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## **Growth and openness: empirical evidence from Bangladesh**

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UNIVERSITY OF  
BIRMINGHAM  
Department of Economics

**Growth and Openness: Empirical Evidence from  
Bangladesh.**

**By  
Munshi Masudul Haq**

**[A Dissertation submitted in fulfilment of partial requirement of the  
Degree of M.Sc. in International Money and Banking in 2008]**



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## Abstract

The study seeks to investigate empirically the direction and shape of causality among trade openness, investment and economic growth using data for Bangladesh during the period 1980-2006. Although in most cases, statistically reliable evidence of cointegration is sufficient to testify the existence of a long-run relationship among the variables of a particular model, Granger causality test provides a more dependable tool for determining the direction of the causality in particular. In order to achieve the objective of the study, modern econometric methodologies such as unit root tests; cointegration tests; and the Granger causality tests have been applied across all the variables of our model using a trivariate framework of regression equations. The test results indicate that there exists a long-run equilibrium relationship between trade openness, national income growth and total investment. Furthermore, empirical results of Granger causality confirm that there exists unidirectional causality between economic growth and investment; between trade openness and economic growth; and between trade openness and investment. The results, however, support the conventional presumption about the relationships between economic growth and investment; and between trade openness and economic growth while contradicts with that between trade openness and investment.

**Key words:** openness, trade liberalisation, GDP, national income, economic growth, investment, trivariate causality tests, unit root test, cointegration, long-run equilibrium relationship, Granger causality.

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# 1. Introduction

## 1.1 Theoretical Background

The theoretical underpinnings of a positive relationship between openness and growth basically came from the neoclassical growth theory of Solow (1956) that predicted that the output is a function of capital, labour and the effectiveness of labour quality through the technology change and knowledge. Building on this exposition, Romer (1980) and Lucas (1988) developed the “Endogenous Growth Theory” where trade leads to higher growth through dynamic gains. Later, Edward (1992), Romer (1992 & 1994), Grossman and Helpman (1991), and Barro and Sala-i-Martin (1995) among others showed that technology change can be influenced by a country’s openness to trade which implies to more productivity and higher economic growth.

‘The openness of an economy is the degree to which national and foreigners can transact without artificial costs that are not imposed on transactions among domestic citizens’ (Berg and Krueger, 2002). In general terms the notion refers to what is viewed as free trade policies. Theoretically, openness is desirable on grounds of efficient resource allocation. This means that in a competitive international economic framework international marginal rate of transformation drives domestic prices to efficient resource allocation. Berg and Krueger (2002) identify a number of channels through which the free trade mechanism influences efficient allocation of resources:

- An increased efficiency of investment;
- An ability to expand constant returns for a longer period through access to wider markets;
- Higher real return to capital in unskilled labour abundant countries enables exploitation of comparative advantage;
- Higher rate of domestic saving and/or foreign capital inflow can be attracted;
- Possible endogenous growth effects arising from more rapid short-term growth in response to trade opening;



- The discipline imposed on the government to undertake other growth augmenting policy reforms;
- Reduction in rent seeking activities provided by restrictions on trade;
- Exposure to innovation and entrepreneurial activities resulting from competition and wider market access;
- Openness to ideas and innovation by way of unconstrained exposure to risk and opportunities of international trade.

## **1.2 The Theoretical and Empirical Dichotomy**

However, despite the above arguments in favour of openness, the issue concerning the relationship between openness and growth characterises conflicting theoretical expositions evolved over time. Before the 1980s, the prominent thoughts on openness and growth relations were predominantly influenced by classical growth theories that presumed no significant role for openness in accelerating growth while the later thoughts gradually tended to acknowledge a significant positive relationship between these two. The now-defunct import substitution industrialisation (ISI) strategies adopted by most of the newly liberalised countries after the Second World War reflects the pre-eminent theoretical alignment of the economic thoughts of the former school<sup>1</sup>. Krueger (1997) mentions at least six premises pushing the developing countries to adopt protectionist or extremely inward-bound trade policies:

- As production structures of most developing countries' were heavily oriented to- ward primary commodity production, and dependence on foreign trade was believed to be extreme, protection was needed to allow domestic productive abilities to grow;
- Given predominant dependence on primary commodity production in the developing countries it followed that industrialisation and development would not take place if open policies were adopted;

---

1. Most of the countries were declared a nationalization all of its industries through the socialistic framework following the Marxian paradigm.

- Since both the global income and price elasticity of demand for primary commodities were low it was anticipated that export earnings would not grow very rapidly, if at all – a premise later termed as "export pessimism";
- As most of the developing countries were labour-surplus and disguised unemployment was too high, free trade policies without necessary industrial capacity could jeopardise the balance of the domestic economy.
- In the context of limited sources of foreign exchange it was argued that free trade option would create unbearable pressure on external balance by way of increasing demand for capital goods; and
- Lack of adequate response to price incentives from the traditional peasants caused inherent structural problems within the economy.

This strand of theoretical proposition, however, began to be replaced by a rather opposite argument since the late 1970s. Policy makers and academics started to argue in favour of openness or more outward-oriented policies in the plea that open policies are more conducive to achieving accelerated growth than inward-oriented or closed door policies. This striking conclusion was spurred mainly by the eye-catching results achieved by the East Asian countries such as Taiwan, Hong Kong, South Korea and Singapore. At the same time, changes in theoretical structures relating growth thinking took place at the behest of the economists belonging to neo-classical tradition of endogenous growth such as Romer (1990), Lucas (1988), and Barro and Sala-i-martin (1995) who predicted positive influence on trade openness on growth through spill over effects on technology.

On the policy front, drastic change in policy stance concerning international trade across a host of developing countries of Asia, Africa and South America started taking place since the 1980s. The principal Breton Woods Institutions, particularly the World Bank, played a significant role in this paradigm shift through the structural adjustment programme (SAF) under which multilateral lending was made conditional upon specific commitment on, among others, trade liberalisation<sup>2</sup>.

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2. SAP was specially designed for developing countries in 1980s by the World Bank and International Monetary Fund in order to tackle the two major oil shocks in 1970s.

Following Weinhold and Rauch (1999), theoretical explanations for such a radical shift in favour of openness can be grouped in three categories: (a) openness promotes more rapid absorption of technical know-how from the developed countries; (b) openness reduces rent seeking which in turn stops resource drain to less productive activities to generate growth; and (c) openness allows countries to absorb advantages of dynamic economies of scale by way of learning by doing.

Despite the sceptic arguments of economists such as Krugman and Rodrik that ‘the effect of openness on growth is, at best, very tenuous, and at worst, doubtful’ (Edwards, 1998), most of the academics and researchers today consider openness as augmenting growth in one or another way.

Empirical studies relating to the growth-openness link is also characterised by contradicting results. Conflicting empirical evidences emanating from various country specific time-series and cross-country studies severely hamper a consensus to be made on the effect of the openness on economic growth. One of major reasons for inconclusive empirical evidence is that there are wide disagreements among the economists in defining appropriate measure of openness. For example, a number of economists such as Dollar (1992), Sachs and Warner (1995), and Edwards (1998) have used an index of real exchange rate distortions and/or an index of real exchange rate variability as an indicator of openness. Many others (e.g., Balassa, 1982) consider trade-GDP ratio as more appropriate indicator of openness.

### **1.3 The Transmission Dilemma**

Economists also differ in viewing the channels of growth-openness link. Some (e.g. Sinha and Sinha (1999)) argue that openness is linked to growth principally through export while others view that the technology diffusion channel is spread across a wider range of operations. Divergences in opinions regarding the potential impact of adopting more open policies are, however, mainly due to low performance of most of the Sub-Saharan countries despite notable shift from protectionist policies toward more open ones in contrast with their Asian and Latin American compatriots. Same policies with differing results across countries, thus, constrains consensus building on the role and implications of openness.

## **1.4 The Research Question**

As is already mentioned, any consensus conclusion about the nature and shape of the relationship between openness and economic growth is constrained by the divergence of views of the academics and researchers. The key empirical question then arises is: what is the most probable effect of openness on the pace of growth particularly in the context of the developing countries?

The present study is specifically aimed at addressing this key issue through an empirical test based on Bangladesh, which, like many other developing countries pursued a predominantly import substitution industrialisation policies during the 1970s and part of 1980s, and then started to gradually open up her economy since the late 1980s. The study is planned to build on a comparative analysis of growth and export performance of the country during last thirty five years segmented as pre-reform and post-reform years while adopting appropriate econometric techniques to measure long-run relationship between openness and growth, and openness and export growth.

An additional aim of the study is to examine the effect of investment on growth of the economy and openness. The study differs with previous studies on the growth-openness link in Bangladesh at least in two respects: First, the current study covers data for most recent years to 2006 whereas previous studies cover till data for years to 2002; and second, the current study adopts, as econometric technique, the cointegration test as well as Granger causality tests which are considered superior to those used in earlier studies on Bangladesh.

## **1.5 Relevance of the Study**

Bangladesh ranks among few developing countries, which responded to the theoretical argument that openness promotes economic growth by way of enhanced export growth. Although Bangladesh initially pursued anti-openness policies under the shadow of ISI dominated strategy after independence, the country gradually moved toward an outward oriented trade policy since mid-1980s that eventually

culminated into what can be called ‘virtual liberalisation’ by the end of the last century. During the same period, Bangladesh also moved toward an enhanced economic growth path raising average annual growth rate from 4% during the 1980s to 6% mark during the current decade.

By the same token, the share of trade (export plus import) has increased significantly during last two and a half decades. Trade volume stood at around US\$ 30 billion in 2006 against less than US\$ 2 billion in 1976. The growth is robust by any standard.

These developments within the policy framework and economy of Bangladesh offer an attractive clue for empirical investigation as the impact of trade liberalisations on growth and investment. In addition, none of the previous studies on the growth-openness nexus in the case of Bangladesh capture the radical developments during the current decade covering trade liberalisation as well as trade growth.

Finally, none of the earlier tests on Bangladesh did include the Granger causality that is known as one of the best econometric method for determining causality between any two variables.

## **1.6 Structure of the Dissertation**

The rest of the paper will proceed as follows. Section 2 presents a brief review of the empirical literature on openness-growth relationship. This section also includes a discussion of different alternative approaches of measurement of openness frequently used in the empirical research. Moreover, the country sample, the empirical methodology, data and variable definitions are discussed both in cross-country and within a country’s perspective. Section 3 then provides an overview of the evolution of the trade policy of Bangladesh, which forms the source of data for the study. Section 4 describes the data characteristics, the model and methodology used in the investigation. Section 5 presents the empirical results of the study with detailed analysis of the findings and probable policy implications. In section 6, a summary of the findings are reported and analysed with a brief discussion of their implications and recommendations for future research.

## 2. Literature Review.

### 2.1 A General Overview of the Empirical Literature

The relationship between openness and economic growth has been extensively examined both theoretically and empirically, particularly since 1970s. Empirical tests on the openness - growth relationship have usually been carried out with either cross-country data or country-specific time-series data. But the tests differ widely in terms of the measure of openness used or considered. Most of the studies, however, are found to use one or more of following indicators or proxies of openness:

- Openness as the ratio of total export plus import divided by GDP at constant price or the current prices.
- A dummy variable to measure a country's openness which is zero (0) for closed economy and one (1) for open economy as suggested by Sachs and Warner (1995).
- Dollar's Openness Index which is introduced by Dollar (1992), based on general price level.
- Black Market Premium as a measure of openness. In this framework, if the premium is higher because of overvaluation of the currency, the market distortion is higher and for that reason the country is less out-oriented.
- A measure of openness proposed by Dennis Quinn (1997) which is based on the "*International Monetary Fund's*" (IMF) annually published in "*Report on Exchange Arrangement and Exchange Restrictions*"<sup>d</sup>.

It is to be noted that not all the studies adopted same line of econometric treatment to determine the extent and direction of output-openness relationship. Many of them used GDP (growth), aggregate or per capita, as the dependent variable while few others such as Edwards (1998) tested the impact of openness on total factor productivity (TFP).

## 2.2 Evidence from Cross-country Studies

Frankel and Romer (1999) in a cross-country study of 63 countries including both developed and developing countries showed that trade openness leads to an increase of income level which again leads to the economic growth. Their measurement of openness is trade GDP ratio (export + import / GDP). Dollar and Kraay (2003) also used this measure in their cross-country study of 123 countries both developing and developed countries. On the other hand, Dollar (1992) used United State as a benchmark country and converted other 'countries consumption price level' into U. S. dollars ( $RPL_i = 100 \times e_{Pi}/P_{u.s.}$ ). In this formulation, if the PPP hold and all the goods are tradable (no barriers) then the openness is 100. He also found that openness is positively related with economic growth in a sample of 95 developing countries from 1976 to 1985. Alcalá and Ciccone (2001) measured openness by export plus import relative to Purchasing Power Parity (PPP) GDP which is termed as 'real openness'. They also found a positive relationship between openness and growth. These results are, however, seen sceptically on the ground that most of the empirical evidence supports failure of PPP.

Similar kind of positive relationship between openness and growth has been found by Sachs and Warner (1995) but they used different measurement of openness. They used a dummy variable zero (0) for closed and one (1) for open economy. If the country is closed (0), it should have average tariff exceeding 40%, over 40% non-tariff barriers on import, overvalued exchange rate which implies black market exchange rate premium over 20%, socialist framework economy and an extractive state monopoly on major export representing and opposite economic condition for open (1) economy.

Shina and Shina (1999) reports that openness have positive effect on growth based on time-series analyses of fifteen Latin American countries adopting Trade-GDP ratio as the measure of openness. Nourzad and Powell (2003) studied the relationship between the levels of development and openness in forty seven developing countries during 1965-1990 and their finding suggest that openness is positively related with growth as well as human capital. Romalis (2006) used per capita GDP as a function of openness

using export plus import to GDP ratio as openness. He argues that increase in income level of large trading partner(s) (e.g. USA) causes an expansion in the trade of other countries trading with them. He also argues that by reducing developed countries tariffs barriers, it would be possible for developing countries to increase one third of trade GDP ratio. On the other hand, annual growth rate could be possible to increase by 0.6 to 1.6 percent. Sarker (2006) finds only countries with higher trade have a positive relation between openness and growth in a time-series panel data analysis of 51 countries during 1981-2002. However, when the sample countries are tested individually the result changes in favour of only middle income countries. Chen and Gupta (2006) find robust positive result between trade openness and growth in South African Development Community (SADC) over the period of 1990 to 2003. They argue that the change of knowledge and technology in SADC through the openness causes economic growth.

However, many few researchers ended with results that contradict with the ones discussed above. For example Yanikkaya (2003) found, in a cross-section of study of two group countries OECD and Non OECD, that trade liberalization doesn't have simple and straight forward positive relation with alternative measurements of openness. A review by Greenaway et al. (1998) concludes that openness can impact both positively as well as negatively on growth taking into consideration individual country's circumstances. This view is also supported by Bolaky and Freund (2004). However Romer (1993) found that openness causes inflation as in sample of 114 countries. He added that monetary expansion because of openness could deprecate the real exchange rate which causes inflation that could much distortion comparing the benefit from openness. Hsiao (1987) found evidence of no causal relation between growth and openness for four Asian economies. Chow (1987) found a bidirectional causal relationship between export expansion and growth of manufacturing industries in Hong Kong, Singapore, South Korea and Taiwan. Similarly, Kwan and Kwok (1995) found a feedback relationship between exports and economic growth in China for 1952-1985.



### 2.3 Country-specific Time-series Tests

Although most of the empirical tests on the relationship between openness and growth are based typically based cross-country or panel data analyses, a host of country-specific time-series tests have also been conducted. For example, Din et al. (2003) found a bidirectional causal relation between openness and between per capita GDP using the Granger causality test on Pakistan from 1960 to 2001. Taking trade-GDP ratio as an indicator of openness, this study also finds that while co-integration test suggests a long run equilibrium relation where short-run relation is characterised by fluctuation. Similar result is also reported by Liu (1997), who tested China's economic growth and export plus import (as measure of openness) during 1983 to 1995. Haung et al. (2007) find a positive relation in Taiwan where Sachs and Warner (1995) dummy variable is used as openness indicator. Sarker (2006) reports a positive link between Indian openness and growth by using a co-integration test called 'Autoregressive Distributive Lag' (ADL).

Nath and Mamun (2004) used a Vector Autoregression (VAR) model to examine the relationship between growth and trade openness (trade-GDP ratio) and investment in Bangladesh. Using three separate data sets from 1959 to 2000 and then from 1963 to 2000 and finally from 1967 to 1992, they found that 'there is some evidence of trade liberalization accelerating growth in Bangladesh'. The study also found trade openness promoting investment with little evidence of trade affecting income distribution or of income distribution affecting growth or investment. In contrast, Bashar and Khan (2007) studied the impact of liberalization on Bangladesh's economic growth by analyzing the 1974-2002 data with the help of cointegration and error correction methods. Using the Sachs and Warner (D) index as the measure trade openness with separate variables for financial liberalisation and capital opening their findings suggest that 'while financial liberalization has had significant negative impacts on economic growth, the effects of trade and capital account liberalizations were rather insignificant'. They conclude that this unexpected result is 'possibly due to weak supply response and lack of credibility of such reform programs'.

## **2.4 The Measurement Controversy**

While a large number of the cross-country and country-specific studies support the theoretical view that openness positively impact on growth rate, their findings are doubted by Rodriguez and Rodrik (1999), Harrison and Hanson (1999) as well as Krueger (2003). Rodriguez and Rodrik (1999) argue that the measure of the trade openness used in most of the papers which show positive relationships between openness and growth, are flawed. Harrison and Hanson (1999) also view that these 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 open trade policy and long run economic growth” by using time series panel data for the developing countries.

These contrasting views on the measurement issue and lack of any significant positive impact of openness on growth and other real economic variables like export and manufacturing reported by a number authors put an apparently undeniable question mark on the validity of the theoretical premise on the growth-openness nexus. Thus, more intensive and cautious examinations of the prediction based on cross-country regressions as well as individual country studies merit special attention. The contradictory findings in the past empirical works also indicate the necessity of adopting more flawless econometric techniques while using more accurate data.

## **3. Overview of Trade Liberalisation Process in Bangladesh**

Bangladesh, the world’s most density populated developing country, which was a part of British India formed a part of Pakistan in 1947. Though surrounded by huge Indian Territory on its north, east and west borders and separated from the present territory of Pakistan by more than 1000 miles, it became part of Pakistan under the name East Pakistan mainly on the basis religious affinity of majority Muslim population. The partnership with Pakistan, however, did not last long due to political domination and economic exploitation of the West Pakistan based ruling coterie and gained its independence in December, 1971 through an armed struggle. After independence, the country’s political as well as economic policies were principally shaped by the then

government's commitment to socialism, democracy and nationalism. Almost all large and medium scale industrial and business undertakings were nationalised and government controls were placed on virtually all economic activities.

Consistent with the government's economic policy a highly regulated trade regime was put in place that, like many other developing countries, featured in high tariffs and non-tariff barriers to control on imports. Scarcity of foreign exchange reserves was also considered in adopting such conservative and restrictive trade regime as the country's source of foreign exchange earning was limited to mainly raw jute and jute products export only. An overwhelmingly import substitution industrialisation policy complemented the inward-oriented trade policies. But the government soon realised the vices of the close-door policies and began to move toward gradual liberalisation of the regime since mid-1970s. Signing of an agreement to reduce some tariffs on some selected goods with its major trading partners like India, South Korea, Sri Lanka, the Philippines and Thailand in 1974 marked the eventual retreat.

By the end of the year 1975, Bangladesh abandoned socialism as one of its four fundamental principles and decide to adopt market principles in the economy towards the end of the decade. Reforms in trade regime and deregulation in other areas of economy complemented by privatisation followed since the mid-1980s under the auspices of a structural adjustment programme (SAF) financed by the World Bank. Special economic zones were established in some places across the country to attract foreign direct investment as the capital market was in its infancy.

In the process of liberalising import, average tariff rates were reduced to 63 by early 1990s and to only 26 at the beginning of this century from 100 in the preceding decade (Berg and Krueger, 2002). Similarly, number of tariff bands was reduced from 15 in 1992 to 5 in 2003. Other import liberalization initiatives included complementary reforms in import procedures under the Import Policy Order (IPO) and establishment of mandatory pre-shipment inspection (PSI) system under the Uruguay Round Agreement on Customs Valuation. Consistent with the core principles of the WTO, the "Import Policy Order 2003-2006" has further lowered tariffs on not only capital goods but on consumables as well<sup>3</sup>. As can be seen from table 1, Bangladesh has reduced tariff from 1995 to 1999 quicker and faster than its

South Asian neighbours (See also Table 8 in appendix). However, from 1999 to 2003, Bangladesh was the lowest average tariff compare with India and Pakistan. The country has almost lowest tariff during the decay. It can be seen from the table 2 that Trade Tariff Restrictiveness Index (TTRI) in Bangladesh has declined from 20.11 to 14.13 during the last 7 years but it is still higher than the average rate in South Asia<sup>4</sup>. According to *World Trade Indicators-2008*, Bangladesh currently has very high tariff and non-tariff trade barriers compare with other developing countries. It is ranked 113<sup>th</sup> out of 125 countries in terms of trade policy. However, it is ranked 53<sup>rd</sup> in terms of internal market access.

**Table 1: Comparative tariff trend (average) in South Asia (percentage)**

|            | 1986 | 1991 | 1995 | 1999 | 2003 | 2005 |
|------------|------|------|------|------|------|------|
| Bangladesh | 81.8 | 88.6 | 42.0 | 22.2 | 19.2 | 15.2 |
| India      | 100  | 79.2 | 41.0 | 30.0 | 20.0 | 15.3 |
| Pakistan   | 66.0 | 66.0 | 51.0 | 41.7 | 20.6 | 14.3 |

Source: *World and RIS, India, 2004 and UNCTAD Hand Book of Statistics, 2006.*

3. TTRI (MFN applied tariff) - All Goods –‘This index summarizes the impact of each country’s non-discriminatory trade policies on its aggregate imports’ (see world trade indicator).

4. Import policy order 2003-2006 was adopted in order to raise production through the cheaper intermediate goods for industry.

**Table 2: Trends in MFN applied tariff and MFN + NTMs tariff <sup>5</sup>.**

| Indicators                                          |           |           |                | South Asia     |
|-----------------------------------------------------|-----------|-----------|----------------|----------------|
| Time Period                                         | 2000-2004 | 2005-2006 | 2006-07 latest | 2006-07 latest |
| <b>TTRI (MFN applied tariff) - All Goods</b>        | 20.11     | 17.01     | 14.13          | 13.02          |
| <b>OTRI (MFN Applied Tariff + NTMs) - All Goods</b> | 27.66     | 25.36574  | 23.1903        | 17.46          |

Source: World Trade Indicator-2008, World Bank.

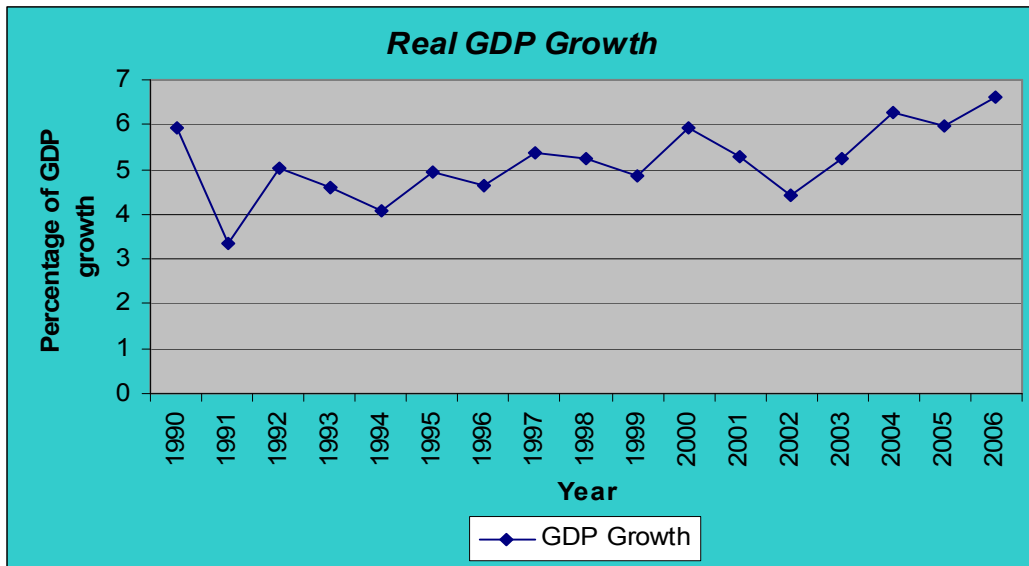
On the export policy front, export performance licensing, export performance benefit scheme (EPBS), special bonded warehouse scheme, duty drawback system, back-to-back L/C System, export credit guarantee scheme (ECGS), and special fund for export promotion were introduced<sup>6</sup>. At the same time, fiscal incentives, such as concessionary duty on imported machinery and “tax holiday” for industries in Export Processing Zones (EPZs) were put in place. However, the country’s exchange rate has been relaxed further recently and at present, there is virtually no restriction on current account transactions which complements the liberalisation on the trade policy front.

As a result of all these reforms, the trade-GDP ratio was raised from 16.24% in 1984 to 33.12% in 2000. According to the World Bank Report 2006, Bangladesh has emerged as one of the few developing countries whose real GDP averaged more than 2% annually during last thirty years. It has registered an average annual growth rate of 5.4% during 2001 to 2005 compared to only 2.4% in during fiscal year 1972-1980. Figure 1 presents the last 17 years’ real GDP growth rates for Bangladesh, which has been slowly increasing during 1990s but gained faster growth since 2003. However, in 1991 and in 2002

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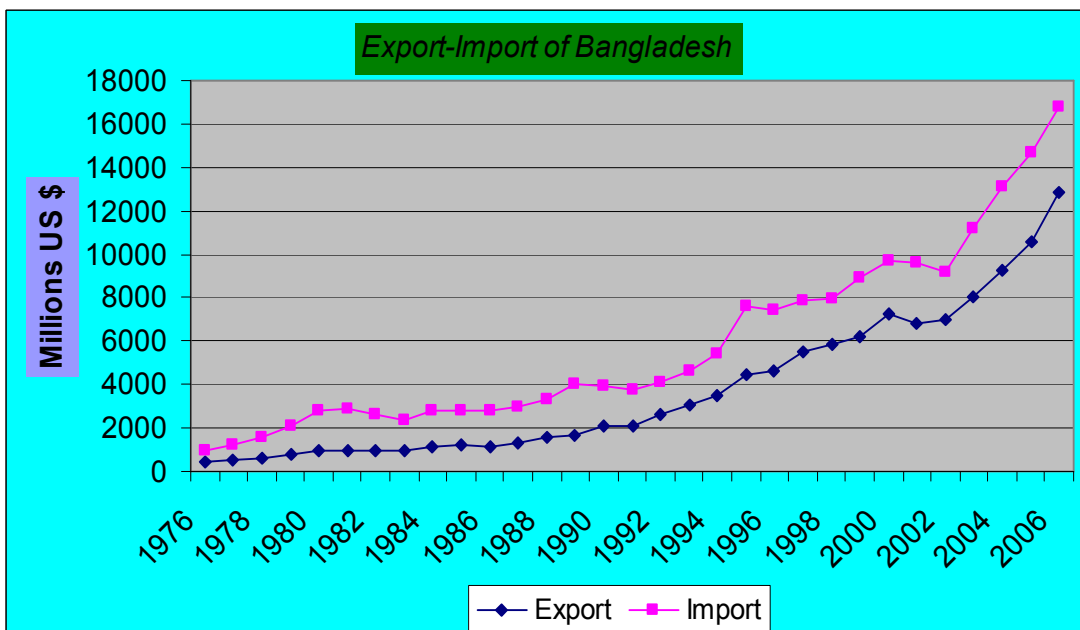
5. OTRI (Overall Tariff Restriction Index) All Goods – “This index summarizes the impact of each country’s trade policies on its aggregate imports”.

6. Steps have been adopted to promote export growth in different times by the government.



Sources: World Development Indicator (World Bank Statistics Data on BD)

Figure 1: Real GDP Growth of Bangladesh from 1990 to 2006.

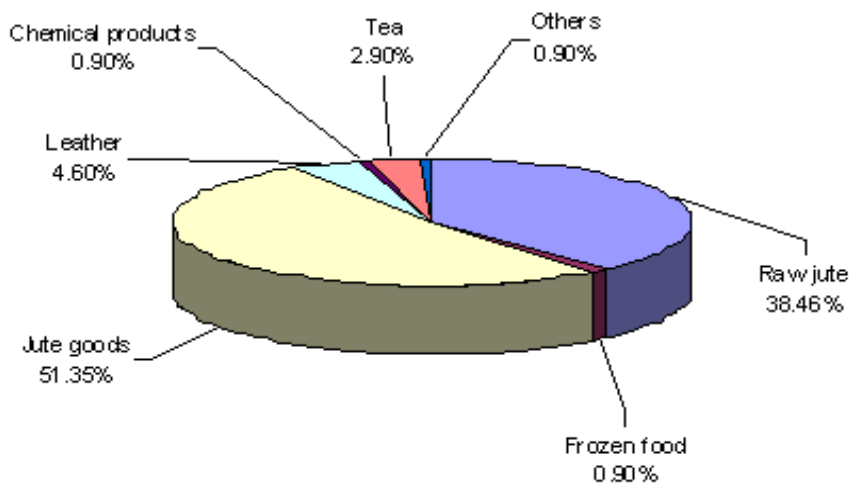


Source: World Development Indicator (Edition: April 2008), World Bank.

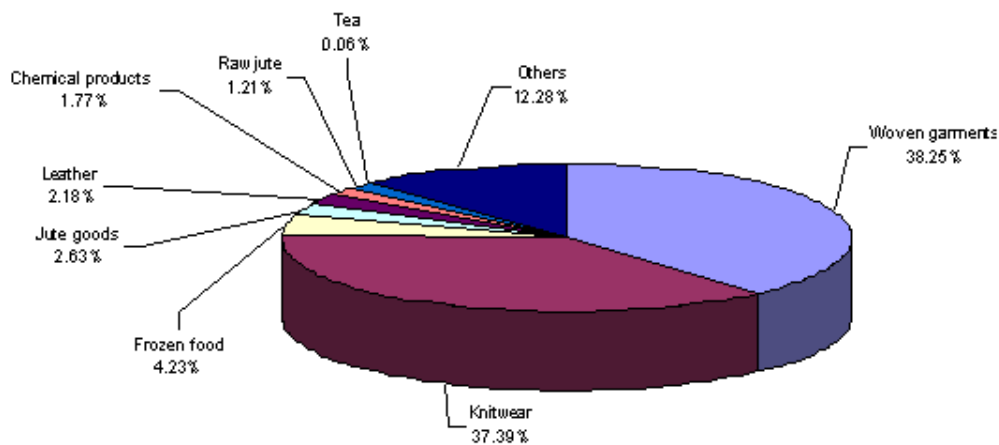
Figure 2: Export-Import trend (Balance of Trade) of Bangladesh

Figure 2 presents the total import and export of Bangladesh during the period from 1976 to 2006. It shows that export and import gained faster growth rates since 1991 reckoning direct positive impact of trade liberalisation and other policy reforms. Total exports were below US\$ 2,000 million in 1978 which have risen to a US\$ 13,000 million mark by 2006.

**Bangladesh Export by Major Products during 1972-1973**



**Bangladesh Export by Major Products during 2006-07**

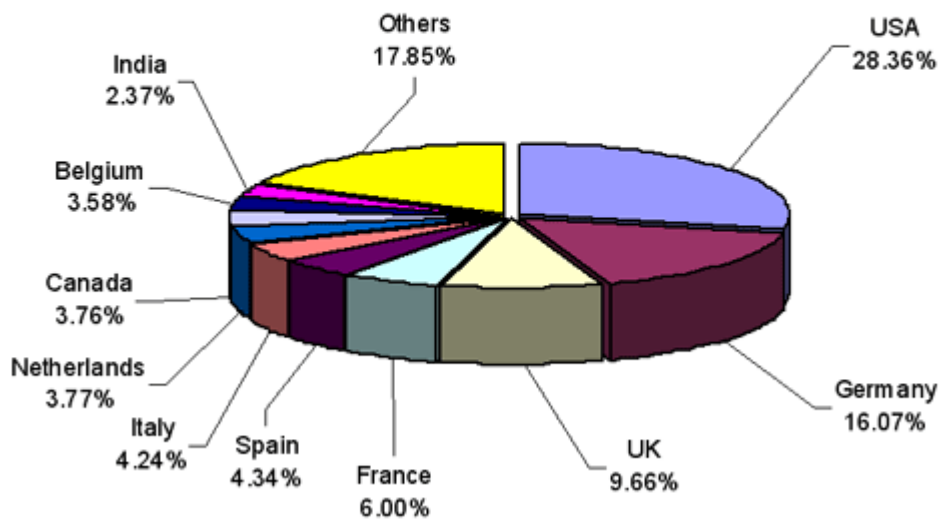


Source: Export Promotion Bureau (EPB), Ministry of Commerce Bangladesh,

Figure 3: Trends in Commodity Wise Export: 1972-2007

Figure 3 show that, woven garments and knitwear emerged as the single largest sector contributing about four-fifths of total export in 2006-2007 against less than 4% share of raw jute and jute products. This is remarkable when set against 89.81% contribution of raw jute and jute products to the total exports in 1972 to 1973. Apart from the ready made garments (RMG), processed shrimp and other frozen foods, pharmaceutical, cement, and leather goods emerged as main exportable items indicating a much diversified and wider base compared what it inherited after its independence.

### Countrywise export during 2006-07



Source: Export Promotion Bureau (EPB), Bangladesh.

Figure 4: Country-wise export during 2006-2007.

Bangladesh has been able to expand its export base gradually across many countries all over the world in recent years. But mainly EU and USA still remain the major importers of Bangladeshi exports both in terms of quantity and value of exportable merchandise. Figure 4 provides a visual representation of the shares of Bangladesh export consumed by different countries in the year 2006-07. It is evident that the EU and USA together consumes more than 78% of total exports for the year.



## 4. The Model, Data and Methodology of the Study

### 4.1 Empirical Framework

Based on Solow (1956) model of endogenous growth, we adopt the following growth model for Bangladesh with respect to inputs and outputs.

$$Y_t = F(K_t, A_t, L_t) \quad (1)$$

Where  $Y$  = output,  $K$  = capital,  $L$  = labour and  $A$  = efficiency of labour through the changes of technology. Subscript  $t$  denotes time which assumes that outputs change over time if the inputs change.  $A$  and  $L$  enter multiplicatively in this equation, so we can specify  $A$  as the function of openness where openness is defined as export plus import to GDP ratio.

$$A = f(\text{Openness})$$

$$\text{Where Openness} = \frac{\text{EXPORT} + \text{IMPORT}}{\text{GDP}}$$

Following Frankel and Romer (1999), Dollar and Kraay (2003) Romalis (2006), we use trade GDP ratio as indicator of Bangladesh's openness. Initially our model assumes that Bangladesh's growth is the function of total investment and openness. Then a log-linear specification of the model can be presented as follows:

$$\ln RGDP = \alpha_0 + \alpha_1 \ln TIN + \alpha_2 OP + \varepsilon_t \quad (2)$$

Where,  $\ln RGDP$  = log of Real Gross Domestic Production,

$\ln TIN$  = log of Total investment (Physical Capital),

$OP$  = Openness.

From the theoretical view that the total investment and openness are positively related with growth of economy and for that reason, the expected sign should be  $\alpha_1 > 0$  and  $\alpha_2 > 0$ .

## 4.2 The Data

Real GDP is taken at constant price of local currency in order to identify real growth rate of Bangladesh. Total investment includes both private and public investment in local currency. Data has been taken from the secondary sources; mainly from '*World development Indicator 2008*' and Bangladesh Economic Review 2007 and various issues of other statistical publications of the Ministry of Finance, Government of the People's Republic of Bangladesh (see appendix table 9). Only 26 years data from 1980 to 2005 are included in the test although data are available for all the years from 1972. The reason for excluding data for years from 1972 to 1979 lies in the fact that during the whole 1970s Bangladesh had undergone frequent and unpredictable changes in economic policies including the trade policy. The same also characterises instability in the political front as well. Thus, it is assumed that the data for the first post-independence decade, if included in the chosen sample, may inflict arbitrariness in the whole sample. The quarterly data is not available from the secondary sources and for that reason the sample contains only annual data.

It should, however, be mentioned that in most of the tables and figures, data for the period from 1976 to 2006 has been used in order to provide a longer-term behaviour trend of the variables.

## 4.3 Econometric Methodology

It is observed that result from any regression analysis becomes worthwhile only when the variables are stationary, the error term  $\varepsilon_t$  is serially uncorrelated and homoscedastic and the period under test are sufficiently long to reflect long-run relationship. Therefore, to ensure that the data properties are in line with these requirements, we adopt the following three-step procedure for our study:

In the beginning, the stationarity properties of the data series are checked in order to determine the order of integration of the series. We first analyse the plotted graph of the data in order to check the stationarity and then proceed to Unit Root test. There

are many different tests for checking stationarity but we will mainly use Augmented Dickey-Fuller (ADF) test, KPSS test and Phillips and Peron test. These tests are different from each other based on their treatment of serial ‘correlation and heteroskedasity’ in the error terms. These tests will be applied both in the levels and first differences of the series. We will find out the same order of integration in order to go to step two.

In the second step, we test for co-integration among the variables involved in our chosen model based on the order of integration of the series. There are quite a few alternative methods for determining co-integration viz., ordinary least squares, nonlinear least squares, maximum likelihood in an error correction model, principal components, and canonical correlations. We adopt the ‘*Engle-Granger Residual*’ based two step method to determine whether there is any cointegration relationship between/among the variables in our model. We then conduct Johansen’s (1988, 1995) maximum likelihood methodology to fix the adjustment process through ECM (Error Correction Modelling). Once the test confirms existence of only one cointegrating vector then we can proceed to the next step i.e., error correction mechanism after determining the precise relationship among the variables. In that way, we will conduct the weak exogeneity test to precisely define the dependent variable.

Finally, we examine the causality dynamics between the variables by carrying out Granger causality tests (Granger, 1986). The well-known procedure is to regress past values of a stationary series  $Z_{1t}$ , on current values of some other stationary process  $Z_{2t}$ . If contains information which helps to model  $Z_{2t}$ , then in the Granger sense,  $Z_{1t}$  causes  $Z_{2t}$ . The reverse procedure allows testing whether  $Z_{2t}$  causes  $Z_{1t}$ . If, however, both regressions provide positive evidence for causality, then it can be concluded that a bidirectional relationship exists between  $Z_{1t}$  and  $Z_{2t}$ . The bilateral relationship of  $y$  and  $z$  are as follows;

$$\Delta y_t = \alpha_0 + b_0 \varepsilon_{t-1} + \sum_{i=1}^m c_{0i} \Delta y_{t-i} + \sum_{j=1}^n d_{0j} \Delta z_{t-j} + \mu_t \quad (3)$$

$$\Delta z_t = a_1 + b_1 \varepsilon_{t-1} + \sum_{i=1}^p c_{1i} \Delta z_{t-i} + \sum_{j=1}^q d_{1j} \Delta y_{t-j} + \mu_t \quad (4)$$

## 5. Empirical Results

This section examines the structural factor of openness that may have positive effect on economic growth. For this purpose, we work with the time series data where variables are estimated in different time series econometrics techniques. We begin with a simple log linear regression specification and then extend different possible equation to find long run relationship through the Johansen techniques. In the process, we finally conduct weak exogeneity test and Granger causality tests in order to determine the shape and direction of causality among the variables considered for the model.

### 5.1 Unit Root Test of Individual Series

Stationary is desirable property to estimate our cointegration. If our series is I (1), we can estimate the long run relationship because non-stationary time series variables will exhibit trending behaviour. In autoregressive process, the present value of  $Y_t$  will depend on its past value  $Y_{t-1}$  and a error disturbance  $\varepsilon_t$ . We can consider the simple AR (1) model,

$$Y_t = \mu + \phi Y_{t-1} + \varepsilon_t \quad (5)$$

From equation 5, we can write as follows,

$$Y_t - \phi Y_{t-1} = \mu + \varepsilon_t \quad (6)$$

When is  $\phi = 1$ , implies that the series is I (1) process and Random Walk with drift. It has a unit root and we can take first difference to remove the trend. On the other hand, when is  $|\phi| < 1$ , the series is I (0) which has not unit root (Stationary).

As is already noted, unit root test is important to identify the stationarity of data series as well as to find out the order of integration of the data (that is whether the series is of I (1) or I (0) order). Initially we graphically present the individual variable in order to check whether it follows random walk. We can view from figure 5 that real GDP (lnRGDP=Lrgdp), Total investment (lnTin=Lin) and Openness (OP=opc) when

plotted at levels show upward sloping trend and for that reason it could have unit root (left hand side graphs). So we use first difference of the variables. With this change the variables now seem to show stationarity (right hand side graphs).

The graphs at level

The graphs at difference.

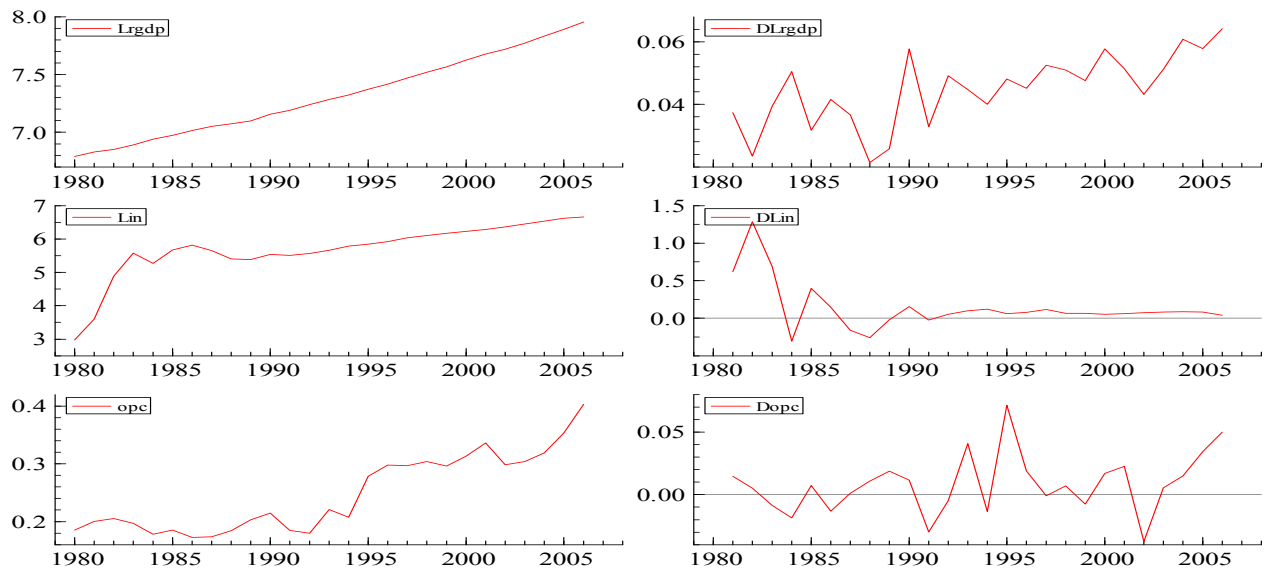


Figure 5: Graphical view of the variables.

*Note: Lrgdp=lnRGDP, Lin=lnTIN and opc=OP at level and DLrgdp= DlnRGDP, DLin=DlnTIN and Dopc=DOP at difference.*

We then applied Augmented Dickey-Fuller test (ADF), Phillips-Perron (P-P) and Kwiatkowski-Phillips-Schmidt-Shin (KPSS) test in order to determine the stationarity level of each of the variables. The three tests are based on estimating the test regression including a trend and intercept with respect to our data.  $Y$  separately represents our each variable (lnRGDP, lnTIN, OP).

$$\text{ADF Test: } \Delta Y_t = \alpha_0 + \beta' D_t + \gamma Y_{t-1} + \sum_{j=1}^p \psi_j \Delta y_{t-j} + \varepsilon_t \quad (7)$$

$$\text{PP Test: } \Delta Y_t = \alpha_0 + \beta' D_t + \gamma Y_{t-1} + \mu_t \quad (8)$$

Where,  $\alpha_0 = \text{Constant}$ ,  $\beta' D_t = \text{Trend}$  and  $\gamma = \phi - 1$

$$H_0: \gamma = 0 \text{ (Unit Root)}$$

$$H_1: \gamma \neq 0$$

$$\text{KPSS Test: } \begin{aligned} Y_t &= \alpha_0 + \beta' D_t + v_t + \mu_t \\ v_t &= \mu_{t-1} + \varepsilon_t, \varepsilon_t \sim WN(0, \sigma_\varepsilon^2) \end{aligned} \quad (9)$$

$$\text{Where, } H_0: \sigma_\varepsilon^2 = 0 \text{ (Stationary)}$$

$$H_1: \sigma_\varepsilon^2 \neq 0$$

Null hypothesis of ADF and PP test is that the series has a unit root (i.e., non-stationary). On the other hand, the null hypothesis of KPSS is that the series is stationary (does not contain a unit root). We could not find stationary at level with Trend and Constant in none of these unit root test approaches. In all three tests it is found that at 5% level of significance all the three variables are stationary at first difference with trend and constant. We use the lag length one (1) because of the paucity of the sample size.

The critical value in the level of 1% for ADF and PP are (-3.50) from the 'Mackinnon (1996) one sided p-values'. Where the test value in both of ADF and PP is greater than the 1% critical value in level which implies we can not reject the null hypothesis that has a unit root. On the other hand, the critical values of KPSS are 0.31 at 1% level so that we can not reject our null hypothesis (stationary).

We then used first difference in order to remove the trend from our data as well as check the order of integration. The critical value of ADF and PP test are (-3.50) at 1% level with trend and constant. However, the critical value is (-2.99) at 5% level which is the significant level of our model integration I (1). The test value both of ADF and PP are smaller than the critical value at 5% level which implies rejection of null hypothesis. The critical values of KPSS are 0.31 at 1% level. KPSS test values reject the null hypothesis.

**Table 3: Results of Order of Integration Tests**

| Test for I(0) ( At Level)               |       |      | Test for I(1) (First Difference) |         |          |
|-----------------------------------------|-------|------|----------------------------------|---------|----------|
| lnRGDP                                  | lnTIN | OP   | ΔlnRGDP                          | ΔlnTIN  | ΔOP      |
| <i>Augmented Dickey-Fuller test</i>     |       |      |                                  |         |          |
| 4.85                                    | -3.42 | 0.67 | -5.58***                         | -3.44** | -4.87*** |
| <i>Phillips-Person test</i>             |       |      |                                  |         |          |
| 10.76                                   | -3.29 | 0.52 | -5.92***                         | -3.23** | -4.86*** |
| <i>Kwiatkowski-Philips-Schmidt-Shin</i> |       |      |                                  |         |          |
| 0.78                                    | 0.69  | 0.71 | 0.14***                          | 0.25*** | 0.05***  |

Note: \*\*\* denotes significant at 1 % level and \*\* denotes significant at 5% level. The critical value both of ADF and PP are -2.99 at 5% level of significance and the critical value of 0.31 at 1% level of significance.

## 5.2 Cointegration Analysis

It is recognised that ordinary least square (OLS) method of regression is not always able to depict the cointegration or long-run relation among the variables of model. To find out the actual long-run relation among the variables, the cointegration test in one form or other should be undertaken. The economic implication of testing the cointegration is to find out the equilibrium or to establish a multivariable dynamic model. Engle-Granger residual based two steps and Johansen technique cointegration approaches are considered as two most effective mechanisms to ascertain the long-run relationship.

### 5.2.1 Engle-Granger's two step cointegration test

Granger (1986) finds that some time series data have unit root (non-stationary) and for that reason the t-hypothesis  $\beta = 1$  is not valid. Engle and Granger (1987) then develop a technique to find out long run relation among the non-stationary time series variables by testing standard error term. They agree when the series is non-stationary I (1), the error term will be I (0) for cointegration vector of  $\alpha$ . On the other hand if the error term is not stationary I (1), there will be no cointegration among the variables. They use two steps, first run the regression (Ordinary Least Square) and second, test the error term in the regression. When the error term is stationary, the null hypothesis

noncointegration is rejected and alternative hypothesis of existing of cointegration is accepted.

We applied Engle-Granger cointegration approach to find out existence of long-run relation in our model. We first estimated the OLS. The result is as follows:

$$\ln\text{RGDP} = 0.164 \ln\text{TIN} + 3.487 \text{OP} + 5.519 + \varepsilon_t \quad (10)$$

(0.35)      (0.42)      (0.15)

$R^2 = 0.91$        $\text{Sigma} = 0.35$   
 $\text{Adjusted } R^2 = 0.90$        $\text{F-Statistics} = 127.18$   
 $\text{S.E. of regression} = 0.10$        $\text{Prob. (F-Statistics)} = 0.000^{***}$  Sum Square  
 $\text{Residual} = 0.27$        $\text{Durbin-Watson Stat.} = 1.83$

*Note: Inside the first brackets are Standard Error of the variables and coefficient.*

When tested by the equation (2), the real GDP (growth) appears in the equation (10) strongly positively related with openness while weakly related with total investment. The test results support our model specification. High R-square and Durbin-Waston statistic indicate no autocorrelation and the overall significance (f statistics) shows that the model is well fitted.

We then estimated the residual which is the second step of Engle-Granger technique because unless the residual is stationary then cointegration test results may give misleading indication. Where our null hypothesis is  $H_0$ : = has no cointegration, and alternative hypothesis is  $H_a$ : has Cointegration. The residual estimation is as follows:

$$\hat{\varepsilon}_t = \ln\text{RGDP} - 3.487\text{OP} - 0.164\ln\text{TIN} - 5.519 \quad (11)$$

In the second step, we plotted the residual in graph to see how drifting the line of the graph is. The graph (figure 8) shows that there is no sign of a random walk (non-stationary). We also checked residual for unit root test through the ADF test. The ADF t-value is -2.66 where the critical value is -2.62 at 5% level and -2.56 at 10% level using 1 lag which rejects the null hypothesis of having a unit root at 5% level of significance. Supporting the Engle-Granger view of cointegration, in our model, the error term is I (0) order of integration which implies that among the variables a long run relation exists by rejecting the null hypothesis of no cointegration.



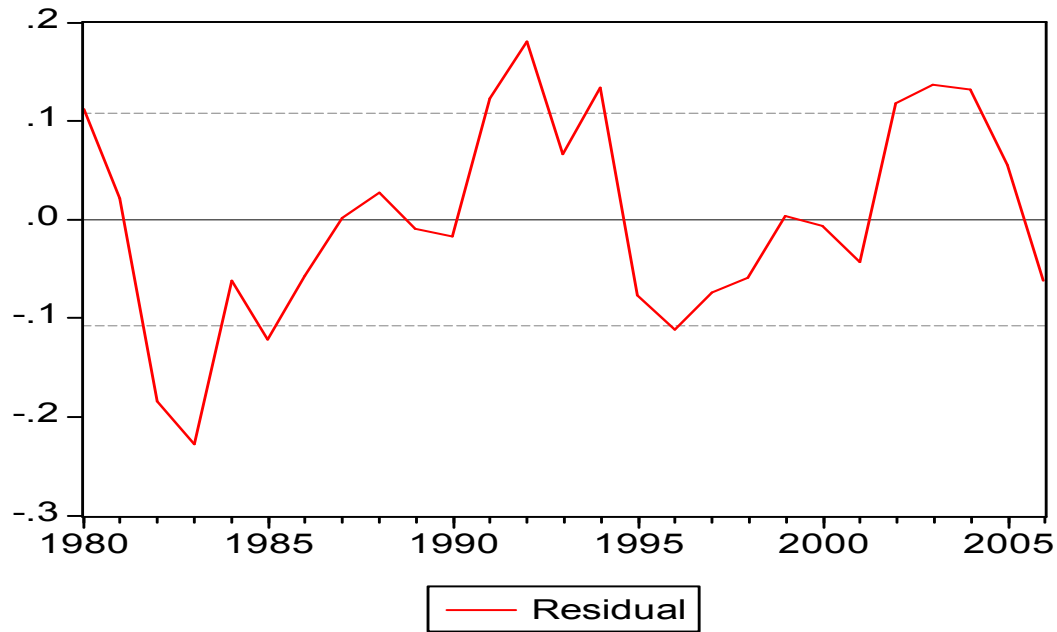


Figure 6: Stationary graph of residual in Engle-Granger procedure.

### 5.2.2 Johansen's Full-Information Maximum Likelihood Method

Although the Engle-Granger two-step procedure is a powerful device to check for existence of long-run relationship it suffers from few deficiencies in that it cannot exactly calculate the number of cointegration vectors existing in the model. However, their estimation of long run relationship is based on the standard error term which may mislead the result. Johansen (1988, 1995) and Johansen and Juselius (1990) approach helps overcome this problem. Johansen's technique is based on the method of maximum likelihood which allows interference with the cointegration variables using likelihood ratio and cointegration rank. This approach does not presuppose any particular variable to be endogenous rather treats all variables equally in terms of possibility of one's being endogenous. In this case, maximum likelihood cointegration approach can be used to calculate the number of cointegrating vector(s) in the model through VAR estimation. The null hypothesis in Johansen approach is  $H_0$ : has no cointegration and alternative hypothesis is  $H_a$ : has cointegration.

We tested our model to find out the number of cointegration existence through Johansen's techniques. We find one cointegration vector. The results of Johansen's cointegration test are presented in table-4.

**Table 4: Johansen's Cointegration Test**

| Trace Test      |                        |                                              | Maximum Eigenvalue Test |                        |                                              |
|-----------------|------------------------|----------------------------------------------|-------------------------|------------------------|----------------------------------------------|
| Null Hypothesis | Alternative Hypothesis | Test Statistics                              | Null Hypothesis         | Alternative Hypothesis | Test Statistics                              |
| R = 0           | R=1                    | <b>73.153<sup>***</sup></b><br><b>(48.5)</b> | R = 0                   | R = 1                  | <b>49.19<sup>***</sup></b><br><b>(30.34)</b> |
| R ≤ 1           | R=2                    | 23.97<br>(30.45)                             | R ≤ 1                   | R = 2                  | 16.43<br>(23.65)                             |
| R ≤ 2           | R=3                    | 7.53<br>(12.25)                              | R ≤ 2                   | R = 3                  | 7.54<br>(16.26)                              |

*Note: (\*\*\*) denotes cointegration at 1% level and inside the first bracket presents the critical value at 1% level. The critical value of Trace test are 48.5 at 1% level and is 42.44 at 5% level which is lower than test statistics and for that reason we accept the alternative hypothesis. The critical values of maximum Eigenvalue test are 30.34 at 1% level and 25.54 at 5% level. We reject the null hypothesis and accept alternative hypothesis of cointegration at 1 % level.*

Both the Trace and Eigenvalue statistics reject the null hypothesis R=0 at both 1% level but the alternative hypothesis R = 1 is accepted. On the other hand, higher critical value than trace as well as eigenvalue test statistics clearly indicate that the null hypothesis of existence of two or more cointegration (R≤1 and R≤2) is rejected. So the alternative hypothesis i.e., R=1 is established implying the existence of one cointegrating vector in our model. Besides, the existence of one cointegrating vector implies that our model is of order I (1) and there exists a significant long-run relation among the variables.

We used first order of Vector Auto Regression (VAR) in order to find out cointegration. To estimate the VAR, we used constant and unrestricted trend (constant). We also used restricted trend because the variables mainly LRGDP and LNK are upward sloping (linear deterministic trend) adding that we find the stationary of our data with trend and constant. We tested the impulse respond graph; Figure 8 in appendix presents that the adjusted relationship among the variables. We used 1 lag in order to get the estimated result because of annual data. Tables 5 and 6 present the standardized  $\beta$  (Beta coefficient) and adjusted coefficient of Alpha ( $\alpha$ ).

**Table 5: The Standardized Beta coefficient**

| <b>Variables</b> | <b>lnRGDP</b> | <b>lnTIN</b> | <b>OP</b> |
|------------------|---------------|--------------|-----------|
| <b>lnRGDP</b>    | 1.0000        | 2.23         | -0.45     |
| <b>lnTIN</b>     | -0.24         | 1.00         | 0.01      |
| <b>OP</b>        | 0.18          | -5.87        | 1.00      |
| <b>TREND</b>     | -0.035        | -0.27        | 0.01      |

*Note: The horizontal variables present Beta value for vertical*

**Table 6: Adjusted coefficients of Alpha**

| <b>Variables</b> | <b>lnRGDP</b> | <b>lnTIN</b> | <b>OP</b> |
|------------------|---------------|--------------|-----------|
| <b>lnRGDP</b>    | -0.06         | -0.01        | -0.01     |
| <b>lnTIN</b>     | 2.7           | -0.0056      | 0.22      |
| <b>OP</b>        | 0.014         | -0.0065      | -0.56     |

*Note: Horizontal variables presents the adjusted coefficients of Alpah for vertical variables.*

Both of Beta and Alpah is positively related with the relation between openness and growth (see also VECM impulse Respond, Figure 9 in appendix)

### 5.3 Weak Exogeneity Test:

To determine the exogenous variables among the all variables in the model after existing cointegration is called exogeneity test. There are mainly three concepts for exogeneity (Weak, Strong and Super exogeneity). The  $\chi^2$  based weak exogeneity test is required to estimate our result. If we assume X variable is weakly exogenous, it is a function of only lagged Zs and the parameter of Z are independent.

We found one cointegration vector which implies long run relation of the variables but as we have three variables, we found only one cointegration so that we assume three possible relationships among the variables of (lnRGDP, lnTIN and OP). It would be possible one variable is endogenous in long run out of real GDP, total investment or openness. However, we don't know which variable is dependent and which are independent. We impose the cointegration restriction in order to test the weak exogeneity . We impose the restriction that Rreal GDP (lnRGDP) is dependent. On the other hand, the total investments as well as openness are independent. The reduce form of the coefficient are found as expected sign implies investment and openness are positively related in the long run. There is also a trend which has very small positive effect. The adjustment coefficient of Alpha -0.114 which appear right sign. The estimation result suggest from weak exogeneity test that our restriction is valid at 5% level of significance which implies the Real GDP is endogenous where total investment and openness are exogenous. The following equation is as given below:

$$\ln\text{RGDP} = 0.21\ln\text{TIN}+0.12\text{OP}+0.004 \text{Trend} \quad (12)$$

From the above equation (12) suggests that, Bangladesh's real GDP is positively related with investment and openness in the long run. Total investment and openness are weakly exogenous in the long run with respect to real GDP as endogenous variables. We found from Engle-Granger residual based cointegration test that openness has a higher positive relation (3.478) with growth in the long run but the relation is very small in weak exogeneity. The Bangladeshi policy makers may be influenced by this outcome but we should think the small positive effect from

openness. We have tried to make a parsimonious equation but our observations are too low to run equation and variables for short run relationship. But we tested Granger causality which is also dynamic in econometrics to describe the short run relation in both way among the variables.

## 5.4 Granger Causality Test:

Granger (1969) method can be described the casual relationship in the short run among the variables in our model. The null hypothesis is ‘X does not cause Y’ and the alternative hypothesis is ‘X cause Y’. This method also checks other way round relation between the variables. The main explanation of Granger causality is that how does the present value of one variable can be illustrated by the lag values of other variables.

Following Granger (1969) the casual relations among the variables has been examined by estimating the test regressions bellow:

$$\ln RGDP_t = \alpha_0 + \sum_{i=1}^p \alpha_i \ln RGDP_{t-i} + \sum_{i=1}^q \beta_i OP_{t-i} + \varepsilon_t \quad (13)$$

$$OP_t = \alpha_0 + \sum_{i=1}^p \alpha_i OP_{t-i} + \sum_{i=1}^q \beta_i \ln RGDP_{t-i} + \varepsilon_t \quad (14)$$

$$\ln RGDP_t = \alpha_0 + \sum_{i=1}^p \alpha_i \ln RGDP_{t-i} + \sum_{i=1}^q \beta_i \ln TIN_{t-i} + \varepsilon_t \quad (15)$$

$$\ln TIN_t = \alpha_0 + \sum_{i=1}^p \alpha_i \ln TIN_{t-i} + \sum_{i=1}^q \beta_i \ln RGDP_{t-i} + \varepsilon_t \quad (16)$$

$$OP_t = \alpha_0 + \sum_{i=1}^p \alpha_i OP_{t-i} + \sum_{i=1}^q \ln \beta_i TIN_{t-i} + \varepsilon_t \quad (17)$$

$$\ln TIN_t = \alpha_0 + \sum_{i=1}^p \alpha_i \ln TIN_{t-i} + \sum_{i=1}^q \beta_i OP_{t-i} + \varepsilon_t \quad (18)$$

The joint hypothesis of F-Statistic for each equation is as follows:

$$H_o : \beta_1 = \beta_2 = \beta_3 = \dots = \beta_i = 0$$

**Table 7: Granger Causality Test Results**

| Variables                | $\Delta \ln \text{RGDP}$ | $\Delta \ln \text{TIN}$ | $\Delta \text{OP}$ |
|--------------------------|--------------------------|-------------------------|--------------------|
| $\Delta \ln \text{RGDP}$ | -----                    | 6.11**                  | 0.52               |
| $\Delta \ln \text{TIN}$  | 0.12                     | -----                   | 0.11               |
| $\Delta \text{OP}$       | 7.50**                   | 8.26***                 | -----              |

*Note: The F-Statistics values of overall significance are presented in the table. (\*\*\*) denotes reject the null hypothesis that horizontal variables does not cause vertical values to change at 1% level and (\*\*) denotes at 5% level of significance.*

It follows from the test results that

- (a) The hypothesis that  $\Delta \ln \text{TIN}$  does not Granger cause  $\Delta \ln \text{RGDP}$  cannot be rejected while the opposite hypothesis (i.e.,  $\Delta \ln \text{RGDP}$  does not Granger cause  $\Delta \ln \text{TIN}$ ) is rejected at 5% significance level. Therefore, it is fairly evident that the Granger causality runs one-way from  $\Delta \ln \text{RGDP}$  to  $\Delta \ln \text{TIN}$ .
- (b) On the causality between openness ( $\Delta \text{OP}$ ) and growth ( $\Delta \ln \text{RGDP}$ ), the hypothesis that  $\Delta \text{OP}$  does not Granger cause  $\Delta \ln \text{RGDP}$  is rejected while the same for  $\Delta \ln \text{RGDP}$  Granger causing  $\Delta \text{OP}$  can be rejected at 5% significance level. This implies that here Granger causality runs from  $\Delta \text{OP}$  to  $\Delta \ln \text{RGDP}$ .
- (c) On the other hand, in the case of  $\Delta \text{OP}$  and  $\Delta \ln \text{TIN}$ , the hypothesis that  $\Delta \text{OP}$  does not Granger cause  $\Delta \ln \text{TIN}$  is rejected at 1% level of significance implying a one-way causality running from  $\Delta \text{OP}$  to  $\Delta \ln \text{TIN}$ .

In sum, the results of the Granger causality test suggest that there exist strong unidirectional causality between economic growth and investment; between trade openness and economic growth; and between trade openness and investment.

## 6. Conclusion

The specific purpose of this study is to examine the effect of trade openness on economic growth performance of Bangladesh with a supplementary aim to determine the relationship among economic growth, trade openness and investment. In doing so the study uses Engle and Granger's (1987) two-steps cointegration and error correction procedure followed by an application of Johansen's (1988, 1991) Full-Information Maximum Likelihood Method and Granger's (1969) causality test. The results of the cointegration tests testimony that OP and lnTIN possesses a long-run equilibrium relationship with lnRGDP growth, which is reinforced by the results of the Granger causality test. However, the weak exogeneity test shows that openness and total investment are independent variable and the real GDP is dependent variable confirming us a long run equilibrium and positive relation. Through Granger's causality test we also established bi-directional causality between OP and RGDP, TIN and RGDP, and TIN and OP which is consistent with the respective theoretical predictions with the exception of the direction of causality between TIN and OP.

The empirical results of the tests clearly indicate that:

- (a) The time series for all the sample data possess stationarity at the first difference with constant and trend;
- (b) There exists a long-run equilibrium relationship among the variables; and
- (c) Increase in openness (OP) Granger causes both growth of real GDP and growth of total investment (TIN) while increase of real GDP granger causes total investment growth (TIN).

The findings of the present study are in line with that of Nath and Mamun (2004) so far as the direction of causal link between openness and growth is concerned. The finding is also consistent with their report in respect of investment and openness relation. But unlike their study, the current study finds significantly unidirectional causality between openness and economic growth in Bangladesh and the test results in this respect are robust. The results of the present study, however, substantially differ

from that of Bashar and Khan (2007) who reported an insignificant relationship between openness and growth.

Differences in findings of the study from these earlier studies may be due to difference in the sample period as well as use of different econometric techniques. The difference may also be caused by the arbitrariness underlying the measure of openness used in the study. Nevertheless, the econometric methodologies and techniques adopted in the present study seem to be clearly superior to the ones used in those earlier studies. In this sense, the results of this study may serve as a useful guide for future studies in this area and this becomes particularly true if the adopted measure is reasonably free from biases.

The empirical findings of the current study suggest that Bangladesh should continue with its current policy in terms of trade openness since more openness implies increased investment and enhanced growth. Spectacular growth of trade share in Bangladesh during most recent years suggests that trade openness complemented with domestic economic and competition policies may bring a formidable and long lasting source of sustained economic growth.

On the other hand, Bangladesh should re-examine the GDP-investment relation as the current study reports causality here running from GDP to investment, which is not consistent with the standard theoretical prediction. It also indicates that the economy might be characterised by structural problems or imbalances in the field of investment.

Future studies in this area should consider incorporation of other important variables significantly influencing the growth pattern of Bangladesh. At the same time, caution should, however, be exercised particularly while selecting the sample period. That is to say that the fact that Bangladesh has started to reap the benefits of its policy leaning towards gradual trade openness only recently warrants special attention if true depiction the effect of openness on growth or other macroeconomic variable is aimed at.



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## APPENDICES

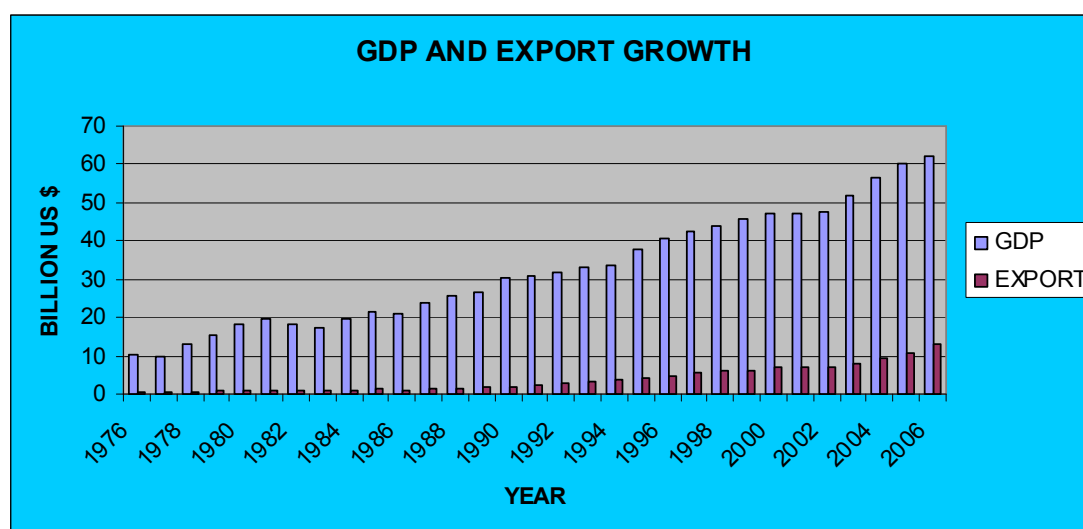
**Table 8: Trend in applied tariff rates, 1999/00 and 2005-2006**

| Product and processing              | Number of Items | Tariff Average |           | Standard Deviation | Coefficient of Variance |
|-------------------------------------|-----------------|----------------|-----------|--------------------|-------------------------|
|                                     |                 | 1999/00        | 2005/2006 |                    |                         |
| Total                               | 6637            | 22.2           | 15.5      | 8.8                | 0.6                     |
| 1 <sup>st</sup> Stage of processing | 932             | 17.7           | 14.9      | 10.0               | 0.7                     |
| Semi-Processed                      | 2014            | 20.6           | 14.4      | 7.6                | 0.5                     |
| Fully Processed                     | 3691            | 24.1           | 16.3      | 9.1                | 0.6                     |

*Source: Trade Policy review 2006, WTO Secretariat*

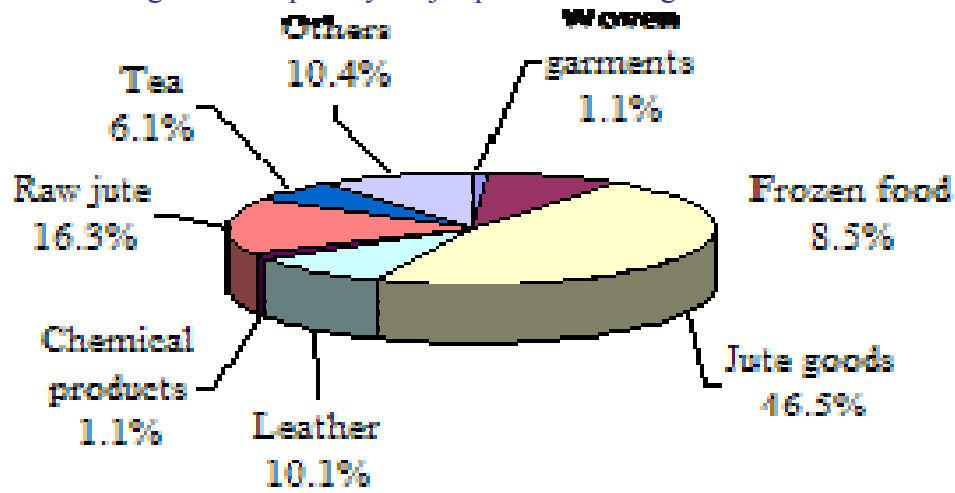
**Table 9: Sources of Data for Regression Analysis**

1. World Development Indicator (April 2008), Country Group: Bangladesh, World Bank Secondary Data Sources.
2. Bangladesh Economic Review (2007 & various years), Ministry of Finance, Peoples Republic of Bangladesh.

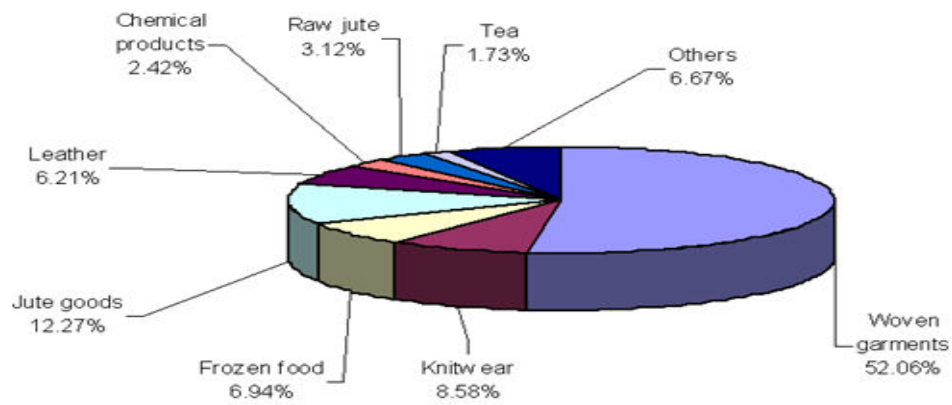


**Figure 7: GDP and Export Growth of Bangladesh.**

Bangladesh Export by Major products during 1982-1983



Bangladesh Export by Major Products during 1992-1993



Bangladesh Export by Major Products during 2006-07

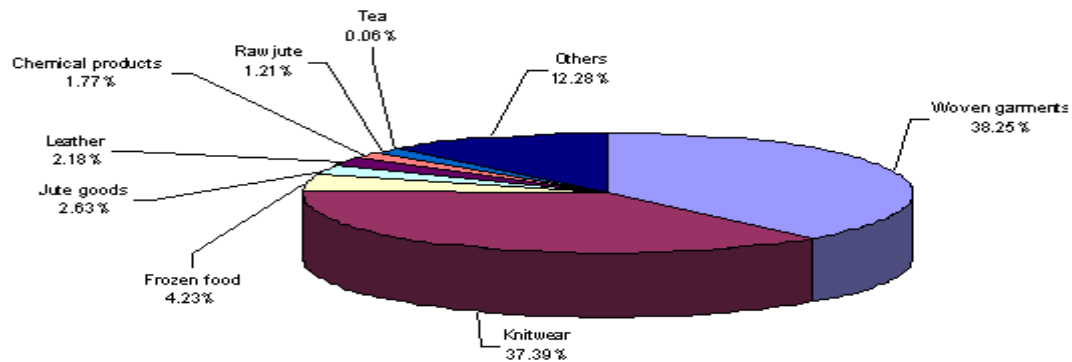
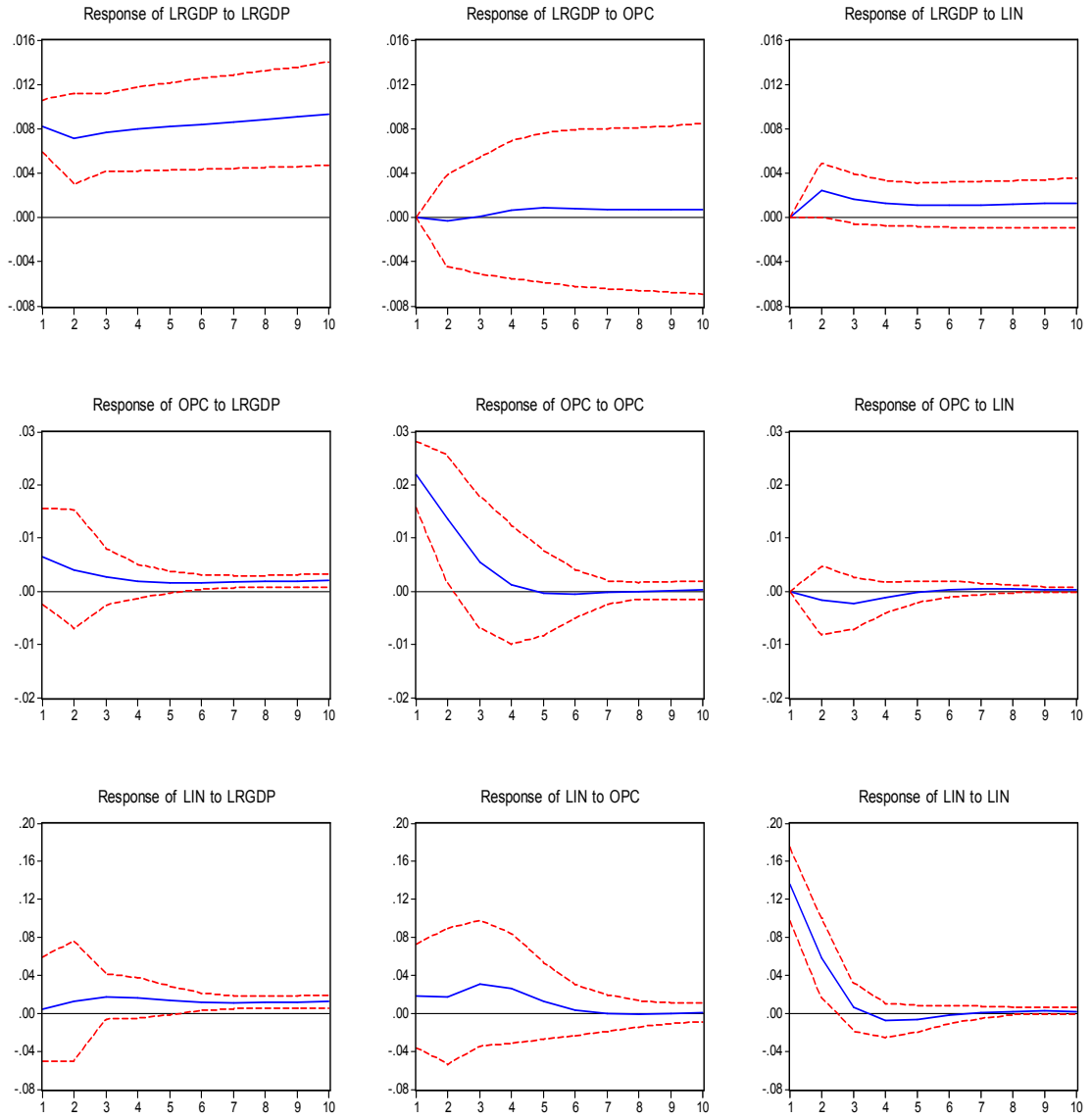


Figure 8: The diversification of Bangladesh's export.



Response to Cholesky One S.D. Innovations  $\pm 2$  S.E.



**Figure 9: Impulse Respond from Unrestricted VAR.**

Response to Cholesky One S.D. Innovations

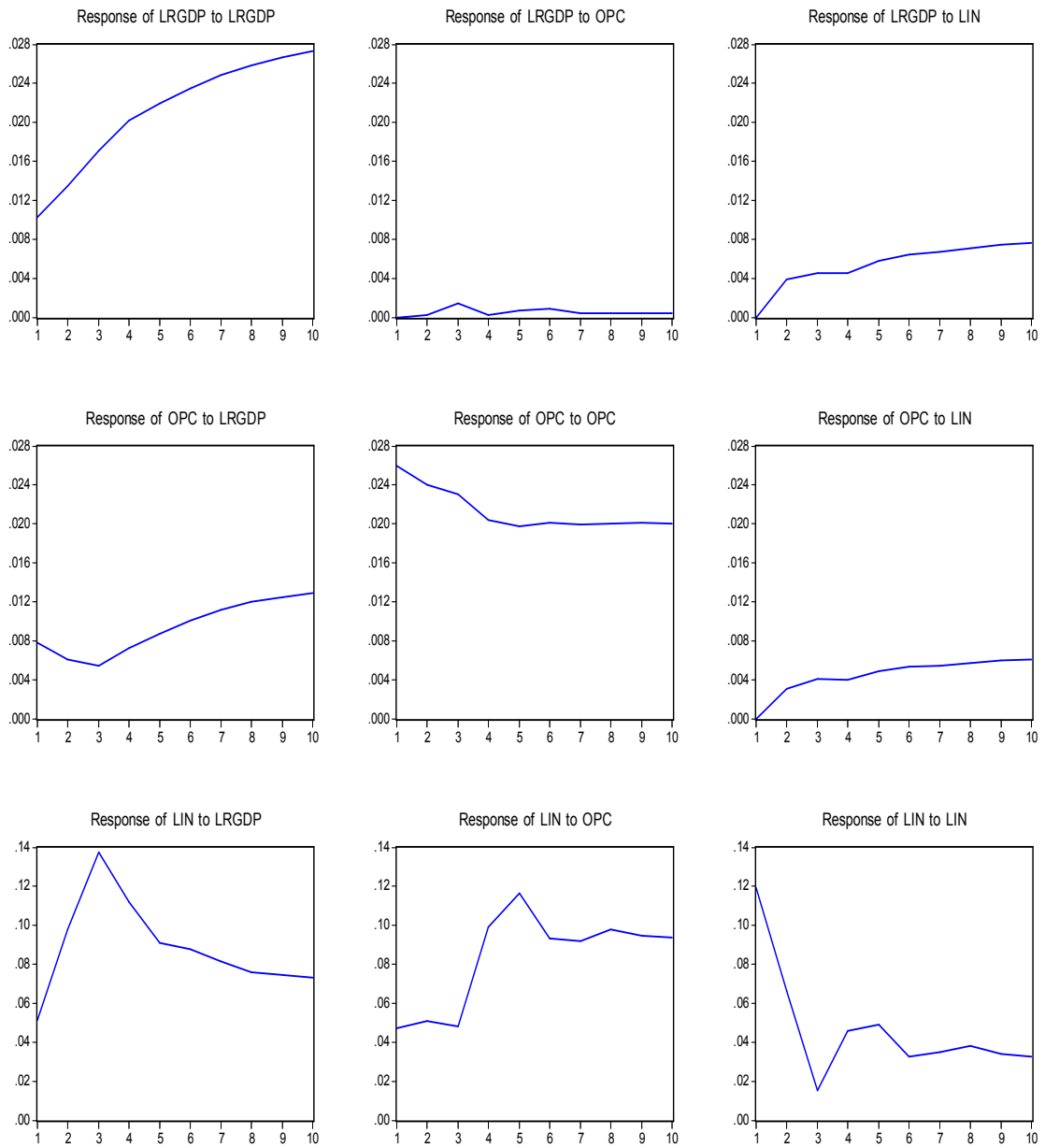


Figure 10. Vector Error Correction Impulse Respond Graph