Volume-7, Issue-1, January-June, 2018
PP. 74-92

The Debt-Public Investment and Export Relationship in Bangladesh: A VECM Approach

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Abstract

We empirically examine the dynamic causal relationship between total debt, public investment and export in Bangladesh during the period of 1981 to 2015. We specifically investigate the impact of accelerating total debt on public investment. Considering the significance of export performance in Bangladesh, we also examine the debt export causality. A Granger causality based Vector Error Correction Model (VECM) is employed to examine the existence of causality among the variables. The results reveal no causality evidence, running from total debt and export to public investment in the long run. However, there exists a uni directional causality both from export and public investment to total debt in the long run. Similar to the long run, total debt and export have no impact on public investment in the short run as well. Therefore, our results suggest that total debt has no positive impact on public investment, neither in the short run nor in the long run in Bangladesh.

Key Words: Debt, Public Investment, Trivariate Causality, Cointegration, VECM

JEL Classification: C22, C87, E22, H63

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Views expressed in this paper are author's own and not necessarily reflect the views of Jagannath University.

1. INTRODUCTION

In recent years, the issue of debt oriented development policies in low income countries gained enormous attention, particularly for its hikes contribution to development fund. As the countries primarily look into the growth led economic development, they demand development fund to finance infrastructural development, import of machineries, and technological knowhow. Farhana and Chowdhury, (2014) argued that the capital-scarce developing countries mainly borrow to accelerate their economic growth by relaxing their macroeconomic financial constraint, which allow them to finance for higher investment and higher consumption of education and health services. Moreover, the frequent acceleration of budget deficit in the developing countries is also an important reason to articulate debt demand from both internal and external sources. Therefore, the study relating to the existence of causal relationship of debt to investment, export earnings or economic growth has been subjected by many researchers over the years. However, the existing empirical and theoretical studies examining the contribution of debt to economic growth have provided diverse results. The study by Korokmaz (2015) found a uni-directional causality running from economic growth to debt in Turkey. Analyzing Ethiopian economy, Kassa (2015) found an opposite uni-directional causality from external debt to economic growth. On the other hand, while Presbitero (2006) and Azeezet al., (2015) found a negative relationship between debt and the growth of investment, Ogunmuyiwa (2002) found the relationship to be ambiguous.

After its inception in 1971, the economy of Bangladesh relied heavily on external debt. The present scenario of debt outstanding is no less spectacular and the debt service burden, due to the overwhelming growth of debt inflows, has now become a serious concern, especially in the quest of achieving inclusive economic growth. Theoretically, the capacity of debt service payment, widely known as debt sustainability, literally relies on efficient debt management, as it contributes to accelerate investment and income generating activities over the economy. According to the World Bank (2012), the external debt is not translated into an increased debt burden when the extent of the rate of growth of income and export earnings outpaces the accumulation of new external obligations. For Bangladesh, the question may arises regarding the debt service payment scenario. The official statistics of Economic Relation Division of Bangladesh shows the unprecedented growth of debt service payment in every fiscal year. The rising debt service payment, however, can be explained as the inefficient utilization of debt. This inefficient utilization acted as a barrier to generate sufficient productivity growth, which

would have helped Bangladesh to lower the physical amount of debt and its corresponding interest payment compared to consecutive previous year. Paradoxically, the success of debt, as the relevant literature argue, is not literally significant in the case of developing countries as the countries are marked with poor institutional management, high depreciation of public capital and corruption. For example, in Bangladesh, without any inclusion of development project, the actual figure of debt increase traumatically as the real cost of development project rises due to the bad debt management.

In this backdrop, the study attempts to measure the efficiency of total debt that has been received by Bangladesh from both internal and external sources. In doing so, the paper investigates the causality between total debt and public investment, by incorporating export as a third variable, which might have a serious effect on the causality between debt and public investment in Bangladesh. The question may arise regarding the rationality of selecting the variables like public investment and export to link up with total debt. The answer stands on the importance of these variables that can influence to make changes the total debt in the developing economy like Bangladesh. For instance, the total debt stock in the developing countries theoretically has made up a link to public expenditure, as major portion of debt calculated in a given year has been received by the government. According to the World Bank statistics (2012), the publicly guaranteed stock of debt in the developing countries at the end of 2012 accounts for 54 Percent, whereas 46 percent of their total debt owed to private non-guaranteed borrowers. Siddique et al., (2015) argued that if such inflow of external debt does not raise the income generating and productive activities, that might lower the ability of debtor nation to repay the loan. In this backdrop, the contribution of publicly made investment to the generation of capital and much needed productivity growth should be significant. On the contrary, the trend of public investment in Bangladesh vis-à-vis total debt, as depicted in table-I, does not show any encouraging scenario. Against the steady growth of total debt, public investment has been hovering around 5 to 6 percent since the 1980's.

The paper has intended to find a causal link between total debt and public investment in the context of Bangladesh by investigating whether debt causes public investment or vice versa. Furthermore, the paper includes export as a third variable by considering its importance to the changes of debt volume and its effects on the creation of much vaunted public investment. Theoretically, total debt indirectly causes export as the acceleration of public investment increases the export oriented activities in the country. On the contrary, in the context of Bangladesh, export earnings can be a major source for

debt retirement. Hence, the exports also can immensely affect to the changes of debt volume in Bangladesh. Thus, the omission of export may cause some serious specification bias in the estimation of causal relationship between debt and public investment in Bangladesh.

TABLE-I

TRENDS OF PUBLIC INVESTMENT, EXPORTAND TOTAL DEBT IN BANGLADESH

Year	Public Investment (% of GDP)	Export (% of GDP)	Total debt (% of GDP)
1981	5.2	4.1	32.17
198	4.5	4.5	37.02
1990	7.2	5.0	40.11
1995	6.7	9.1	51.80
2000	7.4	12.2	50.12
2005	6.2	14.4	51.87
2010	4.67	14.1	40.00
2015	6.90	15.8	35.10
2016	6.66	15.5	34.30
2017	7.41	14.0	30.80

Source: 1) Bangladesh Economy: Recent Macroeconomic Trend, Ministry of Finance
2) Bangladesh Economic Review (Various Issues), Ministry of Finance
3) Medium Term Budgetary Framework, 2010-11 to 2012-13, Ministry of Finance
4) Medium Term Macroeconomic Policy StatementFY15-16, Ministry of Finance

In light of the discussion above, the main contribution of this study is to find the causal relationship between total debt and public investment in Bangladesh. The study has also employed export as a third variable, as stated above, by considering its importance on the estimation of causality between debt and public investment. It is necessary to mention that although the topic has been empirically analyzed in a large a number of studies focusing many other countries, Bangladesh specific studies are very limited. Among these limited studies most of these (Rahman, et al., 2012; Farhana and Chowdhury, 2014; Hasan and Akter, 2013) analyzed the debt-growth relationship in Bangladesh using a bi-variate causality framework.

On the other hand, the present study uses tri-variate causality framework to achieve the objectives. Unit root test is done by using Augmented Dickey Fuller test to examine the time series properties of the variables. The Johansen Juselius cointegration test has been applied to test whether long run equilibrium exist among the considered variables. Finally, the paper adopts Vector Error Correction Model (VECM) to detect both short run and long run dynamics amongst the variables.

The rest of the paper is organized as follows. Following introduction, section 2 provides a brief literature review. Data, methodological aspects and estimation techniques of the study are discussed in section 3. The results of our estimation are discussed in section 4, while section 5 draws the conclusion.

2. LITERATURE REVIEW

Many empirical works have subjected debt to link it to other core macroeconomic variables like economic growth, investment, imports and exports for a number of countries. Most of these empirical studies investigated the debt growth relationship using a bi-variate causality analysis framework. However, the present study methodologically differs from existing literature, as it investigated the relationship among debt, public investment and export in Bangladesh using a trivariate causality analysis framework. This section intends to survey the literature focusing both on Bangladesh and on other countries, by addressing the subject.

In Bangladesh, most of the studies investigated the debt-growth relationship by using a bi-variate causality test. Rahman et al., (2012) examined the debt growth relationship in Bangladesh for the period 1972 to 2010. By using Granger causality test they found bi-directional causality between these two variables. Farhana and Chowdhury (2014) used ARDL bound testing approach to investigate the impact of foreign debt on growth in Bangladesh during 1972 to 2010, and found adverse relationship between debt and growth. Shah and Pervin (2012) investigated the debt growth relationship in Bangladesh and found a strong long run negative effect of public debt service to growth but positive effect of public debt stock to growth. Islam and Faisal (2012) have expressed concerns for the future debt sustainability in Bangladesh without hampering the productivity growth, as too much debt service payment would cost the much needy social sector expenditure. Zaman et al.,(2012), in contrast, eyed differently on the external debt performance as they tried to find relationship of external debt with the military

expenditure in Bangladesh. They found a bi directional causality between debt and growth but unidirectional causality from military expenditure to external debt.

In the same vein, despite a large number of empirical and theoretical researches have subjected debt growth relationship, the studies on debt investment relationship have been found very infrequent in the global perspective as well. Saad (2012) investigated trivariate causality between debt, export and economic growth for Lebanon over the period 1970 to 2010. By using VECM model, the author found bidirectional Granger causality between growth and external debt and unidirectional causality running from external debt to export both in short run and long run. Atique and Malik (2012) examined the impact of debt on economic growth in Pakistan and found that both domestic and external debt is inversely related to economic growth. On the other hand, Azeez et al., (2015), Ogunmuyiwa (2011), Akujuobi and Chima (2012), and Olusegun et al., (2013) examined the performance of debt over the Nigerian economy. Azeez et al., (2015) found that both external debt and FDI is negatively related to economic growth, but the external debt is not significant. By using Johansen cointegration test and Vector Error Correction Model (VECM), Ogunmuyiwa (2011) found no causality between external debt and economic growth in Nigeria. Olusegun et al., (2013) concluded that external debt is mounting the pressure on the various sectors in Nigerian economy; therefore, recommend to be more conscious in taking debt and its appropriate utilization. Ismihan, et al., (2013) studied the cointegration between debt and economic growth in Turkey and found that excessive borrowing and macroeconomic instability are harmful for both financial development and economic growth. On the other hand, Korokmaz (2015) found unidirectional causality running from external debt to economic growth for Turkish economy.

Kassa (2014) used Autoregressive Distributive Lag Model (ARDLM) to explore the relationship between external debt and economic growth for Ethiopia over the period 1970-71 to 2010-11. He revealed that the external debt has negative effect on causing economic growth in Ethiopia. Using data for the period of 1990 to 2010, Kasidi and Said (2013) explored trivariate causality and found that there is no long run relationship between external debt and GDP. In short run, debt stock has a positive impact, while debt service payment has a negative impact on GDP. Pyeman, et al., (2016) found that both FDI and GDP growth are inversely related to the external debt in Malaysian economy.

Ahmed, et al., (2000) used Granger causality three step procedures to find the causality between export, growth and external debt for Asian countries. Under the tri-variate causality framework, they concluded that the regular repayment of external debt services stemmed the growth performance and thus lowered their export revenue. Turner and Spinelli (2013) used panel analysis to estimate the effect of government debt, external debt and their interaction in the interest rate growth differential for OECD countries. The results posit that the interest-rate effect of marginal increases in external debt or government debt is positive and non-linear. On the other hand, Checherita and Rother, 2010 found a non-linear debt growth relationship in twelve euro countries where the government debt GDP ratio has a deleterious impact on long term growth.

3. DATA AND METHODOLOGY

3.1: Data

The study uses annual time series data of Public Investment (PBI), Export (EX) and Total Debt (TD) in Bangladesh for the period of 1981 to 2015. The data set for this research has been taken from Ministry of Finance, Government of the Peoples Republic of Bangladesh[1]. All the variables of the study have been converted into the logarithmic form. The data for all the variables has been measured as a percentage of GDP.

3.2: Model Specification

3.2.1: Granger Causality Test

The granger causality test is used to find the direction of causality between the two variables like X and Y. The test is based on the idea that future cannot predict past. Given this context, the granger causality test says that if X causes Y then changes in X should precede changes in Y (Gujrati, 2005). Thus, the test assumes that the variable Y would be explained better by the present and past values of X rather than the past values of Y alone. For the Granger causality test, the paper progresses by the following

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[1] Data of Public Investment (PI), Export (EX) and Total Debt (TD) for the period of 1981-2008 has been taken from the Bangladesh Economy: Recent Macroeconomic Trend, Ministry of Finance.

Data of Public Investment (PI), and Export (EX) for the period 2009-2015 has been taken from the Bangladesh Economic Review (Various Issues), Ministry of Finance

Total Debt (TD) Data for the period 2009-2015 has been taken from the Medium Term Budgetary Framework, 2010-11 to 2012-13, Ministry of Finance; and Medium Term Macroeconomic Policy StatementFY16-FY16, Ministry of Finance.

procedure. First, to conduct Granger causality the variables must be cointegrated or there must be long run association between the variables. Second, for such long run dynamism, the variables require for stationary test in which the variables must be non-stationary at level and stationary at their first difference. In this study, the test for the order of integration is done by using Augmented Dickey Fuller (ADF) test statistics while cointegration test of the variables is conducted by Johansen Juselius cointegration test. The bivariate causality between debt and investment can be expresses as following regression:

$$Y_t = \alpha_0 + \sum_{t-i}^{m} \alpha_i \, Y_{t-1} + \sum_{t-i}^{n} b_i \, X_{t-1} + \eta_{it} \qquad (1)$$

$$X_t = \gamma_1 + \sum_{t-i}^{m} \beta_i \, X_{t-1} + \sum_{t-i}^{n} \lambda_i \, Y_{t-1} + \phi_{it} \qquad (2)$$

In the above equations, η and ϕ are the white noise error terms where both are assumed stationary and both m and n specified in the equations are the number of lags. The hypothesis as the Granger causality argues whether Y causes X or X causes Y has been formulated in the above equations. Equation (1) represents the present value of variable Y is related to past values of itself and also the past value of X while in equation (2), the current value of X is related to the past value of itself and the past value of Y.

In the bivariate analysis, to find the outcomes whether X causes Y, the null hypothesis which can be set as X does not Granger cause Y has to be rejected, and the vice versa for Y to X. The calculated F statistic is hereby has to be significant at the conventional level. The F statistics for this bivariate causality can be calculated as follows:

$$F = \frac{RSS_R - RSS_{UR}/m}{RSS_{UR}/(n-k)} \qquad (3)$$

The equation follows F distribution with m and (n-k) df where m is the number of lagged M terms and k is number of parameters estimated in unrestricted regression. The restricted residual sum of squares (RSS_R) requires to regress the current X to all lagged X and Y values for X to Y without including the lagged M variables in the regression while for RSS_{UR} the function includes the lagged M terms. However, on the basis of the hypothesis between the computed and calculated F values, the Granger causality can specifies the following cases:

(i) Unidirectional causality from X to Y. In this case, X causes Y if H_0: $b_i = 0$, is rejected and H_0: $\lambda i = 0$ is not rejected, where i=1,…n

(ii) Unidirectional causality from Y to X. i.e. Y causes X if H_0: $\lambda i = 0$ is rejected while H_0: $b_i = 0$ is not rejected, where i= 1….n.

(iii) Bidirectional causality will occur if both (i) and (ii) hold.

(iv) Independence is another commonly seen case when neither (i) nor (ii) will hold.

Moreover, there are some technical assumptions that need to consider conducting the Granger causality test. First, the Granger causality test assumes that the two variables X and Y are stationary. Stationarity is important because the non-stationarity of the variable would make the OLS estimation biased and inconsistent. Second, the researcher should seriously look into the usage of a number of lagged terms in the test because the direction of causality in the Granger causality test depends largely on the number of lagged terms included in the model. Third, the test assumes that error terms included in the model should be serially uncorrelated. Meanwhile, this study uses the Akaika Information Criteria (AIC) to make choice in the selection of optimal lag length for the model.

3.2.2: Unit Root Test

As the econometric wisdom argues, the variables used in the model should be stationary for both cointegration and causality between the variables. In this backdrop, the unit root test is used to examine the time series properties of the variables. Amongst some, in this study, the test has been done by the widely recognized Augmented Dickey Fuller (ADF) test. The ADF test is hereby consist of estimating the following regression:

$$\Delta Y_t = \beta_1 + \beta_2 t + \partial Y_{t-1} + \alpha_i \sum_{i=1}^{m} \Delta Y_{t-i} + \varepsilon_t \quad (4)$$

In the regression model, $\Delta Y_t = Y_t - Y_{t-1}$ and Y is number of variable under consideration and ε_t is the white noise error term. The number of lagged difference m is chosen by Schwartz Information Criteria (SIC). In ADF, the null hypothesis is $\alpha = 0$, where, the rejection of null hypothesis would imply that the variable has no unit root or the variable is stationary. On the other hand, if the null hypothesis is not rejected at level, the test requires the first difference of the variable to make it stationary.

3.2.3: Cointegration Test and the Error Correction Model

The existence of long run relationship amongst the variables is a precondition for Granger causality test. Hence, by the cointegration test, the paper determines the linear

combination of the variables at the same order, *i.e.*, whether there exists a stable and non-spurious relationship among the variables. Amongst some, the paper uses the widely recognized Johansen-Juselius technique (1988) for the cointegration test.

According to the Johansen-Juselius system based method, two test statistics are used to identify the number of cointegrating vectors like the trace statistics and the Maximum Eigen value test statistic.

$$\lambda_{trace} = T \sum_{i=r+1}^{N} ln(1-\lambda_i) \qquad (5)$$

$$\lambda_{max} = - T \ln (1-\lambda_{r+1}) \qquad (6)$$

Here, T is the number of observation and λ_i's are the N-r smallest canonical correlation. The trace statistics test the null hypothesis that the number of cointegrating vectors is equal or less than r against the alternative hypothesis of N cointegrating vectors. On the other hand, the Maximum Eigen value test checks the null hypothesis of r cointegrating vectors against the alternative hypothesis of r+1 cointegrating vectors. The null hypotheses under these two equations, as shown by the (Johansen-Juselius, 1988) have non-standard distributions and produce approximate critical values for the statistic by Monte Carlo methods.

When cointegration is detected, despite it allows for long run equilibrium among variables, however, in short run, the case may be different. Therefore, by using Vector Error Correction Model (VECM), the paper intends to find out the short run dynamics of the variables within a long run relationship. It also determines the direction of causality. However, an extension of standard Granger test (1969) adjusted with an error correction term can be specified as follows for the trivariate causality test:

$$\Delta Y_t = \beta_{10} + \sum_{i=1}^{k} \beta_{11i} \Delta Y_{t-i} + \sum_{i=1}^{k} \beta_{12i} \Delta X_{t-i} + \sum_{i=1}^{k} \beta_{13i} \Delta Z_{t-I} + \beta_{14} R1_{t-1} + u_{1t} \qquad (7)$$

$$\Delta X_t = \beta_{20} + \sum_{i=1}^{k} \beta_{21i} \Delta X_{t-i} + \sum_{i=1}^{k} \beta_{22i} \Delta Y_{t-i} + \sum_{i=1}^{k} \beta_{23i} \Delta Z_{t-i} + \beta_{24} R2_{t-1} + u_{2t} \qquad (8)$$

$$\Delta Z_t = \beta_{30} + \sum_{i=1}^{k} \beta_{31i} \Delta Z_{t-i} + \sum_{i=1}^{k} \beta_{32i} \Delta Y_{t-i} + \sum_{i=1}^{k} \beta_{33i} \Delta X_{t-i} + \beta_{34} R3_{t-1} + u_{3t} \qquad (9)$$

Here, Y_t, X_t and Z_t represents Public Investment (PBI), Export (EX) and Total Debt (TD) in Bangladesh. β's and Δ represent parameters and the difference operator while u_{1t}, u_{2t} and u_{3t} are white noise error terms. $R1_{t-1}$, $R2_{t-1}$ and $R3_{t-1}$ are the error correction term derived from the long run cointegration equation. In this test, the short run causal effects have been determined by Chi-square statistics which is obtained by estimating

the Wald test. On the other hand, long run causality is captured on the basis of the significance of t-statistics on the coefficient of lagged error terms. According to the vector error correction model, in the long run, export and total debt will cause public investment if $\beta_{14}=0$ is rejected when $\beta_{24}= \beta_{34}=0$ is not rejected. Similarly, public investment and total debt will cause export if $\beta_{24}=0$ is rejected and $\beta_{14}= \beta_{34}=0$ is not rejected. Likewise, export and public investment will cause total debt when $\beta_{34}=0$ is rejected and $\beta_{14}= \beta_{24}=0$ is not rejected.

For the short run Granger causality, export and total debt will lead to public investment when all values of β_{12i}'s and β_{13i}'s are not equal to zero. Accordingly, Y_t will cause X_t if all values of β_{22i}'s=0 is rejected and Zt will cause Xt when all values of β_{23i}'s =0 is rejected. Similarly, when β_{32i}'s and β_{33i}'s =0 is not true, then both export and public investment will cause total debt.

4. EMPIRICAL RESULT

The causality test procedure as theorized in the previous section tells that the time series should be cointegrated. Therefore, the paper uses Johansen-Juselius cointegration test method to detect the cointegration among the variables. It is necessary to mention here that the Johansen-Juselius cointegration technique, as depicted in the previous section, requires that the variables must be non stationary at level and they become stationary after the first difference. Therefore, prior to cointegration test the order of integration of the time series under consideration is important. In this back drop, this section examines the time series and presents their empirical result. At first, the variables are tested whether they have unit root or not on the basis of Augmented Dickey Fuller (ADF) test. The tests have done to original series and also to their first difference.

TABLE - II

UNIT ROOT TEST (ADF) FOR THE TIME PERIOD 1981-2015

With Intercept				
Series at Level			First Difference	
Variables	Test Statistic	Probability	Test Statistics	Probability
LN PBI	-1.494923 (0) **	0.5241	-4.282775(0) **	0.0019
LN EX	-1.111152 (0) **	0.7000	-6.075946(0) **	0.0000
LN TD	-1.367183 (1) **	0.5861	-5.115193(0) **	0.0002

With Trend and Intercept

	Series at Level		First Difference	
Variables	Test Statistic	Probability	Test Statistics	Probability
LN PBI	-2.106781(1) **	0.5232	-4.215208(0) **	0.0112
LN EX	-1.209083(0) **	0.8926	-6.164683(0) **	0.0001
LN TD	-0.198908(4) **	0.9900	-3.797459(3) **	0.0308

Note: i) ** indicates significance at the 5% level.
ii) Figures in the parentheses represent the optimal lag length

According to the Augmented Dickey Fuller (ADF) test statistics, the null hypothesis of the variables cannot be rejected at levels and at any level of significance. It would also suggest that when we convert the variables into the first difference, the null hypothesis must be rejected which would imply the variables are integrated of order 1. Hence, the variables LN PBI, LN EX and LN TD are non-stationary at levels in the models of both intercept but no trend and with trend and intercept. At the same time, the probability of the test statistics also suggests that the variables have become stationary after their first difference.

The unit root test shows that the variables are stationary at the first difference. Now, the paper would examine whether there exist a long run associationship between the variables. The paper hereby uses the Johansen-Juselius cointegration approach to detect cointegrating vectors among the variables.

TABLE -III

JOHANSEN JUSELIUS TEST OF COINTEGRATION

Data Vector	Null Hypothesis	λ Trace	Probability	λ Max	Probability
LN PBI,	None	44.08936 **	0.0006	29.96817 **	0.0022
LN EX	At most 1	14.12119	0.0797	12.88234	0.0817
LN TD	At most 2	1.238844	0.2657	1.238844	0.2657

Note - i): Test assumption includes linear deterministic trend in the series
ii): Optimal lag is 5 determined by Akaika Information Criteria (AIC)
ii): ** indicates significant at the 5% level

Table III represents the result of Johansen Juselius cointegration test. In the table, the trace statistics and the maximum Eigen-value statistics are presented to determine the cointegration rank. The results of Trace statistics and maximum Eigen-value statistics reveal that there is one cointegrating vector at 0.05 levels. Hence, the result indicates that there exist a stable long run relationship between total debt, public investment and export in Bangladesh.

TABLE-IV

NOMALIZED COINTGERATING COEFFICIENTS

Co Integrating equations	Cointegrating equation 1	Standard Error	T- Statistics
LN PBI	1.000000		
LNEX	-0.074916	0.03883	-1.92933299
LNTD	-1.103030	0.21242	-5.1926843047

Log Likelihood: 143.4931

As per the table-IV, the results are normalized on PBI. According to the result, both Export (EX) and Total Debt (TD) have expected signs and are statistically significant. As stated by Maggiora and Skerman (2009), the signs are reversed in case of interpretation due to the normalization process. Hence, in the above table, both EX and TD are positively related to PBI. More specifically, 1% increase in each of export and total debt causes 7% and 10% increase in public investment in Bangladesh in the long run.

As all the variables under consideration are cointegrated, now the paper should perform the causality test to detect the nature and the direction of causality among the variables in the tri-variate analysis. The multivariate Granger causality technique has been applied in this regard. Moreover, the paper also performs Vector Error Correction Model (VECM) in order to estimate the short run and long run behavior of the relationship. Under the VECM, the coefficient of the error correction term which is also known as speed of adjustment indicates the long run equilibrium relationship among the cointegrated variables.

TABLE-V

VECTOR ERROR CORRECTION MODEL

LONG RUN CAUSALITY AND SPEED OF ADJUSTMENT

Dependent Variable	Coefficient ECT_{t-1}	T- Statistics	Probability
ΔLN PBI	0.649965	1.233391	0.2410
ΔLNEX	-0.108226	-2.244400	0.0444
ΔLNTD	-0.815054	-2.872834	0.0140

Table-V shows the coefficients of error correction terms for the dependent variables. The coefficient of error correction terms determines the long run causality and the speed of adjustment of the model toward the long run equilibrium. According to the result, the error correction term when ΔLN PBI is dependent variable, is not significant as the coefficient of error correction term is positive and the probability value of T- statistics is more than 5%. This implies that there is no long run causality running from export and total debt to public investment in Bangladesh. On the other hand, the error correction terms for the dependent variables ΔLNEX and ΔLNTD are significant and confirms the long run causality from public investment and total debt to export and public investment and export to total debt in Bangladesh. The speed of adjustment for these two dependent variables shows about 10% and 81% disequilibrium of previous year is corrected in the current year.

TABLE-VI

THE VECM GRANGER CAUSALITY TEST

Dependent variable: ΔLNPBI

Independent Variable	Chi-Square	df	P value
ΔLNEX	5.280543	5	0.3826
ΔLNTD	1.584208	5	0.9032
		Dependent Variable: ΔLNEX	
ΔLNPBI	7.703785	5	0.1733
ΔLNTD	4.184761	5	0.5231
		Dependent Variable: ΔLNTD	
ΔLNPBI	20.66426	5	0.0009
ΔLNEX	14.94873	5	0.0106

Table-VI shows the short run causality result which is found by Wald test statistics under the VECM model. According to the result, as like the result of long run causality, export

and total debt have found no causal effects on public investment in the short run as well. On the other hand, the results, as depicted in table, found unidirectional causality running from public investment and export to total debt in the short run.

5. CONCLUSIONS

The objective of this study is to empirically examine whether total debt causes public investment in Bangladesh. Furthermore, the paper extends its work with the incorporation of another important variable export. Since a significant part of total debt owed to private borrowers and also government from public debt contributes to promote export oriented activities, the paper also seeks to find out the debt export causality in Bangladesh. The Granger causality and vector error correction models have been applied to obtain the stochastic properties of the variables. Empirical results show that there is no short run causality running from total debt to public investment and export in Bangladesh. The results are little different in long run. Because, in the long run, although there is no causality running from total debt and export to public investment but there is unidirectional causal flow running from total debt and public investment to export.

The findings, stated above, suggest that debt is not public investment stimulating for Bangladesh. Since debt is insignificantly related to public investment, as the paper tells, it may create debt overhang in the long run. As argued by Islam and Biswas (2005) that high public debt leads to high taxes and puts upward pressure on real interest rates which may crowed out private investment. Hence, in Bangladesh if the debt inflow continues, the burden for accelerated interest payment against the stagnant yield, as the paper concerns, might force the government to increase tax rate in general and reduce the much vaunted government expenditure. In consequences, the outcomes of poor investment and low expenditure on social sector as a whole might impede the general productivity growth and thereby might halt the pace of economic development.

Given this context, with the prudent debt policies, efficient debt management and high sense of accountability, the paper suggests that the government should work immensely on the issue of corruption and nepotism. However, in short, the paper suggests government to lower debt and pay concentration in the creation of efficient human capital and technological knowhow. Because, as the variables have long run association ship, the acceleration of public investment and export, however, would lower the dependency of Bangladesh on the foreign counterparts in the long run.

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Appendices

VECTOR ERROR CORRECTION MODEL WITH ALL COEFFICIENTS AND LAGS

Independent Variable	Coefficient	Standard Error	T-Statistics
CointEq1	0.649965	0.52697	1.23339
D(ΔLN PBI(-1))	-0.542358	0.65859	-0.82352
D(ΔLN PBI(-2))	-0.610916	0.64107	-0.82352
D(ΔLN PBI(-3))	-0.446219	0.59565	-0.74913
D(ΔLN PBI(-4))	-0.835488	0.48710	-1.71524
D(ΔLN PBI(-5))	-0.310244	0.40831	-0.75983
D(ΔLN EX(-1))	-0. 040086	0.19014	-0.21082
D(ΔLN EX(-2))	-0.300048	0.189619	-1.58180
D(ΔLN EX(-3))	-0.298394	0.20576	-1.45022
D(ΔLN EX(-4))	-0.094999	-0.094999	-0.34635
D(ΔLN EX(-5)	0.309214	0.32657	-0.94686
D(ΔLN TD(-1))	0.092568	0.29980	0.30877
D(ΔLN TD(-2))	0.133385	0.29743	0.44847
D(ΔLN TD(-3))	-0.059812	0.37941	-0.15765
D(ΔLN TD(-4))	0.221899	0..34644	0.64052
D(ΔLN TD(-5))	-0.374562	0.34333	-1.09098