

Export, Imports, Remittance and Growth in Bangladesh: An Empirical Analysis

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This paper investigates the causal nexus between export, import, remittance and GDP growth for Bangladesh using annual data from 1976 to 2005. The paper uses time series econometrics tools to investigate the relationship adding import and remittance in the model. Study finds limited support in favor of export-led growth hypothesis for Bangladesh as exports, imports and remittance cause GDP growth only in the short run. The causal nexus is unidirectional.

JEL Classifications: C32, F24, F43

Keywords: Exports, Imports, Remittances, Economic Growth and Time-Series Models

I. Introduction

GDP growth of Bangladesh has been 5 per cent and above in the past decade or so with increasing exports, imports and remittance. Ratio of total trade (exports plus imports) to GDP rose from 17.6 percent in 1990 to around 29.4 percent in 2002 (World Bank, 2005). Export growth is often considered to be a principal determinant of production and employment growth in an economy. It is also argued that foreign currency made available through export earnings facilitates import of capital goods, which in turn increases production potential of an economy.

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Exports competition causes economies of scale and acceleration of technological progress (Ramos, 2001). In the early years after independence in 1971, Bangladesh embarked on an inward-oriented development strategy. Accordingly, higher tariffs and quota were imposed on imports. This in turn created an anti-export bias within Bangladesh economy. However, since 1980s the policy regime shifted toward export-promotion from import substitution. Tariff rates were reduced and quotas were also abolished gradually. Industrial and trade policy were focused to promote export. Financial incentives are provided, in the form of tax exemption, on exportable commodities. Exclusive Export Processing Zones (EPZ) are established to attract foreign direct investment and export promotion. Foreign firms, investing in EPZs, get special preference and tax exemption facilities. State owned enterprises, nationalized in the early 1970s, are privatized or are in the process of privatization (Ahmed, 2001). The country has also experienced a change in its export composition- from primary commodities to manufacturing goods (Love and Chandra, 2005). Imports of capital machinery, intermediate goods and industrial raw materials have risen over the years. Remittance is another major source of foreign earnings for Bangladesh. Bangladeshi workers, unskilled and semi-skilled, send huge amounts of foreign currency, which at times exceeds the exports earning from goods and services. A number of empirical researches have been conducted to investigate the nexus between exports and growth in Bangladesh. However, none has taken the impact of imports and remittance on growth into account. Figure 1 show real GDP, exports, imports and remittance and each variable depicts a strong upward trend individually. In this paper we intend to investigate short and long-run dynamic impact of exports, imports and remittance on GDP growth of Bangladesh, using the Cointegration and Granger Causality in a VECM framework to analyze the relationship. The rest of the paper is organized as follows. Section 2 discusses the literature. The data and methodology are discussed in Section 3. Finally, Section 4 discusses the results and Section 5 provides some concluding remarks.

2. Literature Review

The speed of economic development of a nation poses one of the most essential issues in economic debate. A nation could accelerate the rate of economic growth by promoting exports of goods and services. The volume of imports is negatively related to its relative price and varies positively with aggregate demand (real GDP growth). The higher relative price leads to substitution away from imports—necessarily reducing the dollar value of imports as volumes decline. Remittances have been used in financing the import of capital goods and raw materials for industrial development.

Garments manufacturing is treated as the highest foreign exchange earning sector of the country (US\$4.583 billion in 2003). However, if the cost of import of raw material is adjusted, then the

net earning from migrant workers' remittances is higher than that of the garments sector. In 2003, net export earning from RMG stood between US\$2.29-2.52 billion, whereas the earning from remittance is net US\$3.063 billion. In 1998-1999, 22 percent of the official import bill was financed by remittances (Afsar, 2000; Murshed, 2000 and Khan, 2003). The steady flow of remittances has resolved the foreign exchange constraints, improved the balance of payments, and helped increase the supply of national savings (Quibria, 1986). The contribution of remittance to GDP has also grown from a meager 1 percent in 1977-1978 to 5.2 percent in 1982-83. During the 1990s, the ratio hovered around 4 percent. However if one takes into account the unofficial flow of remittances, its contribution to GDP would certainly be much higher. Murshed (2000) finds that an increase in remittance by Taka 1 would result in an increase in national income by Tk 3.33.

Remittance constitutes an important source of foreign exchange for the poor countries, which have substantial development impact as can be understood from micro and macro point of view. From macro frontier, remittances are used to make import payments and are used for productive investment by the government (Salim, 1992). World Bank (Ali, 1981) identified overseas remittances achieving a favorable balance of payments and as well as creating a new resources base for the country. In Bangladesh, a significant portion of overseas earnings is spent for consumption purposes, acquisition of assets, investment in trade and business and to finance import of capital goods. It will positively affects the socio economic condition of migrant families. Some of the early studies (Salim, 1992 and Matin, 1994) focused on the macroeconomic impact of overseas remittances in Bangladesh. However, remittances are not devoid of adverse effects. Manpower exports are alleged to deprive the country of their services and upsetting the normal functioning of the economy (Mahmood, 1985).

A large number of studies tested the Export Led Growth (ELG) hypothesis using different econometric procedures ranging from simple OLS to multivariate cointegration but previous empirical studies have produced mixed and conflicting results on the nature and direction of the causal relationship between export growth and output growth. Giles and Williams (2000a, 2000b) provide an excellent literature review of the ELG hypothesis until the late 1990s. In addition to this extensive survey, one notes that the literature on the ELG hypothesis has been constantly expanding with more recent studies such as Darrat *et al.* (2000) for Taiwan; Hatemi-J and Irandoust (2000a) for Nordic countries; Fountas (2000) for Ireland; Panas and Vamvoukas (2002) for Greece; Balaguer *et al.* (2001) for Spain; Chandra (2003) for India; Abual-Foul (2004) for Jordan; Al Mamun and Nath (2005) for Bangladesh; Awokuse (2005a) for Korea; Awokuse (2005b) for Japan; Love and Chandra (2005a) for South Asia; Mah (2005) for China; and Siliverstovs and Herzer (2007) for Chile. Why studying the ELG for Bangladesh? We are investigating consequence of export (X), import (M) and remittances (R) on GDP growth in

Bangladesh. No other previous studies looked at ELG with remittance as a variable. Bangladesh underwent many trade related structural reforms during the eighties and early nineties. This has impact on the overall the trade pattern and economic growth. Mamun and Nath (2005) examine time series evidence to investigate the link between exports and economic growth in Bangladesh. Using quarterly data for a period from 1976 to 2003, the article finds that industrial production and exports are cointegrated. The results of an error correction model (ECM) suggest that there is a long-run unidirectional causality from exports to growth in Bangladesh. Love and Chandra (2005) use annual data on GDP, export and import in a multivariate framework to investigate export-led growth hypothesis for Bangladesh and conclude in favor of short and long-run unidirectional causality from income to exports. Clarke and Ralhan (2005) find support in favor of causal nexus between export and growth for Bangladesh using annual data from 1960 to 2003. They argue that when causality is considered over a time horizon, ancillary variables suggest causal nexus between export and GDP. Shirazi and Manap (2005) examine the export-led growth (ELG) hypothesis for five South Asian countries including Bangladesh using cointegration and multivariate Granger Causality tests. They found feedback effects between exports and GDP and imports and GDP for Bangladesh.

3. Data and Methodology

Annual data on Real GDP, exports, imports, implicit GDP deflator and remittance from 1976 to 2005 are used for this paper. Real GDP, export, import and implicit GDP deflator (base year 1990) data are collected from UN Statistical Division website³. Data on remittance are collected from Bangladesh Economic Review (2005). Export, import and remittance are converted into real terms using the implicit GDP deflator. Since, data on import and export price index are not available for the whole length of the time series used in this paper, we used the implicit GDP deflator to obtain the real values of the variables under consideration. All the data used in the study are in logarithmic form. This transformation can reduce the problem of heteroscedasticity as log transformation compresses the scale in which the variables are measured (Gujrati, 1995).⁴ We use LY, LX, LM and LR for real GDP, real exports, real imports and real remittance respectively.

³ UN Database website: insert website

⁴ Gujrati, D., 'Basic Econometrics', 3rd Edition 1995, McGraw-Hill

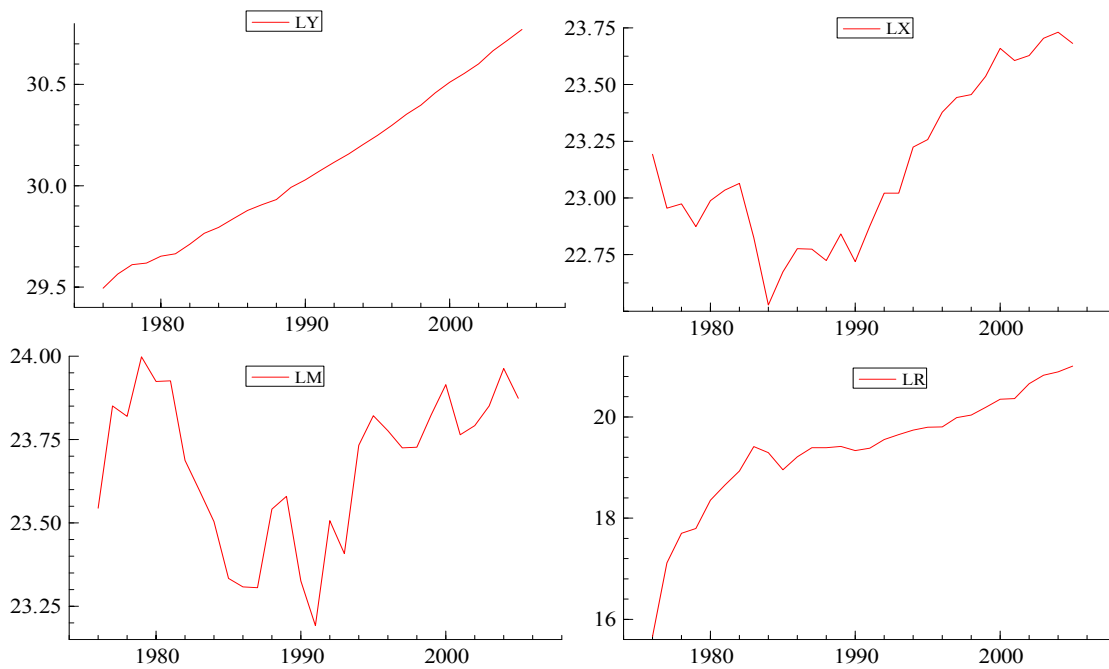


Figure 1: Natural Log of Real GDP, Exports, Import and Remittance

The first step, in our methodology, is to determine whether the variables used are stationary or not. If they are non-stationary in that case the issue is- to what degree they are integrated. This can be addressed by the Augmented Dickey–Fuller (ADF) tests. If the calculated ADF statistic is less than its critical value, then X (*real GDP, exports, imports and remittance*) is said to be stationary or integrated of order zero, i.e. $I(0)$. If this is not the case, then the ADF test is performed on the first difference of X (i.e. ΔX). If ΔX is found to be stationary then X is integrated of order 1, or $I(1)$. The government of Bangladesh took a series of reforms in the external sector in the mid 80s and early 90s. In addition, the Structural Adjustment Program (SAP) advocated by the World Bank and IMF is likely to have an impact on the overall macro economy of Bangladesh. Thus, the use of ADF test for checking the stationary property of the data set given the presence of structural break arising from these reforms might lead to misleading results. Perron (1989, 1990) has shown that a structural change in the mean of a stationary variable tends to bias the standard ADF tests toward non-rejection of the hypothesis of a unit root. Therefore, we under took the Phillips Perron unit root test, in addition to the ADF test, to check the stationary property of the data set used in the study.

If all the variables in a multivariate model are integrated of order one, i.e. $I(1)$, then the next step is to find out whether they are cointegrated or not using Johansen's framework. The details of this approach can be found in Johansen (1988) and Johansen and Juselius (1990). In the following paragraphs the broad contours of this approach are outlined. Consider an unrestricted VAR model up to k lags in which the process X_t , for given values of X_{-k+1}, \dots, X_0 , is defined by

$$X_t = \mu + \Pi_1 X_{t-1} + \dots + \Pi_k X_{t-k} + \xi_t, \quad t = 1, 2, \dots, T \tag{1}$$

where ξ_t is i.i.d (independently and identically distributed) p -dimensional Gaussian error term with mean zero and variance matrix A , X_t is a vector of $I(1)$ variables and μ is a vector of constants. Since X_t is non-stationary, the above equation can be expressed in first-differenced error-correction form.

$$\Delta X_t = \mu + \Gamma_1 X_{t-1} + \dots + \Gamma_{k-1} \Delta X_{t-k+1} + \Pi_k X_{t-k} + \xi_t \tag{2}$$

where,

$$\Gamma_i = -(1 - \Pi_1 - \dots - \Pi_i), i = 1, 2, \dots, k-1 \quad \Pi = -(1 - \Pi_1 - \dots - \Pi_k)$$

Note that Eq. (2) is expressed as a traditional first difference VAR model except the term ΠX_{t-k} . The coefficient matrix Π contains information about long-run relationships between the variables in the data vector. There are three possible cases. If the rank of Π equals p , i.e. the matrix Π has full rank; the vector process X_t is stationary. If the rank of Π equals 0, the matrix Π is a null matrix and the above equation corresponds to a traditional differenced vector time-series model. Finally, if $0 < r < p$ there exist r cointegrating vectors; in that case $\Pi = \alpha\beta'$, where α and β are $p \times r$ matrices. The cointegrating vectors β have the property that $\beta'X_t$ have is stationary even though X_t itself is non-stationary. In this case Eq. (2) can be interpreted as an error-correction model.

Johansen (1988) and Johansen and Juselius (1990) derived the likelihood ratio test for the hypothesis of r cointegrating vectors or $\Pi = \alpha\beta'$. The cointegrating rank, r , can be tested with two statistics, namely *Trace* and *Maximal Eigen value*. The likelihood ratio test statistics for the null hypothesis that there are at most r cointegrating vectors against the alternative of more than r cointegrating vectors is the trace test and is computed as

$$Trace = -T \sum_{i=r+1}^p Ln(1 - \lambda_i) \tag{3}$$

where $\hat{\lambda}_{r+1}, \dots, \hat{\lambda}_p$ are $p - r$ smallest estimated Eigen values. The likelihood ratio test statistic for the null hypothesis of r cointegrating vectors against the alternative of $r + 1$ cointegrating vectors is the Maximal Eigen value test and is given by

$$\lambda_{\max} = -T[\ln(1 - \lambda_i)] \tag{4}$$

It has been suggested that the above tests of cointegration rank are contingent upon the presence or absence of deterministic components in the dynamic model. The next question is to investigate whether all the variables in the model should enter into a long-run equilibrium relationship. This can be done by testing linear restrictions on the long-run coefficients after they have been normalized. The hypothesis of long-run exclusion of each variable is tested using a likelihood ratio test which is asymptotically distributed as χ^2 with degrees of freedom equal to the number of restrictions tested. If the test statistic exceeds the 95% critical value then those coefficients are significant implying that the concerned variables should be present in the long-run equilibrium relationship. The number of cointegrating relationships found will result in a corresponding number of residual series, and hence error correction terms (ECTs), to be used in the subsequent vector error correction model (VECM). The systems we consider are equivalent to the following one, where the ECM must be seen as correcting towards an ‘equilibrium subspace’ which in this case is two-dimensional.

$$\Delta y = \alpha_{11}\xi_{1,t-1} + \alpha_{12}\xi_{2,t-1} + \alpha_{13}\xi_{3,t-1} + \sum_{t=1}^m \phi_{11,t}\Delta y_{t-1} + \sum_{t=1}^m \phi_{12,t}\Delta x_{t-1} + \sum_{t=1}^m \phi_{13,t}\Delta m_{t-1} + \sum_{t=1}^m \phi_{14,t}\Delta r_{t-1} + \mu_1 \tag{6}$$

$$\Delta x = \alpha_{21}\xi_{1,t-1} + \alpha_{22}\xi_{2,t-1} + \alpha_{23}\xi_{3,t-1} + \sum_{t=1}^m \phi_{21,t}\Delta y_{t-1} + \sum_{t=1}^m \phi_{22,t}\Delta x_{t-1} + \sum_{t=1}^m \phi_{23,t}\Delta m_{t-1} + \sum_{t=1}^m \phi_{24,t}\Delta r_{t-1} + \mu_2 \tag{7}$$

$$\Delta m = \alpha_{31}\xi_{1,t-1} + \alpha_{32}\xi_{2,t-1} + \alpha_{33}\xi_{3,t-1} + \sum_{t=1}^m \phi_{31,t}\Delta y_{t-1} + \sum_{t=1}^m \phi_{32,t}\Delta x_{t-1} + \sum_{t=1}^m \phi_{33,t}\Delta m_{t-1} + \sum_{t=1}^m \phi_{34,t}\Delta r_{t-1} + \mu_3 \tag{8}$$

$$\Delta r = \alpha_{41}\xi_{1,t-1} + \alpha_{42}\xi_{2,t-1} + \alpha_{43}\xi_{3,t-1} + \sum_{t=1}^m \phi_{41,t}\Delta y_{t-1} + \sum_{t=1}^m \phi_{42,t}\Delta x_{t-1} + \sum_{t=1}^m \phi_{43,t}\Delta m_{t-1} + \sum_{t=1}^m \phi_{44,t}\Delta r_{t-1} + \mu_4 \tag{9}$$

4. Result Analysis

We first test the stationarity properties of the variables under consideration i.e. their order of integration, then test for cointegration among the variables. Finally, we test for Granger Causality among the variables in a VECM framework.

Testing for Stationarity

In order to investigate the stationarity properties of the variables under consideration (real GDP, exports, imports and remittance) we carry out a univariate analysis for testing the presence of a unit root. Table 1 below reports the Augmented Dickey-Fuller (ADF) *t*-tests and Table 2 reports the Philips Perron Test statistics for the variables.

Table 1: Unit Root Test
ADF Test

Variables	ADF (Constant)		ADF (Constant & Trend)	
	Level	1st Diff.	Level	1st Diff.
LY (Log of real GDP)	6.681249	3.391059	3.23935	-4.646121 ***
LX (Log of real exports)	0.228244	-5.163004 ***	-2.419984	-5.295872 ***
LM (Log of real imports)	-1.782844	-5.807258 ***	-1.796627	-5.843050 ***
LR (Log of real remittance)	3.232414	0.632501	1.985979	-0.467675 ***

*Superscripts***, ** and * indicate rejection of null hypothesis at 1%, 5% & 10% level of significance.*

**Table 2: Unit Root Test
Philips Perron (PP) Test**

Variables	PP (Constant)		PP (Constant & Trend)	
	Level	1st Diff.	Level	1st Diff.
LY (Log of real GDP)	23.97940	-0.084732	8.239276	-4.666896***
LX (Log of real exports)	0.182374	-5.162770***	-2.436749	-5.311769***
LM (Log of real imports)	-1.840781	5.894632***	-1.796627	-6.672157***
LR (Log of real remittance)	3.848606	-3.545680**	1.499692	-4.532557***

*Superscripts***, ** and * indicate rejection of null hypothesis at 1%, 5% & 10% level of significance*

The results indicate that at level the variables are non stationary in both ADF and PP tests. Real exports and imports (LX and LM) are found stationary at first difference when constant is included in the equation. While in the PP test real exports, real imports and real remittance (LX, LM and LR) are found stationary when a constant is included. When we include a constant and linear trend all the variables (LY, LX, LM and LR) become stationary at their first difference in both ADF and PP tests at 1% level of significance. Optimal lag lengths are selected using the Akaike's Information criterion (AIC). Since, differencing once produces stationarity, we conclude that the variables under consideration are integrated of order 1, $I(1)$.

Testing for Cointegration

Since the variables are integrated of order 1, i.e. $I(1)$, we can test whether they are cointegrated or not (Engel and Granger, 1987). We test for the number of cointegrating relationships using the approach proposed by Johansen (1988) and Johansen and Juselius (1990). The optimal lag length of the level VAR system is determined using the Akaike's Information Criterion (AIC), Hernan-Quinn criterion (HQ) and Schwartz criterion (SC). Table 3 below reports the number of cointegrating relationships among the variables under consideration.

Table 3
Johansen Cointegration Test

Hypothesized No. of Ces	Eigenvalue	Trace Statistics	0.05 Critical Value	p- value	Max- Eigen value statistics	0.05 Critical Value	p- value
None *	0.87	117.06	40.17	0.0000	56.33	24.15	0.0000
At most 1 *	0.72	60.73	24.27	0.0000	35.20	17.79	0.0001
At most 2 *	0.59	25.52	12.32	0.0002	24.48	11.22	0.0002
At most 3	0.037	1.04	4.12	0.3571	1.04	4.129	0.3571

Results of both Trace and Maximum Eigenvalue tests suggest the existence of at least three cointegrating relationships among the variables in the series at 5% level of significance. This implies that the series under consideration are driven by at least three common trends. We save the residuals from the first three equations of the VAR, which are used as the error-correction term in the subsequent tests for Granger causality.

Granger Causality Test

We use a Vector Error Correction Mechanism (VECM) to test the granger causality among the variables under consideration. Table 4 reports the Granger non-causality statistics for the variables GDP growth (Δy), export growth (Δx), import growth (Δm), and remittance growth (Δr) with error-correction terms- $\xi_{1,t-1}$, $\xi_{2,t-1}$ and $\xi_{3,t-1}$. The error-correction terms are adjustment term toward equilibrium sub-space and also indicate to long-run causality. Results indicate export growth, import growth and remittance growth Granger cause GDP growth in the short-run and the causality is unidirectional. Shirazi and Abdul Manap (2005) found feedback effect running from imports to GDP growth. Feedback effect of import growth on GDP growth can be interpreted as the consequences of technology transfer. Bangladesh imports capital machinery, which add to our physical capital stock and augment the productive capacity. Results do not indicate a reverse causality among the variables. Long run GDP growth however has effect on

the income growth in the short run. Besides, there exists a feedback effect of long run import growth on import growth in the short run.

Table 4: Granger Causality Test

	Δy	Δx	Δm	Δr	$\xi_{1,t-1}$	$\xi_{2,t-1}$	$\xi_{3,t-1}$
Δy		23.43 [0.0000] **	13.89 [0.0010] **	11.51 [0.0032] **	29.32 [0.0000] **	0.0587 [0.8078]	0.13 [0.7153]
Δx	4.52 [0.1040]		0.67 [0.7142]	6.80 [0.4333]	3.21 [0.0730]	0.77 [0.3772]	0.10 [0.7406]
Δm	0.590 [0.7442]	5.054 [0.0799]		0.452 [0.7976]	0.368 [0.5440]	0.034 [0.8519]	18.105 [0.0000] **
Δr	4.148 [0.1257]	12.74 [0.1852]	11.891 [0.7231]		3.527 [0.0603]	3.439 [0.0637]	3.64 [0.0564]

*Superscripts***, ** and * indicate rejection of null hypothesis at 1%, 5% & 10% level of significance*

5. Conclusion

In spite the variables under consideration depict an increasing trend; this study finds limited support in favor of the export-led growth hypothesis for Bangladesh. Time series analysis indicates exports, imports and remittance cause GDP growth in the short run but has no long run impact. Furthermore, the causal nexus is unidirectional. Long run GDP growth causes short run income growth but this affect is once again unidirectional.

Using Johansen's multivariate approach to cointegration, and using imports and remittance as additional variables, our findings suggest that real GDP, real exports, real imports and real

remittance are cointegrated for Bangladesh, implying a long run relationship amongst all these variables. However, the direction of short run and long run causality is unidirectional. This result is hardly surprising as Bangladesh embarked on import-substituting model of growth after independence in 1971 and the reforms of the external sector are more or less a recent phenomenon which is still going on.

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