"Trade Liberalization and Economic Growth: What's The Empirical Relationship in Bangladesh?"

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Abstract: *Bangladesh adopted a liberal economic regime, particularly in the areas of trade, finance, and capital account, since mid-1980s. This paper attempts to investigate empirically the causality relationship between trade liberalization and economic growth in Bangladesh by employing co-integration and granger causality techniques of time series econometrics for the period of 1975-2010. The data on trade liberalization and economic growth are taken from the world development indicators. The empirical results reveal that there exist short run and long run co-integration and causality relationships among variables in the growth model. It implies that trade openness policies may be feasible with sustained economic growth. It is also found that causality runs from economic growth to trade liberalization. The results are also consistent with the growth theories and economic literature.*

Keywords: *Trade Liberalization, Economic growth, Co integration.*

I.   Introduction:

International trade plays an important role in the development of any economy and assumed to be an engine of growth. Trade is taking place not only in terms of commodities but also in terms of technology, flows of ideas and knowledge spillover. Trade liberalization and degree of join each country to global economy during time, is a category that is considered by economists, planners and policy makers of the world (Heller, 1978).Some economists and planners believe that trade liberalization lead to good Macro-economic performance and faster growth economy (Henriques and Sadorsky, 1996). On the other hand a group of economists doubt that trade liberalization lead to growth economy and they believe that existing empirical studies are faced with Methodological bottlenecks (Hwang, 1998). Most empirical studies support the first view. International institutions, like World Bank, International Monetary Fund and Organization for Economic Cooperation and Economic Development Recommend that trade liberalization has a positive relation on economic growth (Esfahani, 1991). International trade affects economy through different channels. It creates employment; generate capital formation that leads to better living standards in terms of higher level of GDP and GDP per capita (Edwards, 1997). Over the past few years, the world trading system is becoming progressively open and competitive. Tariffs are reducing in both developed and developing countries and restrictions are eliminating. Economies are trying to adopt outward-looking economic policies, also looking for the ways to promote growth and employment through expanding export production and attracting inward investment (Pritchett, 1994). The concept of trade openness and free trade is highly debated topic in economics. It is always assumed to be a very important source of economic growth. Trade openness can promote growth through several ways. It creates massive benefits, increase investments as a result of enlarged markets and economies of scale, flow of information, technology and knowledge spillovers. As, it creates efficient utilization of resources, improved technological efficiency and trade facilitation that returns in higher foreign exchange which is used to expand the less developed sectors of the economy. It is also supported by many economists in different studies. Some studies concluded that openness played effective role mostly in developed countries where as many studies concluded that openness can play significant role in less developed countries as well South Asia is economically one of the less developed regions of the world which accommodates more than 20 per average GDP per capita of US \$1,565. The South Asian economies mostly followed protectionist trade policies during their initial phases of development (Rodriguez & Rodrik, 2001). The prime principles behind the restrictive trade regimes were protection of the domestic industries from foreign competition and conservation of foreign exchange for balance of payments support. Also, South Asia is assumed to be less integrated region of the world in terms of the trade of commodities, capital and ideas whereas, Intraregional trade is very low for South Asia *i.e.* intraregional trade is less than 2 percent of GDP, compared to more than 20 percent for East Asia.

Trade liberalization and degree of join each country to global economy during time, is a category that is considered by economists, planners and policy makers of the world (Rivera & Romer, 1991). Some economists and planners believe that trade liberalization lead to good Macro-economic performance and faster growth economy. On the other hand a group of economists doubt that trade liberalization lead to growth economy and

they believe that existing empirical studies are faced with Methodological bottlenecks. Most empirical studies support the first view. International institutions, like World Bank, International Monetary Fund and Organization for Economic Cooperation and Economic Development Recommend that trade liberalization has a positive relation on economic growth. Trade liberalization has been used in many articles.

Trade liberalization is often considered as a significant tool for increasing economic growth in the world economies. Exports of those countries have greatly liberalized their economies, and consequently these countries have also experienced the fastest growth of GDP. Since the relationship between trade liberalization and economic growth has extensively been analyzed in the world, it remained controversial among policy makers and economists based on empirical findings (Chaudhry and Imran, 2009). Many questions were raised about the relationship between trade and growth in developing countries (Kruger, 1997). However, there is a great consensus that trade policy openness and higher ratios of trade volume to GDP were positively related with economic growth. Many developing countries are liberalizing their economies to become attractive destination for foreign capital inflows. Openness of trade regime can increase the investment and efficiency of investment and also can increase the market size in these countries.

1.1 Economic Liberalization in Bangladesh:

Trade liberalization started in Bangladesh in mid-1980s. Export diversification and import liberalization received the highest priority in the earlier years. This consisted in permitting the exporters of non-traditional items to convert some of their export earnings at higher exchange rate in the secondary market, reduction of the tariff level and tariff dispersion, simplification and rationalization of the tariff structure, and deregulation of the import process. For instance, on import liberalization front, Bangladesh simplified and rationalized the tariff structure by reducing the number of tariff bands from 15 in 1992 to 5 in 2003 (Government of Bangladesh, 2004). Other import liberalization initiatives include changes in contents and structure in import procedures under the Import Policy Order (IPO) and mandatory pre-shipment inspection (PSI) system under the Uruguay Round Agreement on Customs Valuation.

The major export policy reforms in Bangladesh, on the other hand, include Export Performance Licensing, Export Performance Benefit Scheme, Special Bonded Warehouse Scheme, Duty Drawback System, Back-to-Back L/C System, Cash Compensatory Scheme, Export Credit Guarantee Scheme, Export Promotion Fund and bank loans together with fiscal incentives, such as concessionary duty on imported machinery and "tax holiday" for industries in Export Processing Zones (EPZs). Policy changes that took place with trade liberalization in Bangladesh are industrial policy, exchange rate policy, monetary policy and fiscal policy. Bangladesh adopted financial liberalization under the Financial Sector Reform Project (FSRP) during the first half of the 1990s, which predominantly dealt with the banking sector. The program, which is part of structural adjustment program (SAP), was supported by the World Bank under its financial sector adjustment credit (FSAC) scheme. The financial sector reforms in Bangladesh include liberalization of interest rates, improvement of monetary policy, abolishing priority sector lending, strengthening central bank supervision, regulating banks, improving debt recovery and broadening capital market development (Mujeri,2002)**.**

Capital account liberalization in Bangladesh started in 1997 (International Monetary Fund, 2000). On 24 March 1994, the Bangladesh Taka was declared convertible for current account transactions in terms of Article VIII of the IMF Articles of Agreement (International Monetary Fund, 1996). This was a significant step towards capital account liberalization in the country. Capital account liberalization policies in Bangladesh include easing restrictions in capital and money market, derivatives and other instruments, credit operations, direct investments, real estate transactions, personal capital movements, provisions specific to commercial banks, and provisions specific to institutional investors.

Trade liberalization policies pursued by Bangladesh have passed through three phases. The first phase (1982-86) was undertaken as Bangladesh came under the purview of the policy based lending of the World Bank; the second phase (1987-91) began with the initiation of the three year IMF structural adjustment facility (SAF) in 1986; and finally, the third phase since 1992,was preceded by the IMF sponsored Enhanced Structural Adjustment Facility (ESAF). These reform measures led to a significant decline in quantitative restrictions, opening up of trade in many restricted items, rationalization and diminution of import tariffs, and liberalization of foreign exchange regime, which are summarized below.

Table 1: Removal of QRs at 8-digit HS Classification Level

Year	Number of Controlled Items (HS-8 level)	Share of controlled items as per cent of total number of HS-8 lines
1987-88	2306	39.5
1988-89	1907	32.7
1989-90	1525	26.1
1990-91	1257	21.5
1991-92	1103	18.9
1992-93	584	10.0
1993-94	350	6.0
1994-95	117	2.0
Source: World Bank (1996) and Bakht (2000).		

Table 2: Removal of QRs at 4-digit HS Classification Level

Year	Total	Restricted for trade reasons			Restricted for non-trade reasons
		Banned	Restricted	Mixed	
1985-86	478	275	138	16	49
1986-87	550	252	151	86	61
1987-88	529	257	133	79	60
1988-89	433	165	89	101	78
1989-90	315	135	66	52	62
1990-91	239	93	47	39	60
1991-92	193	78	34	25	56
1992-93	93	13	12	14	54
1993-94	109	7	19	14	69
1994-95	114	5	6	12	92
1995-97	120	5	6	17	92
1997-2002	124	5	6	17	96
2003-2006	63	5	8	10	40
Source: Compiled from Bayes et al. (1995), Hussain, et al. (1997) and World Bank (1999).					

Similarly, at the HS-4 digit level a total of 429 commodities were covered under import restrictions for trade reasons in 1985-86, which fell to only 28 by the end of the 1990s (Table 2). Table 2 shows that currently there are only 5 commodities subject to import ban due to trade reasons as compared to 275 in 1986.

Another important element of trade policy reform has been the introduction of a set of generous support and promotional measures for exports. While import and exchange rate liberalization were meant to correct the domestic incentive structure in the form of reduced protection for import-substituting sectors, export promotion schemes were undertaken to provide the exporters with an environment where the erstwhile bias against export-oriented investment could be reduced significantly. Important export incentive schemes available in Bangladesh include, among others, subsidized rate of interest on bank loans, duty free import of machinery and intermediate inputs, cash subsidy, and exemption from value-added and excise taxes. Table 3 summarizes some of the most important export incentive schemes.

Table 3: Important Export-Incentive Schemes in Bangladesh

Scheme	Nature of Operation
Export Performance Benefit	This scheme was in operation from mid-1970s to 1992. It allowed the exporters of non-traditional items to en cash a certain proportion of their earnings (known as entitlements) at the higher exchange rate of WES. In 1992 with the unification of the exchange rate system, the XPB scheme ceased.
Bonded Warehouse	Exporters of manufactured goods are able to import raw materials and inputs without payment of duties and taxes. The raw materials and inputs are kept in the bonded warehouse. On the submission of evidence of production for exports, required amount of inputs is released from the warehouse.
Duty Drawback	Exporters of manufactured products are given a refund of customs duties and sales taxes paid on the imported raw materials that are used in the production of goods exported. Exporters can also obtain drawbacks on the value added tax on local inputs going into production.
Duty Free Import of Machinery	Import machinery without payment of any duties for production in the export sectors.
Back to Back Letter of Credits (L/Cs)	It allows the exporters to open L/Cs for the required import of raw materials against their export L/Cs in such sectors as RMG and leather goods.
Cash Subsidy	The scheme was introduced in 1986. This facility is available mainly to exporters of textiles and clothing who choose not to use bonded warehouse or duty drawback facilities. Currently, the cash subsidy is 25 per cent of free on board export value.
Interest Rate Subsidy	It allows the exporters to borrow from the banks at lower bands of interest rates of 8-10 per cent against 14-16 per cent of normal charge.
Income Tax Rebate	Exporters are given rebates on income tax. Recently this benefit has been increased. The advance income tax for the exporters has been reduced from 0.50 per cent of export receipts to 0.25 percent.
Retention of Earnings in Foreign Currency	Exporters are now allowed to retain a portion of their export earnings in foreign currency. The entitlement varies in accordance with the local value addition in exportable. The maximum limit is 40 per cent of total earnings although for low value added products such as RMG the current ceiling is only at 7.5 percent.
Special Facilities for Export Processing Zones (EPZs)	To promote exports, currently a number of EPZs are in operation. The export units located in EPZs enjoy various other incentives such as tax holiday for 10 years, duty free imports of spare parts, exemption from value added taxes and other duties.

Source: Bayes et al. (1995), Hussain et al. (1997) and Bakht (2000).

The plan of the paper is as follows: Section 2 briefly presents the literature. Section 3 presents the data and methodology employed. Analysis and empirical results in Section 4 and Section 5 presents concluding remarks.

II. Literature Review:

Studies on the effects of trade liberalization on economic growth have traditionally followed a two-step approach- first, finding out impact of trade reforms on export growth; and second, trying to establish link between export growth and economic growth. Krueger (1978) provided strong evidence in favor of an 'indirect' effect of trade liberalization on growth- higher exports positively affected GNP growth. Similar findings were reported by Romer (1989), Dollar (1992), Ghatak *et al.* (1995), Sachs and Warner (1995), Gould and Ruffin (1995) and Edwards (1998). The development in the theory of endogenous economic growth, largely influenced by Romer (1986), Lucas (1988) and Mankiw *et al.* (1992), gives an opportunity to establish a long-run equilibrium relationship between national trade policies and economic growth. The initial idea is that a more open trade regime allows a country to specialize in the production of a subset of intermediate inputs in which it has comparative advantage. Consequently, a higher equilibrium rate of growth can be achieved from a lower cost of a large quantity of that input. In his influential article, Solow (1957) identified that trade liberalization

can facilitate neutral technical change through technological efficiency by eliminating protection for import substitution industries. That is, trade liberalization can promote efficiency by reorienting factors of production in favor of sectors in which the economy possesses a comparative advantage in trade as well as by allowing for a choice of techniques of production which reflects the factor endowments of the economy (Balasubramanyam *et al.* 1996). A little differently, Quah and Rauch (1990) mentioned that a closed economy which has to produce a large group of intermediate goods is likely to run into bottlenecks. Thus the country cannot face these problems under free trade regime which consequently helps it to grow faster than under autarky. On the other hand, Edwards (1993) pointed out that a country with a higher degree of openness can absorb technology developed in advanced nations at a faster rate and thus grow more rapidly than a country with a lower degree of openness. Among the most convincing of recent studies supporting the view that openness indeed promotes growth is that of Frankel and Romer (1999). They deal with the issue of direction of causality between openness and growth by looking only at the effect of that component of openness caused by populations, land areas, borders and distances in other words, the factors that economic growth cannot influence at least in the short run. This component explains a significant proportion of the differences in income levels and growth performance between countries, and from this a general relationship could be established that trade openness leads to economic growth. Vamvakidis (1999) study showed that growth prospects for developing countries are greatly enhanced through an export oriented trade regime. However, the question as to whether trade liberalization increases productivity remains unanswered. While trade liberalization might not provide uniform incentives to all countries, it is accepted as a favorable productivity channel Goldar and Kumari (2003).

Although the relationship between trade and growth has been the subject of a voluminous body of literature, there is a significant amount of disagreement on the direction of causality. The extent to which trade openness engenders economic growth has been intensely debated in literature. Counter arguments of free trade policies can also be found in a situation where economists argued that trade liberalization policies bring macroeconomic instability characterized by high and variable inflation on the one hand, and fiscal and balance-of-payments crises on the other (Rodrik, 1992). Terms of trade deterioration, exchange rate depreciation and capital outflows due to trade liberalization are strong arguments, among others, against trade related reforms. The argument in this case is that trade policies only can affect the volume of trade, but not the relationship between the levels of imports and exports. That is, tariff and nontariff barriers to trade determine the openness of an economy, but not its trade balance, which is determined by the balance between national income and expenditures (Rodrik, 1992). According to Grossman and Helpman (1991), and Srinivasan (2001), endogenous growth model suggests that trade may be growth-stunting. For instance, trade openness exposes a country to volatility of output and terms of trade. If the magnitude of shocks is beyond the absorptive capacity of the country, the forces of dynamic comparative advantage push the economy away from the direction of activities that stimulate long run economic growth. This view is supported by Rodríguez and Rodrik (1999), who argue that the measures of trade openness used in most of the papers showing positive links between trade liberalization and exports, are flawed. Harrison (1996), and Harrison and Hanson (1999) also suggest that the results are dependent on the chosen measure of openness and the specification used. They claim that the measure of openness introduced by Sachs and Warner (1995) "fails to establish a robust link between more open trade policies and long-run growth." A review by Greenaway *et al.* (1998) concludes that trade liberalization has resulted in both an increase and decrease in the growth rate depending on country circumstances. Similar findings were reported by Bolaky and Freund (2004). Guillaumet and Richaud (2001) pointed out that this disagreement centers around two main ideas. Firstly, National development is a vital preliminary to openness. Foreign trade is a step that comes after the agricultural, and in most cases, the industrial development of the nation. Secondly, Openness creates an increase in the exchanges, thus creating extra national wealth. In order to achieve a perfect economic development, it is imperative to develop the size of markets. So it is seen that there is channels through which both trade and growth can cause each other. This causation has been extensively studied and both stances have been evidenced in literature. Some researchers find that more trade stimulates economic growth (Balassa 1978; Baldwin 1963; Bhala and Lau 1991; Keesing 1974; Krueger 1980; Meier 1984; Michaely 1977; Tyler 1981); some has found evidences to the contrary (Myrdal 1957; Nurkse 1961; Prebisch 1962; Singer 1964). Some studies have found that there is bi-directional causality between trade and growth, such as Chow (1987) and Anoruo and Ahmad (2000). No causal relationship has also been evidenced in some studies, such as Jung and Marshall (1985), Abhayaratne (1996), Sinha and Sinha (1996), Guillaumet and Richaud (2001) and Cuadros. A number of studies however failed to establish the link between export and economic growth. For instance, Hsiao (1987) found evidence of no causality for four Asian economies, except Hong Kong, where unidirectional causality from GDP to exports was found. Chow (1987) found a reciprocal causal relationship between export expansion and growth of manufacturing industries in the four Asian NIEs-Hong Kong, Singapore, South Korea and Taiwan. Kwan and Cotsomitis (1990) found a feedback relationship between exports and economic growth in China for the period 1952-85. Similar findings were reported by Ahmed and Kwan (1991), Ahmed and Harnhirun (1995) and Islam (1998).Therefore, trade-growth debate does not reach to any single conclusion.

There are not many studies investigating the relationship between liberalization and economic growth in Bangladesh.Rashid (2000) found positive impact of trade liberalization on manufacturing growth in Bangladesh. Ahmed (2001) looks at the effects of trade liberalization on industrial growth (and not aggregate output growth) using a framework of endogenous growth model. Ahmed reports a positive relationship between an index of industrial production and some measures of liberalization. On the other hand, Siddiki (2002) examines the joint effect of trade and financial liberalization on the overall economic growth of Bangladesh with annual data for 1975-95. Financial liberalization is proxied by the supply of broad money as percentage of GDP while trade liberalization by the ratio of trade to GDP. Siddiki finds positive effects of both types of liberalization. Mamun and Nath (2004) investigated the link between exports and economic growth in Bangladesh. They found unidirectional causality from exports to growth. Similar findings were reported by Wacziarg and Welch (2003), Dollar and Kraay (2004), Chang *et al.* (2005), and Salinas and Aksoy (2006).

III.   Methodology & Model:

The present study employs data that consist of annual observations during the period 1975-2009 to avoid the seasonal biases. Furthermore, Hassapis et al. (1991) noted that co integration is a long run concept and thus requires long spans of data to give the tests for co integration more power than merely increasing the data frequency. In order to investigate the relationship between Trade Openness and growth of Bangladesh, the time series data was collected on the period 1975-2010.The data on growth rate of GDP, trade (exports plus imports) as percent of GDP are obtained from the *World Development Indicators 2010*, the World Bank and are transformed into logarithmic returns in order to achieve mean reverting relationships and to make econometric testing procedures valid.

Finally, the econometric software, namely Microfit 4.1 and Eviews 5.1, SATA 9.2 are used to complete the analysis in this study.

The model intends to establish the relationship between Trade openness and national income of Bangladesh where it can be expressed in the following basic bivariate model.

$$Y_t = \alpha + \beta F_t + \varepsilon_t \tag{1}$$

Where, Y_t is real gross domestic product (GDP) and F_t is the Trade openness and ε_t is white noise. Logarithmic transformation of the above equation and inclusion of a trend variable would leave the basic equation as follows

$$LY_t = \alpha_0 + \alpha_1 t + \beta FE_t + \varepsilon_t \tag{2}$$

where, *t* is the trend variable.

While conducting an econometric study, the direction of causal relationship among variables is determined according to the information obtained from the theory. Classical regression analysis is based on the assumption that the method used is correct and the direction of the causality is determined in the model. Therefore, in this study Granger causality test will be used in order to test the hypothesis regarding the presence and direction of causality between Trade openness and economic growth. In order to apply Granger causality test, the series that belong to variables should be stationary. Therefore, it is necessary to make test for unit roots to examine whether the series for these two variables are stationary or not.

The standard Granger causality test (Granger, 1969) seeks to determine whether past values of a variable helps predict changes in another variable. In the context of this analysis the Granger method involves the estimation of the following equations:

$$LY_t = \beta_0 + \sum_{i=1}^{q} \beta_{1i} LY_{t-i} + \sum_{i=1}^{q} \beta_{2i} LF_{t-i} + \varepsilon_{1t} \tag{3}$$

$$LF_t = \varphi_0 + \sum_{i=1}^{r} \varphi i_{1i} LF_{t-i} + \sum_{i=1}^{r} \varphi_{2i} LY_{t-i} + \varepsilon_{2t} \tag{4}$$

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

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

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

$$\Delta LY_t = \beta_0 + \sum_{i=1}^{q} \beta_{1i} \Delta LY_{t-i} + \sum_{i=1}^{q} \beta_{2i} \Delta LF_{t-i} + \alpha_1 Z_{t-1} + \varepsilon_{1t} \tag{5}$$

$$\Delta LF_t = \varphi_0 + \sum_{i=1}^{r} \varphi i_{1i} \Delta LF_{t-i} + \sum_{i=1}^{r} \varphi_{2i} \Delta LY_{t-i} + \lambda_1 Z_{t-1} + \varepsilon_{2t} \tag{6}$$

where Z_{t-1} is the ECT obtained from the long run co integrating relationship between real GDP and Trade openness. The above error correction model (ECM) implies that possible sources of causality are two: lagged dynamic regressors and lagged co integrating vector. Accordingly, by equation (5), Trade openness Granger causes real GDP, if the null of either $\sum_{i=1}^{q} \beta_{2i} = 0$ or $\alpha_1 = 0$ is rejected. On the other hand, by equation (6), real GDP Granger causes Trade openness, if λ_1 is significant or $\sum_{i=1}^{r} \varphi_{2i}$ are jointly significant. Real output and Trade openness granger cause each other i.e. presence of bidirectional causality), if causality exists in both directions.

IV.   Results and discussion:

Table 4 shows the descriptive statistics and correlation matrix. It is found that for both variables, standard deviation is far less than the mean which tells about data homogeneity. Also the correlation coefficient is very high implying strong linear relationship between electricity consumption and economic growth. We conducted PP (Phillips-Peron) and ADF-GLS (Augmented Dickey-Fuller -GLS) tests to determine the order of integration of the variables, economic growth and electricity consumption. Table 2 reports that both of the variables are stationary at first difference with constant and trend.

Table 4: Estimated results of Descriptive Statistics and Correlation Matrix

	Mean	Median	Maximum	Minimum	Std. Dev.	Skewness	Kurtosis	Y	F
Y	24.14416	24.07846	25.02711	23.45437	0.462888	0.296261	1.917687	1	0.991081
F	3.781081	3.800484	5.337177	2.275699	0.885479	0.079279	1.871998	0.991081	1

The estimation procedure begins with testing the time series properties of the data. Table 3 presents the unit root test results of the variables. As it is important to determine the order of integration among variables, four different types of tests are applied. While the ADF is notorious for its poor power problem, the other two tests are more powerful in rejecting the null of nonstationarity. Between these two tests the DF–GLS tests performs well especially in the presence of unknown shifts in the mean and trend in the data. On the other hand, the PP test is more efficient in the presence of a single break in the data. . In addition to augmented Dickey–Fuller (ADF), DF–GLS and PP test, another more powerful test, namely KPSS test, is also applied. For ADF, DF–GLS and PP tests, both with constant and constant and trend, one is unable to reject the null at level, is able to reject when first differenced series is used. Similarly, for KPSS tests, again both with constant and constant and trend, the null (of stationarity) is rejected at levels but accepted when applied to first differenced data. In total, it emerges from the unit root test results that both the variables are integrated of order 1, I(1)

Table 5: Estimated results of Unit root test

Variables	Augmented Dicky-Fuller (ADF) Tests				Phillips-Perron(PP) Tests			Process
	Statistics	*P*-values	Unit Root	Process	Statistics	*P*-values	Unit Root	
Test equation: intercept								
LF	-1.05063	0.7135	Yes	I(1)	-1.5286	0.5079	Yes	I(1)
LY	4.115253	1	Yes	I(1)	1.771304	0.9995	Yes	I(1)
Δ F	-3.256164**	0.0258	No	I(0)	-10.8786***	0	No	I(0)
Δ Y	-4.725276***	0.0021	No	I(1)	-11.8185***	0	No	I(0)
Test equation: trend and intercept								
LF	-4.672819	0.0062	No	I(0)	-6.34771***	0	No	I(0)
LY	1.798617	1	Yes	I(1)	-4.23461	0.0177	Yes	I(1)
Δ F	-3.468466*	0.0649	No	I(0)	-15.6342***	0	No	I(0)
Δ Y	-14.48783***	0	No	I(0)	-39.1524***	0	No	I(0)

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

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

Variables	Dickey-Fuller GLS Tests			Kwiatkowski-Phillips-Schmidt-Shin test		
	Statistics	Unit Root	Process	Statistics	Unit Root	Process
Test Equation: intercept						
LF	0.923721	Yes	I(1)	0.68998***	No	I(0)
LY	0.276254	Yes	I(1)	0.639373***	No	I(0)
Δ F	-5.913241***	No	I(1)	0.398254	Yes	I(1)
Δ Y	-1.894153***	No	I(0)	0.609752	Yes	I(1)
Test Equation: trend and intercept						
LF	-4.354966***	No	I(0)	0.156767**	No	I(0)
LY	-3.192000**	No	I(0)	0.185731**	No	I(0)
Δ F	-	No	I(0)		No	I(0)

	3.484782***			0.254265***		
Δ Y	-1.877953	No	I(0)	0.076324	Yes	I(1)
Note: The variables 'Trade Openness' and 'Output' stand for the log of 'Trade Openness' as defined before and the log of real GDP respectively. Δ denotes the first difference and ΔΔ denotes second difference of the variable. The null hypothesis states that the variable has a unit root. P-values are used to decide the unit roots at the 1 percent significance level. The critical values and details of the tests are presented in Dicky and Fuller (1979, 1981) and Phillips and Perron (1988). The AIC determines the lag length (P) in the ADF tests (see Stock and Watson 2007:561 for details). Test equation: trend and intercept. *,**, and *** denote rejection of null at 10%, 5%, and 1% level of significance.						
Source: World Development Indicators (WDI-World Bank 2010)						

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

Table 6: Results of Johansen co-Integration test

Results of Johansen co-Integration test				
Variables		Max. Eigen Value Test	Trace Test	Result
LF & LY	r=0	29.42 (27.42)	49.45 (48.88)	Co integrated
	r=1	11.23 (21.12)	20.02(31.54)	
	r=2	5.85 (14.88)	8.79 (17.86)	
	r=3	2.94 (8.07)	2.94(8.07)	

Table 7 presents the Granger causality tests results. Granger causality test has been employed and the results are presented in table 6. *F*-statistic and probability values are constructed under the null hypothesis no causality. It is evident that there is a causal relationship between two variables of interest i.e. the one way causality runs through economic growth (LY) to trade openness (LF).

Table 7: Pairwise Granger Causality Test results

Sample: 1975- 2010; Lag 2			
Null Hypothesis	Observation	F Statistics	Probability
Trade openness does not Granger–cause GDP per Capita	36	1.10603	0.34540
GDP per Capita does not Granger-cause Trade openness		4.33594	0.02328

V.   Concluding Remarks and Policy Implications:

The main objective of this paper is to explore the role of foreign debt, trade openness and labor force in economic growth of Bangladesh. For this purpose, the paper analyzes the time series data for the period, 1975-2010. Using the PP and ADF *unit* root test procedures, the time series data is identified to *be* integrated of order one. As all the selected variables are integrated of order one, the Johansen co integration approach is employed to detect the co integration relationship among the variables. It is found that there is a co integration relationship between economic growth and trade openness. The results show that in the long run, Trade is a great contributor to economic growth of Bangladesh. Trade liberalization can be achieved through reduce tariffs and export expansion and reinforcement of professional and efficient labor force. With export expansion, demand for domestic goods increases and felt the need to develop production. Also reducing taxes on imported goods causes reduced industry costs and leads to expansion of industry sector thus gross domestic product increased. The result can be obtained from this article it is that effect of Trade restrictions like tariffs, export expansion and the

use of human capital leads to the production growth because with trade liberalization, industry sector can be strengthened and to achieve high growth. Therefore, we conclude that trade, free from any limitations, may pave the way for economic growth and reveal its positive effect on it.

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