Public Debt and Economic Growth in Bangladesh: A Causality Analysis

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Abstract: *Government borrowings (often considered as public debt) occupies the central place among different means for accelerating economic growth in the resource scarce less developed economies. In the initial years of independence Bangladesh adopted cautious strategies of borrowings from internal and external sources under restricted economic policy framework. However, the bitter experience of such policies in promoting economic growth led the economy moved towards greater borrowings under liberalized economic atmosphere. The objective of this study, therefore, has been to empirically examine the relationship between public borrowings and economic growth in Bangladesh for the long span of time period from 1974-2014. The time series econometric technique has been applied to determine the direction of causality between debt and economic growth. First, the stationarity properties of the time series data have been checked by the Augmented Dickey Fuller test and Phillip-Parron tests. The test results confirm that both nominal GDP and total public debt are non-stationary processes that are of order 1. Furthermore, there is evidence of a long-run equilibrium relationship between total public debt and economic growth form the Engel-Granger two steps procedure of cointegration test. An error-correction model is estimated to investigate the short-run dynamics of the long-run relationship between the variables. The results indicate the absence of causality between pubic debt and economic growth in the short run. This suggests that short-run variations in public debt and growth rate may be dominated by business cycle fluctuations with no clear causal pattern in the short run. However, the evidence of bidirectional causality between public debt and economic growth in the long-run indicates that both public debt and economic growth reinforce each other in a longer term perspective.*

1. Introduction

Underdeveloped and developing countries often suffer from the scarcity of tangible resources because of trade deficit and current account deficit. Consequently they are encouraged to borrow both from domestic and

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external sources to enhance their economic growth. However, there is no general consensus in the literature whether public debt is a driving force of economic growth. It has been observed that debt and its repayments act as an encumbrance to the economic growth and development of developing countries. In the past three decades it has been observed that public borrowings have been the main cause of decline in investment and the growth performance of many nations.

Chenery (1996) has argued that the main reason of external debt in developing counties is to fulfill saving investment gap. Foreign debt augments investment and so the economic growth. However, literature shows that besides fulfilling the saving investment gap, external debt adversely affects the growth of the developing countries, which is mainly due to the restrictions of the donor agencies.

Developing countries like Bangladesh suffers severely from the excessive dependence on public borrwoings. High interests on external as well as internal debt create macroeconomic imbalances and adversely affect the avenue of economic growth. According to World Bank, the total external debt of the developing countries has increased from US $ 411.4 billion to US $ 523.4b billion over the period 1990-2002(WDI 2004). After 1980s, in most developing countries, the rate of debt accumulation and increase in debt servicing are highlighted as major factors affecting the growth rate of output. Due to the structural imbalances caused by excessive dependence on foreign debt most of these countries lost their competitiveness in the international market mainly as a result of insufficient exchange rate adjustments. Besides, the deterioration of terms of trade, economic mismanagement and crisis of governance also lowered growth rates in the developing countries. The downward pressure was larger in the countries facing higher debt burden as these countries faced higher interest rates, decline in the external resource inflow, lower export earnings, lower domestic output and lower imports.

The empirical literature indicates that the critical ratios that can be helpful in determining the debt burden of the countries include debt-to-export ratio, debt-to-output (i.e., output can be measured either in terms of gross domestic product or gross national product), and the ratio of debt servicing to export or output. If for a country these ratios are larger

than the critical values, the impact of debt on the country's growth may become negative. For example, Pattillo, Poirson and Ricci (2001), report that average impact of debt on economic growth becomes negative when debt-to-export ratio is around 160–170 percent and debt-to-output ratio is around 35–40 percent. According to these ratios for South Asian countries, we can see large variations. For example, in Bangladesh, in 1990s, the debt-to-GNP ratio was above these critical levels (> 50 percent) but due to a large external sector, the debt-to-export ratio was, on average, below 170 percent. As a result, it may generate negative impact on economic growth. Keeping this in view, we examine the impact of government borrowings on economic growth in Bangladesh.

The study is be based on the annual data from 1974 to 2014. In order to analyze short-run dynamics and long-run relationships public borrowings and economic growth the study makes use of Vector Autoregression (VAR) and Vector Error Correction (VEC) specifications in this study. As unrestricted VARs do not impose co-integration on its variables, a VEC model needs to be set up if the variables are known to be non-stationary and cointegrated. The study will use both the ADF and PP test to see whether the considered variables are stationary or not. Then the Johansen Juselius test will be applied to examine the cointegration of the variables. Finally error correction models and Granger causality tests will be applied to examine the short run dynamics of long run relationship between public debt and economic growth.

The paper is organized as follows. After introducing the issues and rationale of the study in section 1, section 2 will present a survey of the literature. Section 3 sets out the framework for testing stationarity, cointegration, error correction models and causality among the variables. Finally, section 4 concludes the paper with policy implications.

2. Survey of the Literature

A good number of studies have dealt with the external debt-economic growth relationship over the last two decades. After the second oil crisis in 1979, all countries were affected by the worldwide recession of 1980-1983. Due to low commodity prices, high real rates of interest and sluggish growth in the industrial countries, several debtor countries have experienced debt servicing difficulties. Thus the period since 1982 has been described as a period of debt overhang. Savvides (1992) asserts

that if a debtor country is unable to pay its external debt, debt payments become linked to the country's economic performance. The country benefits only partially from an increase in output or exports because a fraction of the increase is used to service the debt and accrues to the creditors. Thus, from the perspective of the debtor country as a whole, the debt overhang acts like a high marginal tax rate on the country, thus lowering the return to investment and providing a disincentive to domestic capital formation. The disincentive effect of the debt overhang may have repercussions on private saving and investment, even when all external debt is held by the government. The government has little incentive to institute policies to promote domestic capital formation or to reduce current consumption in exchange for higher future economic growth when the benefits from such policies go to creditors in the form of higher debt payments. Using the cross section-time series data from 43 less developed countries for the period of 1980-1986 by applying Two Stage Limited Dependent Variable model (2SLDV) procedure Savvides (1992) concludes that debt overhang and decreasing in foreign capital inflows have a significant negative effect in investment rates. When capital inflows are divided into commercial and noncommercial flows, the conclusion differs. A decrease in commercial inflow is a significant factor in investment rates. On the other hand, noncommercial inflow is a not a determinant factor in lessening investment rate. This result is also consistent with the IMFÕs (1989) conclusion. It concluded that debt overhang is a significant factor influencing slowdown in investment.

Kruger (1987) states that after the rise in oil prices, the oil importing developing countries faced large current account deficits. On the other hand, oil exporters had large current account surpluses, which they lent to the commercial banks, which in turn financed the deficits of oil importing countries, thus the surpluses of the oil exporting countries were used by oil importing developing countries. Bauerfreund (1989) used a computable general equilibrium model to measure the cost of external debt to the Turkish economy. His dissertation explains the issue of the debt overhang, using a multi sector, non-linear general equilibrium model. The approach taken to measure the debt overhang is to compare the growth rate of the Turkish economy following hypothetical debt forgiveness. In Bauerfreund's thesis, two debt overhang measures are evaluated. The first one is set by Sachs (1986), who indicates that when

indebted countries pay their debt, these payments require a transferring of resources from the private sector to public sector. In order governments to pay debt obligations, they need to levy a tax on the private economy. This increasing taxation causes a decrease in the net returns of investment, resulting in a reduction of investment in the debtor countries, and a negative effect on future production and income. The second one is set by Feldstein (1986). It is argued that the debt burden is not a problem of freeing resources to debt service payments but also doing so in a way that converts these resources into foreign exchange. It is believed that indebted countries are able to achieve this by, increasing exports but in practice the experience shows that maintaining the increase in exports is too difficult.

Deshpande (1997) attempted to explain the debt overhang hypothesis by an empirical examination of the investment experience of 13 severely indebted countries. The severely indebted countries are Algeria, Argentina, Ivory Cost, Egypt, Honduras, Kenya, Mexico, Morocco, Peru, Philippines, Sierra Leone, Venezuela and Zambia. The author explains that debt overhang, which in contrast to the normal debt obligations is the actual amount of paid debt service is determined by creditors and debtor countries. Hence, any increase in production and exports are used for debt payment to creditors. As a consequence, this gives a disincentive to investors. Investors are not willing to invest a large amount of money. The author argues that the adjustment measures, which are applied by severely indebted countries, have an impact on the indebted countries, since the investment crisis has typically implied a growth crisis for the highly indebted countries. This has further worsens severely indebted countries' debt service capacity.

Cohen (1993) estimated an investment equation for a sub-sample of 81 developing countries, over three sub-periods: 1965-1973, 1974-1981, and 1982-1987, using OLS method. The author shows that the level of debt does not explain the slowdown of investment in highly rescheduling developing countries. The author also found that the correlation between debt and investment are the same in 1980's for the rescheduling countries. They tested the effect of foreign aid on domestic investment in 1960's. The impact of foreign finance on investment seems to be low and consistent with the result of Cohen (1993). The author found that 3 percent of GDP transferred abroad reduces investment by 1 percent point

below the financial-autarKz rate. A financial-autarKz benchmark is estimated to see whether the difference between the level that prevailed in the 1980's and that financial-autarKz benchmark is significantly correlated to the service of the debt.

Warner (1992) tried to measure the size of debt crisis effect on investment with the Least Squares estimation for 13 less developed countries over the period of 1982-1989 using a set of independent variables. The reasons behind the decline of investment in many of the heavily indebted countries are declining exports prices, high world interest rates, and sluggish growth in developed countries. These shocks could have directly caused investment to decline. Warner (1992) claims that investment decline in many of the countries on the heavily indebted list can be forecast out of the sample by simple terms of trade and world real interest rate equations. Out of 13 countries, 11 of this group were examined. Forecast investment in the final year of forecasting period was lower than actual investment. Finally, a debt crisis dummy involved a panel regression. The data are pooled on all of the highly indebted countries. The result is that the debt crisis dummy variable failed to have a negative coefficient as the debt theories predict. The effect of dummy debt variable was positive and highly significant.

On the other hand, Rockerbie (1994) criticized Warner (1992). The author affirms that Warner's (1992) has several shortcomings. Warner's paper provides new ideas about the effects of debt crisis on the investment in indebted countries. It is argued that shortcomings may have caused investment to be biased and unreliable testing method. Firstly, to test two competing models, standard econometrics practice should perform either a nested or a non-nested test which involves estimating each hypothetical model. Secondly, Warner's (1992) investment equation did not have debt variables as these variables are probably endogenous to the model. This is a persistent problem in estimating relationships for less developed countries incorporating debt measures. Thirdly, domestic policies and world economic conditions have changed during the 1982 period. In that time debt crisis has occurred in all indebted countries. Hence, these structural changes may impair the usefulness of a forecasting equation estimated using sample period of 1960- 1981. That is why; Warner's hypothesis is weakened by using the dummy variable for the years 1982- 1989.

Rockerbie (1994) utilized Ordinary Least Squares for each of the thirteen countrie s, over the sample period 1965- 1990. The results show that the debt crisis of 1982 had significant effects in terms of dramatic slowdown of domestic investment in less developed countries (LDCs). This study used variables that represent foreign debt stocks and flows, domestic monetary and fiscal policies, as well as world economic conditions. The investment equation used here is similar to one used in Rockerbie (1993). It is also found that the debt crisis of 1982 and subsequent moratoriums on debt service obligations had a significant negative effect on economic growth in less developed countries. The 1982 debt crisis also changed the sensitivity of investment to external and domestic factors. There is no doubt that the dramatic decrease in net flows had significant negative effects on economic growth in less developed countries (LDCs).

Afxentiou and Serletis (1996) examined 55 developing countries facing debt service difficulties. The main objective of this study was to find out the statistical relationship between foreign borrowing and productivity. Data coverage includes 1970-1990 period. The results show that during the period of 1970-1980, the relationship between indebtedness and national productivity is not negative. Developing countries used the foreign loans to take time and absorb the shock from oil price increases as painlessly as possible. These findings were proved by all four groups of developing countries. On the other hand, the debt forgiveness and rescheduling began during the 1980-1990 sub-period. For this period, the debt crisis took place and the debt overhang affected some indebted countriesÕ economic growth. The results reveal that there was a negative relationship between indebtedness and national productivity for two groups of the severely indebted developing countries. Severely indebted developing countries used their foreign loans improperly. Therefore, they faced debt service difficulties when they were required to pay their debt obligations. In this period, developing countries failed to meet their debt payments, as they had both resource wasting and failure to improve their foreign exchange earnings.

Geiger (1990) examined the relationship between GNP growth rate and debt burden. The debt burden represents debt service ratio (the sum of interest payments and repayments of principal on external debt to exports of goods and services), the ratio of debt service to GDP, and the ratio of net transfers to GDP, and the ratio of net transfers to GDP in highly indebted countries in south America where the problem of debt is

serious. This study focuses on the specific country to determine the impact of debt burden and capital inflows on the economic growth. The ratio of net transfers to GDP, debt service to GDP, and debt service to exports were regressed on real GDP growth rate over a 13 year period, from 1974 to 1986, for nine highly indebted South America countries. The countries included were Argentina, Chile, Brazil, Peru, Colombia, Ecuador, Paraguay, Bolivia and Venezuela. The results of this study confirm that there is a statistically significant inverse relationship between debt and economic growth. Furthermore, intra country analysis shows that the marginal effects of the debt burden on the economy decrease when the debt burden increases. Even though there is an important variation in the model from country to country, many different factors affect economic development in each of the countries and there are also different reactions to the debt burden. For all countries examined, the lagged model is the most highly correlated. On the other hand, the burden of the principal and interest payments has a greater impact on the economy in the following year rather than in the current year. It is also not surprising that the lagged equations model results have more statistical significance than the linear equations.

Fosu (1996) tested the relationship between economic growth and external debt with an empirical study for the sample of sub-Saharan African countries over the 1970-1986 period by employing the OLS method. This study examined to which degree debt had a negative impact on economic growth of sub-Saharan African (SSA) countries. This study estimates the direct effect of debt hypothesis and indirect debt hypothesis. The direct effect of debt hypothesis proposed that if debt service payments do not decrease investment and saving levels considerably, the debt negatively affects growth directly by reducing productivity. It is also argued that the direct effect of debt hypothesis suggests that both debt service payments and debt outstanding may affect GDP growth rate negatively even if debt outstanding and debt service payments do not affect investment levels. The results show that by using a debt-burden measure, direct effect of debt hypothesis reveals that GDP growth is negatively influenced via a diminishing marginal productivity of capital. The findings of this study also show that on average a high debt country faces about one percentage reductions in GDP growth rate annually.

Cunningham (1993) examined the association between debt burden and economic growth for 16 heavily indebted nations during the period 1971

to 1987. It is predicted that the growth of a nationÕs debt burden has a negative effect on economic growth because of the impact on the productivity of labour and capital. As a nation has a significant debt burden, the debt burden needs to be serviced. This will influence how capital and labour will be used in production. This study concludes that the growth of a nationÕs debt burden had negative effect on economic growth during the period of 1971-1979. On the other hand, the results for the 1980-1987 periods offer little support for the inclusion of the growth of debt burden in the economic growth model.

Sawada (1994) investigated whether the heavily indebted countries (HICs), concerned with their external debt repayments, stay solvent. A direct test of the solvency condition derived from the usual in temporal budget constraints shed light on the sustainability of their current policies. This study employed annual time series data for sample period from 1955-1990 and estimated the cointegration regression using the OLS method. The findings of this study show that heavily indebted countries (HICs) have debt overhang problems. Since their current external debts are above the expected present value of the future gains.

Smyth and Hsing (1995) have tried to test the federal government debtÕs impact on economic growth and examine if an optimal debt ratio exists that will maximise the economic growth. The author calculated the optimal debt ratio (DEBT/GDPT), which represents the maximum real GDP growth rate (38.4 percent). The DEBT/GDP ratio corresponding to the maximum GDP growth rate is 38.4 percent. The results show during the1980s and early 1990s, federal debt has a different role in economic growth. In the early 1980, debt ratios (DRHP) rose but it was below 38.4, thus debt-financing stimulates economic growth. On the other hand, during 1986-1993, debt ratio rose from 40.7 percent to 50.9 percent. This ratio is above the (38.4) optimal debt ratio and expected to adversely effect economic growth.

Perasso (1992) has tried to compare the impact of debt servicing obligations and domestic policies on domestic investment in highly indebted less developed countries (LDCs) for the 1982-1989 periods. Data are obtained from 20 middle income severely indebted countries. The results of this empirical study show that appropriate domestic policies have a stronger impact on increasing investment and growth in highly indebted countries than decreasing (debt relief) debt servicing obligations, for example, a 1 % real devaluation causes up to a .32 %

increase in propensity to invest. On the other hand a 1 % reduction in interest payments causes a .19 % increase in propensity to invest. Another reason concerns with deficits stems from the arguments that government deficits eventually are monetized and therefore lead to inflation.

According to Elmendorf and Mankiw (1998), a country with a large debt is likely to face high interest rates and the monetary authority may be pressured to try to reduce those rates through expansionary policy. This strategy is believed to be able to reduce interest rates in the short run, but in the long run will leave real interest rates roughly unchanged and inflation and nominal interest rates higher Economic theory suggests that foreign debts exert positive effect to the economic growth. First, according to Lin and Sosin (2001), the benefits that a country may have from borrowing from origin funds (external debts) include purchasing advanced equipment and technology and investing in the essential projects private firms are unwilling to support such as infrastructures. With better technology and improved infrastructure, the debtor country can raise the efficiency of the production process and perhaps reach self-stainable economic growth. Second, foreign debts may permit an increase in a country's current capital stock and stimulate current economic growth, while debt repayment may decrease the future capital stock and reduce future economic growth (Lin and Sosin, 2001). Furthermore, the growth of external debts in the 1990s seems to have accompanied with higher incomes, stronger GDP growth, and greater openness to trade in borrowing countries (Dadush et al.,2000). Third, in the face of adverse economic shocks, countries may borrow to smooth consumption. This is possible as global financial integration have enlarged their access to international capital markets. Nevertheless, engaging in foreign debts involved risks. The risks to specific types of foreign debts operate via, at least, three major channels. The first risk is foreign borrowing may trigger conditions that encourage resi-dents to engage in capital flight. External borrowing can directly lead capital flight by providing the resources necessary to effect flight (Cuddington, 1987; Henry, 1996; Chipalkatti and Rishi, 2001). For example, Cuddington (1987) shows that more capital flight occurred contemporaneously with increased debt inflows in Mexico and Uruguay, hence attesting to a strong liquidity effect in these countries.

Chipalkatti and Rishi (2001) show that there is a direct relationship between debt and capital flight, where the flows directly fuel one another by providing capital for each other. They find that a percent increase in real capital flight is significantly associated with a 0.06% increase in net real debt disbursements The second risk is that foreign borrowing can significantly reduce domestic investment. According to Borensztein (1990); Karagol (2002); Pattillo et al. (2004) and Serieux and Samy (2001), the debt overhang hypothesis indicates that a heavy debt burden may act as an implicit tax on the resources generated by a country, and therefore reduce the size of domestic and foreign investments as well as their quality, and create negative incentives for policy reforms. Borenzstein (1990) further distinguishes two channels in which foreign debt may influence domestic investment, that is, "debt overhang" and "credit rationing" channels. Applying a simulation technique, he shows that those two non-mutually exclusive effects are crucial in explaining the sharp decline in investment in the 1980s for heavily indebted countries. The third risk is the large short-term external liabilities of the countries involved as a fundamental source of financial fragility. For example, Eichengreen and Mody (1999) show that risk spreads on emerging market syndicated loans and bonds are higher for countries with a higher short-term debt to reserves ratio while Detragiache (1996) demonstrates a strong and robust correlation relationship between the occurrence of external debt crises and short-term debt. Moreover, a number of studies find that the ratio of short-term debt to reserves helps predict huge reversals of capital flows and countries with excessive short-term external liability are more vulnerable to crises (Cole and Kehoe, 1996, 2000; Detragiache, 1996; Rodrik and Velasco, 2000)

A cost-benefit analysis on various types of foreign debts from the perspectives of recipient countries should consider the following elements:external debt can bring negative impacts to the economic growth as well through several contributors such as the interest payment of the debt and the debt overhang situation. The rate of debt accumulation and increase in debt servicing are highlighted as major factors affecting the growth rate of output, (Siddiqui and Malik, 2001). Lin and Sosin (2001)

argue that it is the interest payment of the debt that retards the economic growth. The authors mentioned that in order to pay the

principle and interest, more future tax revenues must be raised or the given tax revenue must be diverted from other productive uses, which may hurt economic growth. IMF (2004) adds that greater reliance on foreign-currency debt is associated with a higher frequency of debt crises. Relatively large shares of foreign-currency debt and depreciations can abruptly render a country insolvent.

3.0 Analytical Framework

3.1. Data

The analysis in this study is based on annual data covering the period from 1974 to 2014. Data on Gross Domestic Product (GDP), Total Public Debt (TPD) which consists of government's borrowing both from domestic and external sources have been obtained from 6th Five Year Plan documents published by the Ministry of Planning. Econometric estimations have been done by using STATA 11.0.

3.2. Methodology and Results

The most traditional practice in testing the direction of causality between two variables has been to use the standard Granger (1969) framework. The standard Granger causality test consists of estimating the following equations:

$$Y_t = \beta_0 + \sum_{i=1}^{m} \beta_i Y_{t-i} + \sum_{j=1}^{n} a_j X_{t-j} + u_t \quad (1)$$

$$X_t = \gamma_0 + \sum_{i=1}^{m} \gamma_i X_{t-i} + \sum_{j=1}^{n} \delta_j Y_{t-j} + v_t \quad (2)$$

where u and v are mutually uncorrelated white noise series and t denotes time period. Causality may be determined by estimating equations (1) and (2) and testing the null hypothesis that $a_j = \delta_j = 0$ for all j's against the alternative hypothesis that $a_j \neq 0$ and $\delta_j = 0$ for at least some j's. If the coefficients a_j's are statistically significant but δ_j's are not, then Y is said to have been caused by X. The reverse causality holds if δ_j's are statistically significant while a_j's are not. If both a_j and β_j are significant, then causality runs both way.

The stationarity properties of the series are not taken into consideration in the standard Granger causality test which may report one-way, or two-way causality or no causality. However, if the variables are cointegrated,

the modified Granger causality test rules out the possibility of no causality when the variables share a common trend. The estimation of the Granger causality test involves three steps. Step I includes the identification of the order of integration of the variables under consideration. Cointegration is determined through the Engle-Granger two-step method (Engle and Granger, 1987) in step II. In step III, we proceed with the standard Granger causality test if the variables are not cointegrated. However, if the variables are cointegrated, the residuals obtained from the cointegrating regressions are used as error-correction terms in estimating the modified Granger causality equations.

3.2.1 Testing for the Order of Integration

The first step consists of determining the order of integration of the variables under consideration. This is done by using the Augmented Dickey- Fuller (ADF) test (Dickey and Fuller, 1981) as follows:

$$\Delta Q_t = \phi_0 + \phi_1 t + \gamma_0 Q_{t-1} + \sum_{i=1}^{n} \psi_t \Delta Q_{t-1} + \varepsilon_t \quad (3)$$

In the above equations, Wt is a random walk with drift around a stochastic trend, $\varepsilon_t$is the first difference operator, is the white noise error term. The null hypothesis that W is a nonstationary time series is rejected if γ_0 is less than zero and statistically significant. The ADF test is carried out by replacing Q_t withGDP$_t$, PD$_t$ in equation (3) respectively.

Table 1: Test for Integration

Variable	ADF		Phillips-Perron	
	Level	First Difference	Level	First Difference
lngdp	-1.421	-11.089*	-2.648	-10.520*
lntpd	-0.894	-5.818*	-2.493	-5.844*

Note: * denotes the rejection of the null hypothesis at the 1% level.

Table 1 shows that the time series are non stationary i.e. I(0) at their levels, while first difference makes them stationary. That is each of the considered time series are integrated of order 1, I(1). Since all of the series are integrated of the same order, the series may be tested for the existence of a long-run relationship between them. Thus, cointegration analysis can be applied to the selected variables in the present analysis as all the series are found to be stationary in first differences.

3.2.2 Cointegration Test

Cointegration is the statistical implication of the existence of a long-run relationship between economic variables (Thomas, 1993). In other words, a long-run relationship means that the variables move together over time so that any short-run deviations from the long-run trend will be corrected (Manning and Andrianacos, 1993). The central idea behind cointegration is that if, in the long-run, two or more series move closely together, even though the series themselves are trended, the difference between them is constant. It is possible to regard these series as defining a long-run equilibrium relationship, as the difference between them is stationary (Hall and Henry, 1989). A lack of cointegration suggests that such variables have no long-run relationship and they can wander arbitrarily far away from each other (Dickey et. al., 1991).

Since both variables are I(1), then it is necessary to set out cointegration tests to determine whether there exist a stable long run relationship between the variables. Thus the second step involves searching for cointegration between variables. This can be understood from the graphical representation of the two series and to see whether they have any common stochastic trend and can be tested either by Engle-Granger two step cointegration procedures or by Johansen-Juselius cointegration technique. We relied on Engle and Granger (1987) two-step procedure due to the limited data points.

In the first step, the following equation is estimated by OLS:

$$Y_t = \beta_0 + \beta_1 X_t + U_t \qquad \text{.....(4)}$$

In the second step, ADF and PP tests are applied on the residuals obtained from (6), which indicate that the residuals are stationary and hence public debt and economic growth are cointegrated i.e. there exists a long run equilibrium relationship between the two variables (Table 2). According to the Granger representation theorem [Engle and Granger (1987)], a system of cointegrated variables has an error-correction representation that combines the short run dynamics of the variables with their long run properties as implied by the cointegrating relationship. Consequently, error-correction models (ECM) are estimated to determine the direction of causality between public debt and economic growth.

Table 2: Test for Cointegration

Cointegrating Equation	Constant	Coefficient of Independent Variable	Adjusted R-squared	ADF test	PP test
$Y_t = \beta_0 + \beta_1 X_t + U_t$					
	-7.34	1.45	0.87	2.97**	-3.44*
	(-4.97)	(-10.06)			
$X_t = \beta_0 + \beta_1 Y_t + U_t$	6.45	0.58	0.88	3.12**	-4.06*
	(-5.87)	(-11.23)			

* indicates significance at 1% level.

** indicates significance at 5% level.

3.2.3 The Modified Granger Causality Test

As the variables turn out to be cointegrated, the standard Granger causality test is modified by incorporating the error correction terms obtained from the cointegrating regressions as follows:

$$\Delta Y_t = \beta_0 + \rho_1 \eta_{t-1} + \sum_{i=1}^{m} \beta_i \Delta Y_{t-i} + \sum_{j=1}^{n} a_j \Delta X_{t-j} + u_t \quad (5)$$

$$\Delta X_t = \gamma_0 + \rho_2 \mu_{t-1} + \sum_{i=1}^{m} \gamma_i \Delta X_{t-i} + \sum_{j=1}^{n} \delta_j \Delta Y_{t-j} + v_t \quad (6)$$

where all variables are stationary time series, is the first difference operator and and are the error correction terms which represents the lagged residuals from the cointegrating equations, m and n are the lag lengths chosen by the Akaike Information Criterion (AIC) and and are the disturbance terms. X is said to Granger- cause Y not only if 's are jointly significant but also if is significant. Similarly, Y is said to Granger- cause X not only if 's are jointly significant but also if is significant.

Table 3: Causality Results Based on Error-Correction Models

Direction of Causation	No. of Lags Used	EC Term: t-statistic	F-statistic
Total public debt to GDP	3	-2.12*	1.52
GDP to Total public debt	3	-2.49*	0.29

* indicates significance at 1% level.

Table 3 reports the results of Granger causality tests based on error correction models. Column 2 indicates the number of lags in the ECMS, chosen on the basis of Akaike's information criteria, column 3 provides the t-statistics for the error-correction terms, while column 4 contains the F-statistics for the joint significance of the lagged independent variables in the causality equations. The statistical significance of the co-efficient of the error-correction term and the F-statistic is used to detect the presence of long-run and short-run causality respectively. The test result does not detect the short-run causality in either direction. However, there is strong support for long-run bidirectional causality between public debt and economic growth. The absence of short-run causality seems to suggest that short-run variations in openness and growth rates may be dominated by business cycle fluctuations with no clear causal pattern in the short run (Din et.al. 2003). However, the presence of bidirectional causality indicates that both debt and economic growth reinforce each other in the long run. The implication of the result is that the greater the amount of debt the higher is the economic growth, which arises from the fact that debt increases the economy's capacity, competition, specialization and economies of scale, and to productivity improvements made possible by access to advanced technologies. This result seems plausible it is in line with both the theoretical and empirical evidence.

4.0 Summary and Conclusions

Government borrowings occupy the central place among different means for accelerating economic growth in the resource scarce less developed economies. In the initial years of independence Bangladesh adopted cautious strategies of borrowings from internal and external sources under restricted economic framework. However, the bitter experience of such policies in promoting economic growth lead the economy moved towards greater borrowings under liberalized economic atmosphere. The objective of this study, therefore, has been to empirically examine the relationship between public debt and economic growth in Bangladesh for the long span of time from 1974-2014. The time series econometric technique has been applied to determine the direction of causation between debt and economic growth. First, the stationarity properties of the time series data have been checked by the Augmented Dickey Fuller test and Phillip-Parron tests. The test results confirm that both nominal GDP and total public debt are non-stationary processes that are integrated of order 1. Furthermore, there is evidence of a long-run equilibrium

relationship between total public debt and economic growth form the Engel-Granger two steps procedure of cointegration test. An error-correction model is estimated to investigate the short-run dynamics of the long-run relationship between the variables. The results indicate the absence of causality between pubic debt and economic growth in the short run. This suggests that short-run variations in public debt and growth rates may be dominated by business cycle fluctuations with no clear causal pattern in the short run. However, the evidence of bidirectional causality between public debt and economic growth in the long-run indicates that both public debt and economic growth reinforce each other in a longer term perspective.

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