth is confirmed in Nigeria and South Africa. They also found that South Africa performs better than Nigeria in the application of external loans to promote growth.

Jayaraman and Lau (2009) examined whether external debt contributed to economic growth in PICs by undertaking a study of six major PICs. The empirical study findings indicate that (i) although there is no long-term relationship, in the short run there is a causal linkage running from external debt, budget deficit and exports to output; and (ii) there is a short run bi-directional causal relationship between economic growth and external debt. The conclusions are: since external borrowing contributes to growth in PICs in the short run, growth enhances the image of a PIC as an efficient user of borrowed funds, enabling it to borrow from abroad on better terms; consequently, higher growth results in further rise in external debt level.

Loganathan, Sukemi and Sanusi (2010) analysed the long-run and short-run relationship between external debt and macroeconomics performance of Malaysia. They applied time-series econometric techniques with annual data series for the entire period of 1988-2008. The co-integration approach was employed to investigate the long-run relationship; and vector error correction method (VECM) to investigate the short term dynamics. They found that there was a significant long-rung and short-run relationship between external debt and macroeconomics variables performance.

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Kumari (1996) investigate whether external debt really plays a significant role in the attainment of higher and sustainable rates of economic growth by relieving the foreign exchange constraint in the developing countries. He concluded that debt flows do not automatically contribute to the economic growth; it is mainly domestic efforts which make these flows to contribute to it.

3. METHODOLOGY AND DATA COLLECTION

Annual data are used in this study to avoid the seasonal biases. Furthermore, Hakkio and Rush (1991) noted that co-integration is a long run concept and thus requires long spans of data to give the tests for co-integration more power than merely increasing the data frequency. The data were collected from Asian Development Bank, key indicators (KI), international financial statistics (IFS) and World Bank, world development indicators (WDI). Finally, the econometric software, namely Microfit 4.1 and Eviews 5.1 are used to complete the analysis in this study.

In the time series literature, if the series are non-stationary or I(1) process, the regression results with variables at level will be spurious (Granger and Newbold, 1974; Phillips, 1986). Thus, we start with examining the time series properties of the series through the ADF and PP stationarity tests. The results revealed that all the examined series are integrated of order one, I(1). These results are consistent with the notion that most of the macroeconomic variables are non-stationary at level, but become stationary after first differencing (Nelson and Plosser, 1982).

4. THE MODEL

The model intends to establish the relationship between external debt and national income (GDP) of Bangladesh where it can be expressed in the following basic bivariate model.

$$Y_t = \alpha + \beta C_t + \varepsilon_t \quad (1)$$

where, Y_t is real gross domestic product (GDP) and C_t is the external debt (ED) and ε_t is error term. Logarithmic transformation of the above equation and inclusion of a trend variable would leave the basic equation as follows

$$LY_t = \alpha_0 + \alpha_1 t + \beta CE_t + \varepsilon_t \quad (2)$$

where, t is the trend variable.

The standard Granger causality test (Granger, 1988) seeks to determine whether past values of a variable helps predict changes in another variable. In the context of this analysis the Granger method involves the estimation of the following equations:

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$$LY_t = \beta_0 + \sum_{i=1}^{q} \beta_{1i} LY_{t-i} + \sum_{i=1}^{q} \beta_{2i} LC_{t-i} + \varepsilon_{1t} \quad (3)$$

$$LC_t = \varphi_0 + \sum_{i=1}^{r} \varphi i_{1i}\, LC_{t-i} + \sum_{i=1}^{r} \varphi_{2i}\, LY_{t-i} + \varepsilon_{2t} \quad (4)$$

where, LYt and LCt represent real GDP and external debt, respectively, ε_{1t} and ε_{2t} are uncorrelated stationary random process, and subscript t denotes the time period. Failing to reject $H_0 : \beta_{21} = \beta_{22} = ... = \beta_{2q} = 0$ implies that external debt does not Granger cause real income activities. On the other hand, failing to reject $H_0 : \varphi_{21} = \varphi_{22} = ... = \varphi_{2r} = 0$ implies that real GDP does not Granger cause external debt.

Empirical works based on time series data assume that the underlying time series is stationary. However, many studies have shown that majority of time series variables are nonstationary or integrated of order 1 (Engle and Granger, 1987). The time series properties of the data at hand are therefore studied in the outset.

The above specification of the causality test assumes that the time series at hand are mean reverting process. However, it is highly likely that variables of this study are nonstationary. Formal tests will be carried out to find the time series properties of the variables. If the variables are I (1), Engle and Granger (1987) assert that causality must exist in, at least, one direction. The Granger causality test is then augmented with an error correction term (ECT) as shown below:

$$\Delta LY_t = \beta_0 + \sum_{i=1}^{q} \beta_{1i} \Delta LY_{t-i} + \sum_{i=1}^{q} \beta_{2i} \Delta LC_{t-i} + \alpha_1 Z_{t-1} + \varepsilon_{1t} \quad (5)$$

$$\Delta LC_t = \varphi_0 + \sum_{i=1}^{r} \varphi i_{1i}\, \Delta LC_{t-i} + \sum_{i=1}^{r} \varphi_{2i}\, \Delta LY_{t-i} + \lambda_1 Z_{t-1} + \varepsilon_{2t} \quad (6)$$

where Zt–1 is the ECT obtained from the long run co-integrating relationship between real GDP and external debt. The above error correction model (ECM) implies that possible sources of causality are two: lagged dynamic regressors and lagged co-integrating vector. Accordingly, by equation (5), external debt Granger causes real GDP, if the null of either $\sum_{i=1}^{q} \beta_{2i} = 0$ or $\alpha_1 = 0$ is rejected. On the other hand, by equation (6), real GDP Granger causes external debt, if λ_1 is significant or $\sum_{i=1}^{r} \varphi_{2i}$ are jointly significant.

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Real output and external debt granger causes each other (i.e. presence of bidirectional causality), if causality exists in both directions.

5. RESULTS AND DISCUSSION

The study uses annual data on external debt (X) and Gross Domestic Products (Y) of Bangladesh. Annual data on real income (GDP, constant US$ 2000) and external debt (ED, constant US $ 2000) are extracted from World Development Indicator (WDI-2010). The study is confined to the period of 1972 – 2010 due to data availability. Data are used in constant US $ 2000 for GDP and External Debt. Data are used in natural logarithms.

TABLE-1 - DESCRIPTIVE STATISTICS

	LY	LX
Mean	24.02578	20.29224
Median	24.12875	20.49285
Maximum	25.21594	21.18612
Minimum	22.56195	17.05810
Standard Deviation	0.670943	0.764135
Skewness	-0.303887	-2.696920
Kurtosis	2.304029	11.13554
Jarqua-Bera	1.387369	154.8308
Probability	0.499732	0.00000
Sum	937.0053	791.3974
Sum Sq. Dev.	17.10623	22.18828
Sum	39	39

TABLE 2 - CORRELATION BETWEEN EXTERNAL DEBT AND GDP

	LX	LY
External Debt Sig. (2-tailed)	1.00	0.850** 0.000
GDP		1.00

** Correlation is significant at the 1% level.

For understanding of the behavior of economic activity and external debt, a preliminary analysis of the data is first carried out. Table 1 represents summary of the logarithms of the GDP and ED.

Table 2 represents the pair-wise correlation of GDP and ED. The table shows there is a strong positive correlation between two variables and which is statistically significant at 1% level of significance.

The estimation procedure begins with testing the time series properties of the data. Table 3 presents the unit root test results of the variables. As it is important to determine the order of integration among variables, two different types of tests are applied. While the ADF is notorious for its poor power problem, the other one test is more powerful in rejecting the null of nonstationarity. The PP test is more efficient in the presence of a single break in the data. For ADF, and PP tests, both with constant and constant and trend, one is unable to

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reject the null at level, is able to reject when first differenced series is used. In total, it emerges from the unit root test results that both the variables are integrated of order 1, I(1).

TABLE 3 - UNIT ROOT TEST OF THE VARIABLES

Variables	Augmented Dickey-Fuller (ADF) Test			Process	Philips-Perron(PP) Test			Process
	Statistics	p-values	Unit Root		Statistics	p-values	Unit Root	
Test Equation: Intercept								
LEDEBT	-0.197036	0.6701	Yes	I(1)	-0.785455	0.5782	Yes	I(1)
LGDP	0.582637	0.9871	Yes	I(1)	-0.153852	0.9358	Yes	I(1)
ΔEDEBT	-4.892487***	0.0003	No	I(0)	-5.141796***	0.0001	No	I(0)
ΔGDP	-8.638972***	0.0000	No	I(0)	-9.733619***	0.0000	No	I(0)
ΔΔEDEBT	-6.251114***	0.0000	No	I(0)	-10.31664***	0.0000	No	I(0)
ΔΔGDP	-7.775742***	0.0000	No	I(0)	-20.21541***	0.0001	No	I(0)
Test Equation: Trend and Intercept								
LEDEBT	-6.799574***	0.0000	No	I(0)	-12.08194***	0.0000	No	I(0)
LGDP	-7.548398***	0.0000	No	I(0)	-4.119534***	0.0128	No	I(0)
ΔEDEBT	-4.864325***	0.0019	No	I(0)	-4.987179***	0.0014	No	I(0)
ΔGDP	-7.443582***	0.0000	No	I(0)	-10.89482***	0.0000	No	I(0)
ΔΔEDEBT	-6.538734***	0.0000	No	I(0)	-11.42032***	0.0000	No	I(0)
ΔΔGDP	-7.684293***	0.0000	No	I(0)	-21.42088***	0.0000	No	I(0)

Note: The variables 'external debt' and 'economic growth' stand for the log of 'external debt' as defined before and the log of economic growth respectively. L stands for level, Δ denotes the first difference and ΔΔ denotes second difference of the variable. The null hypothesis states that the variable has a unit root. P-values are used to decide the unit roots at the 1 percent significance level. The critical values and details of the tests are presented in Dickey and Fuller (1979, 1981) and Phillips and Perron (1988). The AIC determines the lag length (P) in the ADF tests (see Stock and Watson 2007:561 for details). Test equation: trend and intercept. *,**, and *** denote rejection of null at 10%, 5%, and 1% level of significance.

Source: World Development Indicators (WDI-World Bank 2010)

TABLE 4 - OUTPUT OF REGRESSION

Dependent Variable: LY Method: Least Squares Included observations: 37				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	10.294	1.868	5.511	0.0000
LX	0.677	0.092	7.357	0.0000
R-squared	0.594	Mean dependent var		24.0959
Adjusted R-squared	0.583	S.D. dependent var		0.6123
S.E. of regression	0.1402	Akaike info criterion		-0.9895
Sum squared resid	0.6487	Schwarz criterion		-0.8153
Log likelihood	45.52867	F-statistic		199.7246
Durbin-Watson stat	0.419171	Prob (F-statistic)		0.000000

Table 4 presents the long-run equation, which is derived by normalizing on output based on the estimated co-integration coefficient. As expected all the signs are positive and significant indicating that external debt has an influence on GDP for Bangladesh. The adjusted-R squared shows that the 58% variation in GDP is explained by ED.

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2067- 2462

TABLE 5 - RESULTS OF CO-INTEGRATION TEST [VAR LAG K = 2, X= [LY, LC]

Null	Eigen values	Trace Test		Max Eigen value Test	
		$\lambda - trace$	*p*–value	$\lambda - \max$	*p*–value
$r \leq 0$	0.357444	21.46262	0.0011	16.36517	0.0058
$r \leq 1$	0.128700	5.097454	0.0285	5.097454	0.0285

Once it is established that variables are I(1), the next step is to test for existence of any co-integration relationship between income and external debt. The Johansen (1991) LR test of co-integration is applied and results are showed in Table-5. The appropriate VAR lag length is selected using BIC. The λ-trace statistic rejects the null of r ≤ 0 but cannot reject r ≥ 1 and also, the λ-max statistic rejects the null of r = 0 but fails to reject r = 1 at 5% level. These Eigen value tests based on stochastic matrix indicate existence of the co-integrating relationship between income and external debt. So, the Granger causality tests will be modeled using ECM as explained in Equations (5) and (6).

TABLE 6: GRANGER CAUSALITY TEST RESULTS

Pairwise Granger Causality Tests			
Lags: 2			
Null Hypothesis:	Obs	F-Statistic	Probability
LC does not Granger Cause LY	37	5.64480	0.00795
LY does not Granger Cause LC		5.27918	0.01044

Table 6 presents the Granger Causality tests results. Granger causality test has been employed and the results are presented in Table-06. F-statistic and probability values are constructed under the null hypothesis no causality. It is evident that there is bi-literal causal relationship between the variables i.e. the both way causality runs through GDP to ED and ED to GDP.

6. CONCLUSIONS

The main contribution of the paper is to empirically investigate the relation between economic growth and external debt in Bangladesh with the up-to-date time series econometric method. The paper uses time series econometric tools to investigate the relationship among the variables. The ADF, PP Test, Granger Causality Test and Co-integration Models are employed taking care of stochastic properties of the variables. The unit root test results that both the variables are integrated of order 1. The co-integration analysis suggested that there is a long-run equilibrium relationship between income and external debt. These Eigen value tests based on stochastic matrix indicate existence of the co-integration relationship between GDP and ED. The empirical results suggest the existence of long-run relationship between GDP and ED. The result of Granger's Causality test implies that there is bi-directional causality runs through GDP to ED as well as ED to GDP.

Bangladesh Government has to borrow from local banks as well as from foreign country. Due to lack of fund there is no other alternative without borrowing. Our study reveals that there is a significant positive relation

ISSN
2067- 2462

between GDP and ED. So, Bangladesh should use the debt carefully for the development of country. One major problem for taking debt from foreign country is the imposition of some regulations. Bangladesh can overcome it by bargaining with the foreign country.

REFERENCES

Adesola, W.A. (2009), "Debt Servicing and Economic Growth in Nigeria: An Empirical Investigation", Global *Journal of Social Sciences*, Vol. 8, No. 2, pp. 1-11.

Ayadi ,F. S. and Ayadi, F.O. (2008), "The Impact of External Debt on Economic Growth: A Comparative Study of Nigeria and South Africa", *Journal of Sustainable Development in Africa*, Volume 10, No.3, pp. 234-264.

Cholifihani, M. (2008), "A Cointegration Analysis of Public Debt Service and GDP in Indonesia", Journal of *Management and Social Sciences*, Vol. 4, No. 2, pp. 68-81.

Frimpong, J.M. and Oteng-Abayie, E.F. (2006), "The Impact of External Debt on Economic Growth in Ghana: A Cointegration Analysis", *Journal of Science and Technology*, Vol. 26, No. 3, pp. 122-131.

Hameed, A., Ashraf, H. and Chaudhary, M.A. (2008), "External Debt and its Impact on Economic and Business Growth in Pakistan", *International Research Journal of Finance and Economics*, Issue 20, pp. 132-140.

Jayaraman, T.K. and Laub, E. (2009), "Does external debt lead to economic growth in Pacific island Countries*", Journal of Policy Modeling*, Vol. 31, pp. 272–288.

Kumari, P. (1996), External Debt, Foreign Exchange Constraint and Economic Growth in Developing Countries, *Finance India*, Vol. X, No. 2, pp. 394–396.

Loganathan, N., Sukemi, M.N. and Sanusi, N.A. (2010), "External Debt and Macroeconomics Performance In Malaysia: Sustainable Or Not?" *Global Economy and Finance Journal*, Vol. 3. No. 2. pp. 122 - 132

Malik, S., Hayat, M.K. and Hayat, M.U. (2010), "External Debt and Economic Growth: Empirical Evidence from Pakistan", *International Research Journal of Finance and Economics*, Issue 44, pp. 88-97.

Qureshi, M.N. and Ali, K.(2010), "Public Debt and Economic Growth: Evidence from Pakistan", International *Research Journal of Finance and Economics*, Issue 53, pp. 100-108.

Siddiqui, R. and Malik, A. (2001), "Debt and Economic Growth in South Asia", *The Pakistan Development Review*, Vol. 40(4), Part II, pp.677-688