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Dynamics and Causality among Exports, Imports and Income in Bangladesh

by

MOHAMMAD AMZAD HOSSAIN*
LAILA HASEEN
NAZNEEN JABIN

I. INTRODUCTION

There exists a wide range of theoretical and empirical literature on the relationship between foreign trade and economic growth in both developed and developing countries. The early literature focused mostly on the role of export in economic growth. The spectacular success of the outward oriented policies in the East Asian countries provided a basis for the adoption of such policies in developing countries. Accordingly, the literature tried to support or reject the logic of universal application of export led growth policy in developing countries. The dynamic linkages between export and import or import and income did not receive much attention in the literature. But experience shows that in many countries export is highly dependent on import of capital goods and intermediate inputs as well as raw materials giving a case of trivariate causality between exports, imports and economic growth.

The relationship between foreign trade and economic growth has long been discussed by different schools of thought. The theoretical standpoints can be summarised in terms of technological know how, market expansion, resource allocation, ease of balance of payments, employment generation and income creation (Hossain and Salim 2009). Karl Marx focuses on the role of exchange in economic growth. In his opinion, the expansion of production needs a growing

* The authors are respectively Associate Professor and Assistant Professor, Department of Economics, Jahangirnagar University, Savar, Dhaka, and Lecturer, Department of Economics, Jagannath University, Dhaka. The authors are grateful to Professor M. Ismail Hossain, Department of Economics, Jahangirnagar University, Dhaka, for his suggestions and guidance in preparing the revised version of the paper, and an anonymous referee of this Journal for comments on earlier versions. However, the usual disclaimer applies.

market which will promote production continuously (Chen 2009). The classical school treats the foreign trade as a means for optimal distribution of resources and increasing productivity that stimulate economic growth. The structuralist school led by Lewis (1936) holds that in the dual economy model if the modern industrial sector produces export goods and the traditional agricultural sector produces import substitutes, then foreign trade would expand the market and lead to increase in production. According to the neoclassical school, trade enhances growth because of the benefits of comparative advantage, full capacity utilisation, greater economies of scale and increasing rate of investment and technological change (Krueger 1978, Kavoussi 1984). This school identifies five different ways in which foreign trade affects macroeconomic performance of a country: the revenue effect, capital accumulation effect, substitution effect, income distribution effect and the effect of the weighted elements. All these effects together imply that trade strengthens economic growth over time as an economy develops (Chen 2009). The new growth theories which consider increasing returns to capital put more focus on trade as an argument of growth. According to these theories, international trade leads to technological diffusion that affects the medium and long term output growth of the developing countries by improving productivity. The new trade school (led by Paul Krugman) emphasizes the role of trade in economic growth through economies of scale and improving the optimal allocation of resources.

There is a growing volume of empirical literature on the relationship between foreign trade and economic growth. However, most of the early studies (e.g., Michaely 1977, Balassa 1978, Kavoussi 1984, Williamson 1978, Tyler 1981, Feder 1983, Ram 1985, Jung and Marshall 1985, Chow 1987, Dodaro 1993, Love 1994, Amirkhalkhali and Dar 2003) focused on the effect of export on economic growth by employing different econometric techniques. However, these studies suffer from bias due to omission of the important import variable. Only a handful of studies (e.g., Baharumshah and Rashid 1999, Ramos 2001, Howard 2002, Barisik and Cetintas 2009) examine the dynamic relationship among exports, imports and income. These studies establish the validity of the export growth hypothesis for the concerned countries, which is shaped by the augmentation of import demand.

Following the general pattern, a few empirical studies explored the validity of export-led growth in Bangladesh using different data sets and adopting different econometric techniques and found mixed results. In an ordinary least squares framework based on annual data (1971-1990), Islam and Zaman (1996) found no significant relationship between exports and growth. The results cast considerable doubt as the time series used in the study was non-stationary. By adopting standard econometric techniques to analyse time series data for the period 1969-1991, Islam (1998) examines the nature and direction of causation between export expansion

and growth for 15 Asian countries including Bangladesh. The estimation results show that export granger causes economic growth positively but not *vice versa*, in both the bivariate and error correction models. However, the multivariate Granger test shows no causality between the two. This study uses quarterly data for the considered time period, but did not provide any explanation of data generating process for Bangladesh. Hossain and Salim (2009) addressed the short run dynamics of long run relationship between export and economic growth in Bangladesh using annual time series data and found that export led growth and growth led exports were both valid for Bangladesh. Using annual time series data, Hossain (2007) found that exports and imports in Bangladesh are cointegrated. This validates the Lerner's (1936) symmetry condition that if export promotion is a goal of policy, the most direct instrument of achieving it is import liberalisation. Eusuf and Ahmed (2008) examined the growth led export hypothesis for five South Asian Countries by applying Granger causality tests thus ignoring short run dynamics between export and economic growth. Although these studies bear significance, they suffer either from methodological deficiencies or from the omitted variable bias or have data problems. The present paper marks an improvement over the early studies in terms of overcoming the above problems and relying on the Johansen-Juselius maximum likelihood method in fully specified error correction modeling which produces identical cointegrating vectors for either variable in the model.

The objective of this paper is to examine the causality among exports, imports and income in Bangladesh. Bangladesh provides a good case for studying this relationship because of significant dependence of its major export, namely, readymade garments, on imported inputs. This paper differs from the existing studies in several ways. First, the study uses a long data set covering the period 1973-2008. Second, it takes into account various modeling issues that arise in causality framework and overcomes the omitted variable bias. It employs augmented Dicky Fuller and Phillips-Perron tests to examine the time series properties of exports, imports and income. Further, Johansen and Juselius test is used to examine the cointegration properties of the variables. Finally, the study examines both short-term and long-term dynamic relationships among the relevant variables within an error-correction framework. By and large, this paper is an improvement over the early literature in terms of the data used and techniques employed.

The paper is divided into four sections. After introducing the issues and a brief survey of theoretical and empirical literature in section I, section II provides a brief overview of the foreign trade sector of Bangladesh. Section III sets out the framework for the analysis of causality, conintegration and error correction among the variables. Finally, section IV concludes the paper.

II. AN OVERVIEW OF THE FOREIGN TRADE SECTOR IN BANGLADESH[1]

Bangladesh pursued an inward looking import substitution strategy characterised by high protection and foreign exchange rationing with multiple exchange rates since its independence in 1971. The result of this strategy was painful as Bangladesh faced balance of payments disequilibrium, foreign exchange shortage, relatively low growth and micro inefficiencies like uncompetitive enterprises. Consequently, after 1982 Bangladesh started to shift to a more outward looking trade strategy as part of the broader market oriented economic reforms in the economy.

The liberalisation process has undergone three phases based on the coverage and the degree of implementation. Phase I (1982-1986) is marked by denationalisation of the public enterprises, simplification of the private investment procedure, reducing the level of quantitative restrictions and removal of import licensing. The private sector was accorded greater role under structural adjustment policy in Phase II (1987-1991). This is characterised by elimination of quantitative restrictions on imports, reduction and rationalisation of tariffs, and simplification of trade procedure. Phase III (1992 onwards) began more intense liberalisation of trade regime including adoption of flexible exchange rate.

There have also been other aspects of trade liberalisation in Bangladesh. The number of items in the control list at the HS 4 digit level declined from 315 in 1987-91 to 63 in 2003-06. Over the same period, the number of trade related items in the control list at the HS 4 digit level also decreased from 253 to 24, implying a phenomenal improvement of the removal of import restrictions. Besides, tariff structure has been rationalised. The maximum effective tariff rate has declined from 350 per cent in 1992 to 23 per cent in 2008 and the unweighted average duty rate has come down from 56.68 per cent to 13.54 per cent over the same period. In general, reduction of tariff has been greater for the capital goods than that for intermediate and consumers' goods.

Though the basic focus of trade liberalisation in Bangladesh has been import liberalisation, measures have also been taken to boost up exports. Incentives in the form of provision of duty drawback facilities, income tax rebate, gradual removal of import license fee for the export-oriented industries and import tariff for capital equipment imports, back-to-back L/Cs, and credit facilities at a lower interest rate were provided to augment exports. Other measures to facilitate export include reduction of government's regulatory role, creation of export promotion fund,

[1] This section draws on Haseen (2007).

providing support for participation in the international trade fairs, creating product development councils, and expediting BMRE in different exporting units.

The positive outcome of these policies has been evident. Foreign trade as a share of GDP increased from 14.5 per cent in 1973-75 to 40.2 per cent in 2007-08, implying increasing openness of the economy. The compound growth rate of trade during the period 1973 to 2008 is 9.3 per cent and the corresponding figures for exports and imports are 11.5 per cent and 8.3 per cent respectively. However, exports and imports grew at different rates under different policy regimes. The growth rates of exports, imports and total trade are shown in Table I.

TABLE I
GROWTH RATES OF FOREIGN TRADE IN BANGLADESH

Period	Compound growth rates[2]		
	Export	Import	Total
1973-2008	11.49	8.26	9.29
1973-1982	9.57	13.88	12.75
1983-1991	11.65	6.46	7.87
1992-2008	10.33	8.78	9.38

Source: Author's calculation from data of Export Promotion Bureau and BBS 2009.

An important feature of the external sector of Bangladesh is its narrow export base. Export is also concentrated to a small number of countries. In the 1970s and the early 1980s, jute and jute goods dominated Bangladesh's export basket while readymade garments became dominant export afterwards. Imports are also sourced from a few countries. Therefore, any shock emanating from the major trading partners can exert adverse repercussion on the domestic economy.

III. ANALYTICAL FRAMEWORK

III.1 The Data

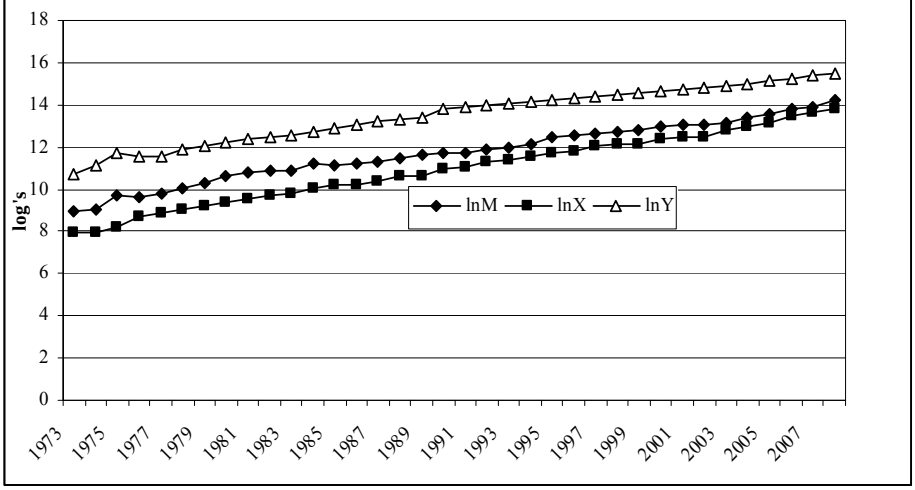
The paper is based on secondary data from the Export Promotion Bureau (EPB), Bangladesh Bank, and Bangladesh Bureau of Statistic (BBS). The data are observations on exports, imports and GDP (which stands for income). Annual nominal data on all variables are available from 1973 to 2008. After compilation of

[2] The compound growth rates have been calculated by using the linear trend regression model. For details of the model, see Gujarati (1995).

the data, empirical results were obtained by using MS Excel and econometric programme Eviews.

Plots of the logarithms of the three time series are shown in Figure 1. From Figure 1 it reveals that exports (x), imports (m) and income (y) exhibit an upward trend and they have a tendency to move together, implying that they are causally linked to each other.

Figure 1: Natural Logarithms of Exports, Imports and GDP



III.2 Testing for Integration

In order to investigate the stationary properties of the time series (x, m and y), the presence of unit root is to be tested. That is, it has to be tested whether exports, income and GDP are *I(1),* implying that they are stationary. This is accomplished by applying augmented Dickey-Fuller (ADF) test. This test is based on the following regression equation with a constant and a trend of the form:

$$\Delta Q_t = a_1 + a_2 t + bQ_{t-1} + \sum_{i=1}^{n} \rho_i \Delta Q_{t-i} + \varepsilon_t \qquad (1)$$

where $\Delta Y_t = Y_t - Y_{t-1}$ and Y is the variable under consideration, n is the number of lags in the dependent variable chosen by Schwarz criterion, and ε_t is the stochastic error term. The null hypothesis of a unit root implies that the coefficient of Qt_{-1} is zero. If the null hypothesis is rejected, then the series is stationary and no differencing in the series is necessary to induce stationary. The ADF is widely used

due to the stability of its critical values as well as its power over different sampling experiments. The result is also further justified by Dickey-Fuller (DF) and Phillips and Perron (1988) test. The results of these tests are presented in Table II.

TABLE II
TEST FOR INTEGRATION

Variable	ADF		Phillips-Perron	
	Level	First Difference	Level	First Difference
lngdp	-2.6955	-11.6274*	-3.6376	-6.7806*
lnexp	-4.0643	-5.8625*	-2.9656	-6.7462*
lnimp	-3.7329	-4.8293*	-3.0991	-6.7472*

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

Table II shows that the time series are non stationary i.e. *I(0)* at their levels, while first difference makes them stationary. That is, each of the series lngdp, lnexp and lnimp are integrated of order 1, *I(1)*.

III.3 Testing for Cointegration

The second step involves searching for cointegration among exports, imports and income as they have common stochastic trend i.e. *I(1)*. The graphical representation of the series in Figure 1 shows that the series have a common movement. Empirically it means testing for the existence of linear independence, the so-called cointegrating relationship:

$$\sum_{j=1}^{3} \chi_{ji} Q_{jt} = \nu_{it} \quad i = 1,.....,r \tag{2}$$

The υ_{it} are *I(0)* series, although the Q_{jt} are *I(1)*. Under *I(0)* of υ_{it} the long run relationship of Q_{jt} (j= 1, ..3) is determined by 3-r common trends. This can be tested empirically either by Engle-Granger (1987) two step cointegration procedures or by Johansen-Juselius cointegration (1990) technique. This paper relies on Johansen-Juselius cointegration technique, which requires identifying the number of cointegrating vectors, namely, the trace statistic and the maximum eigenvalue test statistic. The trace test statistic for the null hypothesis that there are at most *r* distinct cointegrating vectors is:

$$\lambda_{trace} = T \sum_{i=r+1}^{N} \ln(1 - \lambda_i) \tag{3}$$

where λ_i's are the N-*r* smallest squared canonical correlations between Q_{t-k} and ΔQ_t (where $Q_t = (x_t, m_t, y_t)'$ and all the variables in Q_t are assumed I(1)), corrected for the effects of the lagged differences of the X_t process.

The maximum eigen value statistic for testing the null hypothesis of at most *r* cointegrating vectors against the alternative hypothesis of *r* + 1 cointegrating vectors is given by

$$\lambda_{\max} = -T \ln(1 - \lambda_{r+1}) \tag{4}$$

Johansen (1988) and Johansen and Juselius (1990) show that equations (2) and (3) have non-standard distributions under the null hypothesis and provide approximate critical values for the statistic, generated by Monte Carlo methods. Table III shows the results of the application of Johansen procedure.

TABLE III
JOHANSEN'S TEST FOR MULTIPLE COINTEGRATING VECTORS

Hypothesized cointegrating Ho	Number of relationship H_1	Test Statistic LR	5% Critical Value	1% Critical Value
r = 0	r > 0	41.13366*	29.68	35.65
r ≤ 1	r > 1	6.220667	15.41	20.04
r ≤ 2	r = 3	1.947483	3.76	6.65

Note: * denotes rejection of Ho at 1% level. Likelihood ratio (LR) test indicates 1 cointegration vector for the group of variables.

From Table III, the trace tests of Johansen and Juselius (1990) suggest that the considered time series are cointegrated. This implies that there are stable long run relationship among exports, imports and income in Bangladesh. That is, foreign trade strategy will have some important long run implications for changes in GDP in Bangladesh.

III.4 Granger Causality in the ECM-VAR

If two time series $\{P_t: t = 0,1....\}$ and $\{Q_t: t = 0,1....\}$ are *I(1)* processes, then in general, $v_t = P_t - \gamma Q_t$ is an *I(1)* process for any number of γ. Nevertheless, it is possible that for some $\gamma \neq 0$, $v_t = P_t - \gamma Q_t$ is an I(0) process, which means it has constant mean, constant variance and autocorrelations that depend only on the time distance between any two variables in the series and is asymptotically uncorrelated. If such a γ exists, we can say that P_t and Q_t are cointegrated and γ the cointegration

parameter (Wooldridge 2003). The cointegrating relationship $v_t = P_t - \gamma Q_t$ represents a long run or equilibrium relationship between two variables.

The notion of cointegration provides the basis for modeling both short run and long run relationships simultaneously. If it is found that the considered variables are cointegrated, then according to Granger representation theorem (Engle and Granger 1987) the relationship among exports, imports and income can be expressed as the error correction mechanism as follows:

$$\Delta y = \mu_{11} + \mu_y v_{t-i} + \sum_{i=1}^{k} \delta_{11,i} \Delta y_{t-i} + \sum_{i=1}^{k} \delta_{12,i} \Delta x_{t-i} + \sum_{i=1}^{k} \delta_{13,i} \Delta m_{t-i} + u_1 \quad (5)$$

$$\Delta x = \mu_{21} + \mu_x v_{t-i} + \sum_{i=1}^{k} \delta_{21,i} \Delta y_{t-i} + \sum_{i=1}^{k} \delta_{22,i} \Delta x_{t-i} + \sum_{i=1}^{k} \delta_{23,i} \Delta m_{t-i} + u_2 \quad (6)$$

$$\Delta m = \mu_{31} + \mu_m v_{t-i} + \sum_{i=1}^{k} \delta_{31,i} \Delta y_{t-i} + \sum_{i=1}^{k} \delta_{32,i} \Delta x_{t-i} + \sum_{i=1}^{k} \delta_{33,i} \Delta m_{t-i} + u_3 \quad (7)$$

This equation system constitutes VAR in first differences, which also has error correction terms and allows examining the short run dynamics of the long run relationship among the variables. The coefficient of the error correction term must be seen as correcting towards equilibrium subspace, i.e., how adjustment is taking place in the short run to maintain stable equilibrium long run relationship among the considered variables. The coefficients of the lagged values of the variables show whether the independent variables cause the corresponding dependent variable (Ramos 2001). The results of the causality tests are shown in Table IV.

Table IV reveals that export led growth hypothesis is valid for Bangladesh. The unidirectional causality runs from export to GDP implying that export promotion strategy will be beneficial for the Bangladesh economy in the long run. This refutes the result of Hossain and Salim (2009), which establishes bi-directional causality between export expansion and economic growth. The table also shows that export significantly induces import in the long run, implying that the ELG hypothesis is dependent on import liberalisation. This result is in line with Lerner's (1936) symmetry condition and also coincides with findings of Hossain (2007). The ECM shows that this relationship also holds in the short run. However, the study did not find any causal relationship between import and GDP.

TABLE IV
TEMPORAL CAUSALITY RESULTS BASED ON GRANGER CAUSALITY (F STATISTIC)

Vector Correction Model (t statistic)				
Dependent	Significant levels of F-statistics			t statistic
variable	Δ lny	Δ lnx	Δ lnm	on ECM $_{t-1}$
Δ lny	-	9.8803***	1.5947	-0.51707
Δ lnx	1.5309	-	2.0132	-1.89358**
Δ lnm	0.03184	11.7926***	-	-4.99016*

Note: * denotes 1% level of significance, ** denotes 5% level of significance, ***denotes 10% level of significance.

IV. CONCLUSIONS

In this paper, the relationship among exports, imports and GDP has been investigated by applying cointegration and error correction models using annual time series from 1973 to 2008 in Bangladesh. The paper addresses the issue of short run dynamics of exports-imports-income within a long run framework. The paper is an improvement over the earlier studies in terms of data used and techniques applied and dealing with specification bias resulting from omitted variables. The empirical evidence suggests that there is unidirectional causality from exports to income, which suggests that export promotion strategy can contribute to Bangladesh's economic growth. The increasing degree of Bangladesh's trade openness is justified by this fact. Again, the role of imports cannot be ignored in examining the relationship between exports and economic growth as the empirical evidence suggests that exports significantly affect import both in the long and short runs. It is important to note here that expansion of exports is not a guarantee for economic growth as exports is significantly affected by imports.

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