An Empirical Investigation of External Debt - Military Expenditure Nexus in Bangladesh

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ABSTRACT
The objective of this paper is to empirically investigate a two-way statistical relationship between the real external debt and real military expenditure in the context of Bangladesh. A time series co-integration and Granger causality tests have been employed from 1980 - 2009 for analysis. The empirical results support the bi-directional causality between the external debt and economic growth, while unidirectional causality runs from military spending to external debt.

KEYWORDS: *Bangladesh, Cointegration, Granger causality, Real Arms import, Real External debt, Real Military expenditure.*

JEL CLASSIFICATION: *H00, C1, C2*

INTRODUCTION

Bangladesh is categorized to be a developing country by the virtue of its economic conditions. Its per-capital income constituted to be lower than that of Pakistan and India in 2008, which stood at US$ 1,500 (Purchasing power parity adjusted) that is even lower than the world average of US$ 10,497. Although Bangladesh has improved its economic conditions quite remarkably since its independence in 1971 and especially in the era of 1990s, still it faces issues in foreign trade and needs to make further drastic improvements on it. Slow paced implementation of economic reforms, insufficient power supplies, rising unemployment and inefficient state owned enterprises constitute the major challenges and barriers to economic growth which require to be overcome. Despite all these impediments, Bangladesh has made remarkable advancements in the development of a favorable climate for foreign investors and has managed to liberalize its capital markets. This is manifested in

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rounds of negotiations which were held with foreign firms to invest in oil and gas exploration, construction of gas pipelines, power stations and distribution of cooking gas nationwide. Advancements on the economic reforms front have been quite slow paced due to the resistance faced by the establishment, public sector associations and other pressure groups. Heavy floods have furthered the dependence of Bangladesh on international aid since 1998 (Masud, 2010).

Bangladesh government is indebted to both domestic and external debt. Domestic debts are procured to finance the budget deficits as well as to facilitate the subsequent cash flow management issues. External debts are obtained from multilateral or unilateral institutions for the funding of annual development programs and budget assistance. In principal short term, medium and long term commitments are fulfilled through domestic borrowing while external borrowing is specifically utilized for long term commitments (Bangladesh Bank, 2008).

International Monetary Fund's (IMF) *Country Report for 1999* registered Bangladesh's external debt at US$15.145 billion which stands at 35 percent of GDP. Past capital account restrictions can be attributed to this relatively small amount as per international standards. One more peculiar trait of Bangladesh's external debt, according to IMF resources is that this debt comprises of almost entirely of public debt, private debt is as low as 5 percent of the total debt.

Since 1970s, various studies have been conducted on the nexus between military spending and economic growth. Pioneer of these studies, Benoit (1973, 1978) examined 44 less developed countries and found a positive correlation between military expenditure and economic growth. Dakurah et al. (2000) in his study concluded that out of 62 less developed countries that he had examined, 13 showed unidirectional causality from military expenditure to growth: 10 countries showed from economic growth to military expenditure: 7 countries demonstrated bidirectional causality and the rest 18 countries exhibited no significant relationship.

The effect of military expenditure on economic growth was also deliberated by Yildirim, Sezgin & Ocal (2005). In this particular study cross-sectional and dynamic panel data estimation techniques were used to examine 12 Middle Eastern countries and Turkey, from 1989 to 1999. It was concluded that military expenditure gave a boost to the economic growth in the Middle Eastern countries and Turkey all together. Hassan et al. (2003) highlighted the relationship between military expenditure and economic growth in context of South Asian Regional Cooperation Council (SAARC) countries. Their study included the five out of seven countries of South Asian Regional Cooperation Council (SAARC). A thorough analysis was carried out to investigate the military expenditure's impact on economic growth and FDI using data from 1980-1990 periods. Results depicted that military expenditure had a positive relationship on the economic growth, which support the idea that increased military expenditure can result in positive economic growth. Mueller and Atesoglu (1993); MacNair *et al.* (1995), Chletsos and Kollias (1995), Sezgin (1999b, 2000) and Yildirim and Sezgin (2002) also found a positive relationship between the military expenditure and economic growth.

Likewise, military spending might also have a negative relationship on economic growth. Their might be a possibility that military spending would reduce the availability of public funds required for more productive spending, this scenario would create increased inflationary pressures. This negative relationship between military expenditure and economic growth in less developed countries was found by Deger (1986). He attributed it to this trait of military expenditure which deducts resources from fruitful investments and fails

to generate and rally additional savings. Similar studies by Deger and Smith (1983), Deger and Sen (1983) and Faini et al. (1984), Antonakis (1997), Heo (1998), Linden (1992), Dunne and Mohammed (1995), Sezgin (1999a) and Dunne, Nikolaidou & Smith (2002) found noteworthy adverse effect of military spending on economic growth.

The study conducted by Chowdhury (1994) used a system of simultaneous equations to inspect the direct, indirect and complete effects of external debt on GNP and vice versa. Panel data from 1970-1988 periods was employed for this study from Asian-pacific countries namely Bangladesh, Indonesia, Malaysia, Philippines, South Korea, Sri Lanka and Thailand. This study found out that there are very insignificant effects of public and private external debts on the GNP level in these countries. Further it is discoursed that debt overhang is the key reason for sluggish economic growth in indebted countries. Investments in productive capability are hindered by the heavy debts. These investments are mandatory to stimulate economic growth. However it is argued that external debt is not the prime reason behind the economic slowdown of these developing countries.

Abu-Bader *et al*. (2003) employed Granger causality framework over a period of 1972-2001 on Egypt, Syria and Israel to conclude that military expenditure had a negative effect on their economic growth. DeRouen (2000) also arrived at the same conclusion in his study for a single country, Israel. Long-run impact of military expenditure on economic growth was examined by Aizenman and Glick (2006) and recommended that military spending provoked by external threats ought to increase growth, whereas military expenditure tempted by rent seeking and corruption ought to diminish growth. Smyth and Narayan (2009) established that external debt is elastic with regard to military expenditure in the long-run whilst inelastic in the short-run. Their study revolved around the six countries of Middle East where they studied the relationship between external debt and military expenditure nexus.

It appears that several studies have been conducted to examine the relationship between external debt - economic growth; and economic growth - military expenditure worldwide, but fewer works have been done in the perspective of relationship between external debt and military expenditure, especially in the context of Bangladesh economy. The above discussion corroborates the existence of a strong linkage between external debt – military expenditure, external debt - economic growth and external debt – arms import in the different panel studies. However, this paper anticipates to add in the existing literature by examining the bivariate co-integration between the above said variables in the context of single country, Bangladesh. Secondary data is being used for the study for the periods 1980-2009.

Specific objectives of this study are:

i. To approximate whether there exist short-run or long-run adjustment effects between real external debt – real military expenditure, real external debt – real arms import and real external debt – real economic growth in Bangladesh.

ii. To understand the statistical relationship between the real external debt – real military expenditure, real external debt – real arms import and real external debt – real economic growth, whether it is uni-directional, bi-directional or causality independent.

This paper is organized as follows: Section 1 above provides the introduction. A brief over view of external debt, military expenditure, arms import and economic growth of Bangladesh economy is presented in Section 2. Data source and methodological framework are analyzed in Section 3. Section 4 presents the empirical results. Final section concludes the study.

1. OVERVIEW OF EXTERNAL DEBT, MILITARY EXPENDTURE, ARMS IMPORT AND ECONOMIC GROWTH IN BANGLADESH

Bangladesh's economy has undergone a variety of stages over the 29 year period (1980-2008) which comprised situations of decreased and elevated external debt which provides with an interesting case study. The data illustrates that external debt of Bangladesh ascended steadily from US $ 7785 million in 1980 to US $ 23644 million in 2008. Whereas, defense expenditure steadily roses from US $ 251 million in 1980 to US $ 767 million in 2008. For the Fiscal year of 1989, Bangladesh allocated US $290 million for defense which stood at 17.2 percent of the national budget and was the biggest item on the budget. Bangladesh spent about 2 percent of its gross national product on defense. This however was small amount compared to international standards for a military establishment of 100,000 personnel. In break up, 15-20 percent of defense budget was allocated for foreign imports while more than 50 percent accounted for running costs which include salaries and training. Overall the military expenditure has increased from US $347 million in 1988 to US $767 million for 2007-08, but the share of the GDP for military expenditure has reduced from 1.4 percent in 1988 to 1.12 percent in 2008 (Bangladesh Bank, 2008).

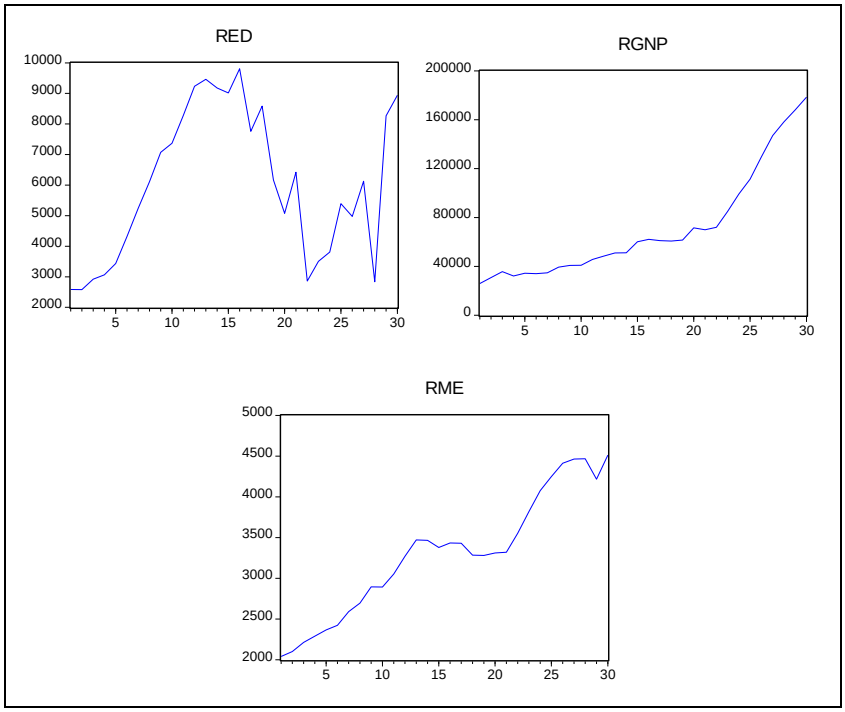

Figure 1. Trend Analysis of Real External Debt, Real GNP and Real Military Expenditures over a period of 1980-2009
Source*:* SIPRI (2010) and World Bank (2010)

The allocations made for arms import steadily declining from US $181 million in 1980 to US $ 10 million in 2008. Arms import as percentage of GDP has shrunk from 1.0 percent in 1988 to 0.014 percent in 2008. Bangladesh has made huge leaps in economic growth since 1990s. Overall progress, since its independence in 1971, has been quite credible especially

in the fields of economic and human development. According to World Bank Report 2008, Bangladesh requires increasing its GDP and sustaining it at 7.5 percent or more, it can very well confirm a spot amongst the middle-income countries (MICs) within a decade (by 2016). The available data exhibits that the economic growth of Bangladesh rose progressively from US $23101 million in 1980 to US $ 68415 million in 2008. Figure 1 depicts the overall trends of the variables over 1980-2009 for ready reference

2. DATA SOURCE AND METHODOLOGICAL FRAMEWORK

Annual observations for the period 1980 to 2009 have been used in this study. The primary focus of attention of this paper is on military expenditure, arms import and economic growth over external debt, taken into context distinctly. The data expressed in real terms, has been accessed through IFS (2010), SIPRI (2010) and World Development Indicators (2010).

A simple non-linear external debt-military expenditure model has been developed which has been specified as follows:

$$\begin{aligned} \log(RED) &= \alpha_1 + \alpha_2 \log(RME) + \mu \\ \log(RED) &= \beta + B_2 \ \log(RARMSM) + \mu \\ \log(RED) &= \gamma_1 + \gamma_2 \log(RGDP) + \mu \end{aligned} \qquad (1)$$

Where,

- RED represents Real External Debt in US $ million,
- RME represents Real Military Expenditures in US $ million,
- RARMSM represents Real Arms Import in US $ million,
- RGDP represents Real Gross Domestic Product at current prices in US $ million.

2.1 Econometric Procedure

The impact of the military expenditure, arms import and economic growth on external debt of Bangladesh's economy has been reviewed through following manners:

- It has been examined whether the time series has a unit root test; an Augmented Dickey-Fuller (ADF) unit root test has been employed for this purpose.
- The existence of a long run relationship among the variables has been investigated by applying the Engle and Granger Co integration test.
- When the variables were established to be co-integrated, an Error–Correction Model (ECM) has been applied to determine the short run dynamics of the system.

2.1.1 Cointegration Test

The use of Cointegration approach was pioneered by Granger (1981) and further expounded by Engle & Granger (1987), Phillips & Ouliaris (1990) and Johansen (1991). Engle & Granger Cointegration test requires that

- Time-series, say Y_t and X_t, are non-stationary in levels but stationary in first differences i.e., $Y_t \sim I(1)$ and $X_t \sim I(1)$.
- There exists a linear combination between these two series that is stationary at levels i.e., $\hat{Y}_t = \hat{\alpha} + \hat{\beta} X_t \sim I(0)$

Thus, the first step for co-integration is to test whether each of the series is stationary or non-stationary. If both are found to be stationary at first difference i.e. they are *I*(1), then we may proceed to the second step to verify the existence of a long run relationship amongst them.

Augmented Dickey Fuller (ADF) test is usually applied to test the stationarity. It tests the null hypothesis that a series (Y_t) is non-stationary by calculating a t-statistics for $\beta = 0$ in the following equation:

Where k = 2, 3, …, n. While α, β, γ and δ are the parameters to be estimated and ε_t is white noise error term.

If the value of the ADF statistic is less than the critical value at the conventional significance level (usually the 5 % significance level) then the series (Y_t) is said to be stationary and vice versa. If Y_t is found to be non-stationary then it should be determined whether Y_t is stationary at first differences $\Delta Y_t \sim I(0)$ by repeating the above procedure. If the first difference of the series is stationary then the series (Y_t) may be concluded as integrated of order one i.e. $Y_t \sim$ I(1).

2.1.2 Error Correction Model (ECM)

The ECM combines both short-term and long-term relationships of variables in one equation. The short-term relations are incorporated by the variables in first differences, whereas the long-term relation is represented by the residuals of the estimated co-integration relationship. The parameter of the long-term relationship 'ρ' defines the rate of adjustment to the new equilibrium. If the long-term relationship is valid then 'ρ' has to be negative, and if a departure from the long-term equilibrium appears, the deviation will be reduced in the next period by the value 'ρ'. The reciprocal ($1/\rho$) indicates the length of time for a complete adjustment, i.e. after ($1/\rho$) periods the deviation from the equilibrium is completely eliminated.

2.1.3 Granger Causality Test

If a pair of series is co-integrated then there must be Granger-causality present in at least one direction, which would reflect the direction of influence between the series. Theoretically, if the current or lagged terms of a time series variables, say X_t, determine another time-series variable, say Y_t, then there exists a Granger-causality relationship between X_t and Y_t, in which Y_t is granger caused by X_t.

Four types of causal relationship between real external debt – real military expenditure; real xternal debt – real arms import and real external debt – real economic growth are possible:

- Real e*xternal debt – driven real military expenditure, real external debt – driven real arms import and real external debt – driven real economic growth:*

unidirectional causality from real external debt –to- real military expenditure, real external debt–to-real arms import and real external debt–to-real economic growth, but not *vice versa.*

- Real m*ilitary expenditure – driven real external debt, real arms import–driven real external debt and real economic growth – driven real external debt:* unidirectional causality from real military expenditure –to- real external debt, real arms import –to- real external debt and real economic growth –to- real external debt, but not *vice versa.*
- *Two-way causality*: unidirectional causality from real external debt–to- real military expenditure, real external debt–to- real arms import and real external debt–to- real economic growth and *vice versa*, which could be interpreted as the existence of a mutually reinforcing bilateral causality amongst them.
- *Independence*: no causality between real external debt–to real -military expenditure; real external debt–to- real arms import and real external debt–to- real economic growth, which could be interpreted as the existence of an independent relationship between them.

3. EMPIRICAL RESULTS

Economic time-series data are often found to be non-stationary, containing a unit root. If an OLS regression is estimated with non-stationary data and residuals, then the regression is spurious. To overcome this problem the data has to be tested for unit root (i.e. whether it is stationary). If both sets of data are I(1), then if the regression produces an I(0) error term, the equation is said to be co-integrated. Therefore, first we need to check the stationarity of all variables i.e. RED, RME, RARMSM and RGDP used in the study. For this purpose we apply Augmented Dickey-Fuller (ADF) test. Table 1 portrays the results of ADF tests.

Table 1. Augmented Dickey Fuller (ADF) Test on the levels and on the First Difference of the Variables (1980-2009)

Variables	Level	First Differences	Mackinnon Critical Values for Rejection of Hypothesis of a Unit Root			Decision
			I %	5 %	10 %	
RED	0.653	-2.042	-2.653	-1.953	-1.609	Non Stationary at level but stationary at first difference, i.e., *I* (1)
RME	1.597	-2.118	-2.653	-1.953	-1.609	Non Stationary at level but stationary at first difference i.e., *I* (1)
RARMSM	0.889	-4.028	-2.653	-1.953	-1.609	Non Stationary at level but stationary at first difference i.e., *I* (1)
RGDP	-0.498	-2.482	-2.653	-1.953	-1.609	Non Stationary at level but stationary at first difference i.e., *I* (1)

Note: The null hypothesis is that the series is non-stationary, or contains a unit root. The rejection of the null hypothesis is based on MacKinnon (1996) critical values. The lag length are selected based on SIC criteria, this ranges from lag zero to lag two. Source: calculated by the authors.

The results of Table 1 depict that all variables appear to be non-stationary at levels but stationary at first difference. Thus, we may conclude that these variables are integrated of order one i.e. *I* (1). The co-integration test between real external debt – real military expenditure, real external debt – real arms import and real external debt – real economic growth are carried out separately as mentioned below:

3.1. Cointegration Test for RED and RME

Co-integration test for the RED and RME would enable us to elucidate the existence of a relationship between these two variables. Results of regression and ADF test for the residual are presented in Tables 2 and 3 respectively.

Table 2. Empirical Results of the Model - RED Vs RME (1980-2009)

Dependent Variable: Log [RED]	
Constant	4.782 (8.617)*
Log (RME)	0.771 (8.816)*
AR(1)	0.872 (5.337)*
R-squire	0.803
Adjusted R-squire	0.793
Durbin-Watson Statistics	1.812
F-Statistics	77.712
Probability (F-Statistics)	0.0000*
Number of Observations	30

Note: Values in parentheses show t-statistics. The statistics significant at 1% level of significance is indicated by*.

Source*:* Calculated by the authors

Table 3. Augmented Dickey-Fuller Test for the Residuals

Estimated Residual Integration	**Level**	**Mackinnon (1996) Critical Values for Rejection of Hypothesis of a Unit Root**			**Decision**	**Order of Integration**
		1 %	**5 %**	**10 %**		
Residual	-4.181	-2.656	-1.954	-1.609	Stationary at level	I (0)

Source*:* calculated by the authors

The findings reveal that RME has a positive and significant effect on RED. A one percent increases in real military expenditure (RME) lead to an increase of almost 0.77 percent in real external debt (RED). The results of Table 3 indicate that the residual is stationary at a level that is integrated of order zero. This authenticates our intention that RED and RME are indeed co-integrated that is a long run relationship between them holds. In order to ensure stability of long run relationship between RED and RME, an Error Correction Model (ECM) has been employed and the results are presented in Table 4.

Table 4. Empirical Findings of Error Correction Model – RED Vs RME

Dependent Variable: DLog (RED]	
Constant	4.749 (10.073)*
DLog (RME)	0.684 (3.012)*
p	-0.342 (-3.446)*
R-squire	0.885
Adjusted R-square	0.872
DW	1.967
F-Statistics	7.055
Probability (F-Statistics)	0.005**
Number of Observations	30

Note: Values in parentheses show t-statistics. The statistics significant at 1 and 5 % level of significance are indicated by * and **.

Source*:* Calculated by the authors

The results of Table 4 indicate short-run effect and long-run adjustment impact of RED and RME. In the short-run, if there is one percent increase in RME, real external debt increases by almost 0.68 percent. This simply reflects that large military expenditure can result in large real external debt. While in the long-run, the adjustment parameter (*p*) appears with negative value, signifying the long run convergence. The ECM estimation reveals that 34.2% of the disequilibrium in RED produced by RME would be adjusted in every year. It is concluded here that there is a stable long run relationship between RED and RME.

To confirm the causal relationship between the RED and RME, a Granger-Causality test has been applied using lag length of up to two periods. The following four hypotheses are tested.

1) RED Granger causes RME
2) RME Grange causes RED
3) Causality runs in both directions
4) RED and RME are independent

The results are provided in Table 5. It shows the hypothesis that 'RED' does not Granger cause 'RME' is rejected at both first and second lag. This, of course, accords with the conventional hypothesis 1. But in the same table the null hypothesis that 'RME' variables do not Granger causes 'RED' is accepted even at two lags. It validates the hypothesis 2. These results, when taken together do not support hypothesis 3 and 4. So a unidirectional relationship between the RED and RME is established. This finding additionally implies that any investigation of the impact of RME on RED should be performed within a simultaneous equation model.

Table 5. Causality Patterns – RED Vs RME

Lagged Years	Null Hypothesis	Decision
1	No causality from Log (RED) to Log (RME) No causality from Log (RME) to Log (RED)	Rejected Accepted
2	No causality from Log (RED) to Log (RME) No causality from Log (RME) to Log (RED)	Rejected Accepted

Source*:* Calculated by the authors

3.2 Co-integration Test for RED and RARMSM

The co-integration test for second variable i.e., real arms import (RARMSM) and real external debt (RED) is carried out. Results of OLS regression and ADF test for the residual are presented in Tables 6 and 7 respectively.

Table 6. Empirical Results of the Model – RED Vs RARMSM (1980-2009)

Dependent Variable: Log (RED)	
Constant	10.042 6.025*
Log (RARMSM)	-0.445 -2.012**
AR(1)	0.823 4.463*
R-square	0.591
Adjusted R-squire	0.552
Durbin-Watson Statistics	2.012
F-Statistics	7.125
Probability (F-Statistics)	0.012*
Number of Observations	30

Note: Values in parentheses show t-statistics. The statistics significant at 1 and 5 % level of significance are indicated by * and **.

Source*:* Calculated by the authors

Table 7. Augmented Dickey-Fuller Test for the Residuals

Estimated Residual Integration	Level	Mackinnon (1996) Critical Values for Rejection of Hypothesis of a Unit Root			Decision	Order of Integration
		1 %	5 %	10 %		
Residual	-3.524	-2.656	-1.954	-1.609	Stationary at level	I (0)

Source*:* Calculated by the authors

Table 6 shows that there is a negative relationship between real external debt and real arms import. If there is an increase of one percent in arms import, it leads to a decrease in external debt by almost 0.44 percent. The result of Table 7 indicates that the residual is stationary at level that is integrated of order zero. This authenticates our intention that RED

and RARMSM are indeed cointegrated that is a long run relationship between them holds. In order to ensure stability of long run relationship between RED and RARMSM, an Error Correction Model (ECM) has been used. The results are displayed in Table 8.

Table 8. Empirical Findings of Error Correction Model –RED Vs RARMSM

Dependent Variable: DLog (RED)	
Constant	2.124 (1.912)**
DLog (RARMSM)	-0.324 (-2.765)*
p	-0.524 (-2.431)**
R-square	0.485
Adjusted R-square	0.443
Durbin-Watson Statistics	1.845
F-Statistics	6.421
Probability (F-Statistics)	0.014*
Number of Observations	30

Note: Values in parentheses show t-statistics. The statistics significant at 1 and 5 % level of significance are indicated by * and *.

Source*:* Calculated by the authors

The result of Table 8 bring to light that in the short-run, a one percent increase in arms import lead to decrease in external debt by almost 0.32 percent. This simply demonstrate that purchase of arms with scarce foreign exchange, reduces the availability of resources for importing intermediate and investment goods that assist sustainable long-run economic growth (Looney, 1989; Dunne, Perlo-Freeman & Soydan, 2004a). In the long-run, the adjustment parameter (*p*) appears with negative value signifying the long run convergence. The ECM estimation reveals that 52.4% of the disequilibrium in RED produced by RARMSM would be adjusted in every year. The conclusion is that there is a stable long run relationship between RED and RARMSM.

To confirm the causal relationship between the RED and RARMSM, a Granger-Causality test has been applied using lag length up to two periods. The following four hypotheses are tested.

- RED Granger causes RARMSM
- RARMSM Grange causes RED
- Causality runs in both directions
- RED and RARMSM are independent

The results are provided in Table 9. The results show that the hypothesis that RED does not Granger cause RARMSM is rejected at both lags. This of course, accords with the conventional hypothesis 1. But in the same table, the null hypothesis that RARMSM does

not Granger cause RED is accepted. This demonstrates that there is a uni-directional causality relationship between the variables.

Table 9. Causality Patterns – RED Vs RARMSM

Lagged Years	Null Hypothesis	Decision
1	No causality from Log (ED) to Log (ARMSM) No causality from Log (ARMSM) to Log (ED)	Rejected Accepted
2	No causality from Log (ED) to Log (ARMSM) No causality from Log (ARMSM) to Log (ED)	Rejected Accepted

Source: Calculated by the authors

3.3 Co-integration Test for RED Vs RGDP

Co-integration test for external debt and economic growth would enable us to clarify the existence of a relationship between these two variables. Results of regression and ADF test for the residual are presented in Tables 10 and 11 respectively.

Table 10. Empirical Results of the Model – RED Vs RGDP (1980-2009)

Dependent Variable: Log (RED)	
Constant	3.399 (2.742)*
Log (RGDP)	0.592 (5.130)*
AR(1)	0.544 (2.601)*
R-squire	0.908
Adjusted R-squire	0.897
Durbin-Watson Statistics	1.559
F-Statistics	84.109
Probability (F-Statistics)	0.000*
Number of Observations	30

Note: Values in parentheses show t-statistics. The statistics significant at 1% level of significance is indicated by *.

Source*:* Calculated by the authors

Table 11. Augmented Dickey-Fuller Test for the Residuals – RED Vs RGDP

Estimated Residual Integration	**Level**	**Mackinnon Critical Values for Rejection of Hypothesis of a Unit Root**			**Decision**	**Order of Integration**
		1 %	**5 %**	**10 %**		
Residual	-2.783	-2.656	-1.954	-1.609	Stationary at level	I (0)

Source: Calculated by the authors

The finding affirms that the residual is stationary at level I (0). This legalizes the proposition that RED and RGDP are definitely co-integrated. In order to check reliability of long run relationship between RED and RGDP, the Error Correction Model is applied. The results are presented in Table 12.

Table 12. Empirical Findings of Error Correction Model – RED Vs RGDP

Dependent Variable: DLog (RED)]	
Constant	3.290 (6.302)*
DLog (RGDP)	0.602 (8.241)*
P	-0.718 (-3.289)*
R-square	0.911
Adjusted R-square	0.900
DW	1.637
F-Statistics	82.403
Probability (F-Statistics)	0.000*
Number of Observations	30

Note: Values in parentheses show t-statistics. The statistics significant at 1 % level of significance is indicated by *.

Source*:* Calculated by the authors

The results of Table 12 disclose that in the short-run, a one percent increase in the RGDP results in an increase of almost 0.602 percent in real external debt. Two primary reasons behind the increase of output and external debt in Bangladesh have been offered. First, theories of constrained access to international credit markets and second, in order for international borrowing and lending to occur in the presence of repudiation risk, creditors must have the ability to punish countries that default (Lane, 2004). In the long-run, the adjustment parameter (*p*) appears with negative value, this signifies the long run convergence. The ECM estimation reveals that 71.8% of the disequilibrium in ED produced by RGDP would be adjusted in every year. It can be hereby concluded that there is a stable long run relationship prevalent between RED and RGDP.

To confirm the causal relationship between the RED and RGDP, a Granger-Causality test has been applied using lag length up to two periods. The following four hypotheses are tested.

- RED Granger causes RGDP
- RGDP Grange causes RED
- Causality runs in both directions
- RED and RGDP are independent

The results are provided in Table 13.

Table 13. Causality Patterns – RED Vs RGDP

Lagged Years	Null Hypothesis	Decision
1	No causality from Log (RED) to Log (RGDP) No causality from Log (RGDP) to Log (RED)	Rejected Rejected
2	No causality from Log (RED) to Log (RGDP) No causality from Log (RGDP) to Log (RED)	Rejected Rejected

Source*:* Calculated by the authors

The result shows that the hypothesis that RED does not Granger cause RGDP is rejected. This supports our hypothesis (1). But at the same time, the null hypothesis that RGDP does not cause Granger cause RED is also rejected. It validates the hypothesis (2). These results, when taken together, support the hypothesis (3) and suggest that while RED has caused RGDP, RGDP also caused RED; therefore, causality runs in both directions. This finding implies that any investigation of the impact of RGDP over RED should be performed within a simultaneous equation model.

SUMMARY AND CONCLUSION

The objective of the paper has been to inspect the role of real military expenditure, real arms import and real economic growth in contributing to the real external debt of Bangladesh economy. The present study uses annual data for Bangladesh for the period of 1980 to 2009 and is primarily based on co-integration analysis and error correction model strategy. The Granger causality approach analyzes the relationship between real external debt – real military expenditure, real external debt – real arms import and real external debt – real economic growth separately. It provides a useful means of segregating the alternative hypotheses. The empirical results moderately support the conventional view that real military expenditure and real arms import have significant long-run casual effect on real external debt. While the relationship between real external debt and real economic growth supports the bi-directional causality in the specific context of Bangladesh. Such bi-directional causality link is consistent with the third alternative hypothesis and it is suggestive of a simultaneous determination of these two key variables. This also suggests that only single equation / conventional method is insufficient to assess these strong relationships. Therefore it is important to establish simultaneous equation/s for long-run relationship. This conclusion opens a new avenue for future researchers.

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