

Causality between Industrial Production and Exports in Bangladesh

M Gazi Salah Uddin (Corresponding Author),

Senior Lecturer

Department of Business Administration

East West University

43, Mohakhali, Dhaka-1212, Bangladesh

Email: gsu@ewubd.edu/rimsust2002@yahoo.com

And

Abdullah M Noman

Assistant Professor

Faculty of Business Administration

American International University Bangladesh

Kemal Ataturk Avenue, Banani

Dhaka 1213, Bangladesh

Causality between Industrial Production and Exports in Bangladesh

M Gazi Salah Uddin

East West University, Bangladesh

Abdullah M Noman

American International University, Bangladesh

Abstract:

This paper investigates the causal nexus between exports and economic growth in Bangladesh. The paper uses time series econometrics tools to investigate the relationship among the variables. The ADF test Granger Causality test and Co-integration Models are employed taking care of stochastic properties of the variables. All information is collected from International Financial Statistics (IFS, 2007). Using monthly data for a period from 1973 M7–2006 M8, the article finds that industrial production and exports are co integrated. The co-integration analysis suggested that there is a long-run equilibrium relationship. The results of an error correction model (ECM) suggest that there is long-run bidirectional causality from exports to growth and growth to export in Bangladesh.

Keywords: Export-led growth; Cointegration; Granger causality; Error-correction model

JEL Classification: O1; F1

Causality between Industrial Production and Exports in Bangladesh

1. Introduction

Economists supporting the export-led growth hypothesis consider that exports can serve as an engine of growth. The increase in demand for output of a country through the growth of exports allows the exploitation of economics of scale for an economy. On the other hand, the expansion in exports promotes specialization in the production of export products, which in turn boosts the productivity level and causes the general level of skills to rise in the export sector. A nation could arguably accelerate the rate of economic growth by promoting export of goods and services. In the last decade, exports from Bangladesh have gone up significantly. The economy has come a long way since independence and the volume of international trade as a share of GDP has increased considerably. While exports as a proportion of GDP increased to 16.8% in 2005–06 from 6.1% in 1972–73, the imports to GDP ratio increased to 21.5% from 11% over the same period (Bangladesh Economic Review, 2007).

Exports in Bangladesh largely depend on the manufacturing sector. Bangladesh is a manufactured goods exporting country, although most export items being produced utilize relatively simple technology. Ready made garments (RMG) and knitwear account for the large part of exports of Bangladesh. Starting from almost negligible share of 1.1% in total exports in 1981–82, their combined share increased to 68% in 1996–97 (Bakht, 2000). In 1996–97 exports of primary commodities have been approximately 11.88 percent of total exports which further reduced to 7.34 percent in 2005–06. Manufacturing exports increased to approximately 92.65% from 88% during the same period¹. Other major exports include frozen foods, jute goods, leather and leather products, and raw jute. According to the World Development Report, 2003, the share of manufactured goods in total merchandise exports was as high as 91% in 2000. It is interesting to note that the share of manufactured exports in Bangladesh was higher in comparison to other South Asian countries such as India (79%), Pakistan (85%) and Sri Lanka (75%) in 2000.

¹ Authors' own estimate. Data taken from Bangladesh Economic Review, 2007, p 249

Policy wise, Bangladesh has moved from an import–substituting one to an export–promoting one. Liberalized trade policies took place and quantitative restrictions were removed. At the same time, more emphasis is now given towards securing foreign direct investment (FDI). Exclusive ‘Export Promotion Zones’ have been established for attracting FDI which offer infrastructure as well as fiscal incentives (Mamun and Nath, 2005). Industrial expansion is a key element of the Poverty Reduction Strategy Paper (PRSP) prepared by the government and industrial policy is designed to give necessary impetus to the manufacturing sector.² In recent years, FDI has increased but the trend suggests that the significant share of this FDI has been in the service sector (Bangladesh Economic Review, 2007). Rashid (2000) argues that trade policy reforms have augmented the manufacturing capacity of the country through increased imports of capital machinery. He further asserts that large and medium scale industries benefited from this, while the small and cottage industries and import substituting ones suffered. Within the large and medium enterprises, export oriented sectors have benefited largely from trade liberalization. Duty free access to inputs under the Multi Fiber Agreement (MFA) provisions has helped the export sector grow. However, high cost of credit is considered as a major challenge for the manufacturing sector, it is argued that the L/C facilities from the banking sector have generally facilitated imports of capital and intermediate inputs.

The paper contributes to the existing literature on export–growth nexus by focusing on a narrower aspect of this relationship. More specifically, instead of looking at a broader measure of growth, namely, real GDP per capita, we look at a proxy for growth of economic activities, i.e. industrial production index. Exports directly stimulate industrial production in Bangladesh, as the nation relies more on manufacturing exports rather than primary or service exports. Therefore, it is more appropriate to examine whether exports affect level of industrial production activities rather than GDP per capita. The rest of the paper is organized as follows. Section 2 documents brief literature review and section 3

² Please check http://www.fbcci-bd.org/policy/Industrial_Policy_2005.htm for the detailed Industrial Policy 2005. (accessed on 5 January 2009)

outlines the methodology of the paper. Section 4 presents results and findings and section 5 concludes the paper.

2. Literature Review

Evidence of strong economic growth accompanied with robust export performance has lead many economists to conclude that export sector of a country has pivotal role in its economic growth. Theoretical agreement on export-led growth (ELG) emerged among neoclassical economists due to the success of the free-market, and outward-oriented policies of the East Asian Tigers (World Bank 1993). Export-led growth hypothesis has not only been widely accepted by academics (Feder 1982; Krueger 1990), and evolved into a “new conventional wisdom” (Tyler 1981; Balassa 1985), but it also has shaped the development of a number of countries as well as the policies of the World Bank (World Bank, 1987). Many other empirical papers, however, fail to unequivocally support a robust export-economic growth nexus. Jung and Marshall (1985), for instance, based on the standard Granger causality tests, analyzed the relationship between export growth and economic growth using time series data for 37 developing countries and found evidence for the export-led growth hypothesis in only four countries. Darrat (1986, 1987) rejects exports-economic growth causality for three out of four countries. Furthermore, seven countries out of a sample of eight newly industrialized countries, Chow (1987) found strong bidirectional causality between export growth and industrial development. Several researchers, such as Bahmani-Oskooee *et al.* (1991) and Dodaro (1993), showed mixed results.

Researchers have produced different results even for a single economy. Results from investigations on Indian data are a case in point. Nandi (1991) found evidence of unidirectional causality from export growth to economic growth. Bhat (1995) reexamines the export-economic growth nexus for India, and finds evidence of bi-directional causality between export growth and economic growth. Xu (1996) confirms rejection of the export-led growth hypothesis for India. Ghatak and Price (1997), on other hand, conclude that export growth is caused by output growth in India. In addition to India, there have also been studies on South Asian neighboring countries of Bangladesh, which

share many economic characteristics among themselves. For example, Khan *et al.* (1995) find strong evidence of bi-directional causality between export growth and economic growth for Pakistan. Anwar and Sampath (2000) examine the export-led growth hypothesis for 97 countries (including India, Pakistan and Sri Lanka) for the period 1960–1992. They find evidence of unidirectional causality in the case of Pakistan and Sri Lanka, and no causality in the case of India. However, Kemal *et al.* (2002) find a positive association between exports and economic growth for India as well as for other economies of South Asia. Mamun and Nath (2005) shows industrial production and exports are co-integrated and long-run unidirectional causality from exports to growth in Bangladesh. Love and Chandra (2005) shows both short and long-run unidirectional causality from national income to exports in Bangladesh. Clarke and Ralhan (2005), and Mollik (1996) also support causal nexus between export and growth for Bangladesh.

3. Data and Methodology

Data

The monthly data of industrial production index and exports were taken from International Financial Statistics (IFS, 2007). The data span over 33 years from September, 1973 (M7) to October, 2006 (M8). Necessary logarithmic transformation of the data was done. The monthly data set consists of industrial production index (as a proxy for economic activity) and exports earning for Bangladesh. In order to obtain a better understanding of the behavior of economic activity and exports earnings, a preliminary analysis of the data is first carried out. Table 1 presents summary of the logarithms of the industrial production index and exports earnings. The mean average of the industrial production index is 4.066 whereas the maximum and minimum values are 5.145 and 3.318, respectively. The mean average of the export earning is 8.288 while the maximum and minimum values are 11.056 and 5.010, respectively. The standard deviation of the exports earnings is higher than the industrial production index. The pair-wise correlation is also calculated and the coefficient is 0.90 indicating high and positive co-movements between two variables under investigation.

Table 1: Descriptive Statistics on Industrial Production Index and Export Earnings

(Bangladesh: 1973 M7–2006 M8)

	<i>IPI</i>	<i>EXP</i>
Mean	4.066	8.288
Median	3.899	8.2970
Maximum	5.145	11.056
Minimum	3.318	5.0172
Std. Dev.	0.462	1.501
Skewness	0.514	-0.208
Kurtosis	1.975	1.998
Jarque–Bera	34.978*	19.506*
Observations	398	398

Note: *IPI*: Log of Industrial Production Index; *EXP*: Log of Exports earnings

Methodology

The standard Granger causality test (Granger, 1988) seeks to determine whether past values of a variable helps predict changes in another variable. In the context of this analysis the Granger method involves the estimation of the following equations:

$$\Delta IPI_t = \beta_0 + \sum_{i=1}^q \beta_{1i} \Delta IPI_{t-i} + \sum_{i=1}^q \beta_{2i} \Delta EXP_{t-i} + \varepsilon_{1t} \quad (1)$$

$$\Delta EXP_t = \varphi_0 + \sum_{i=1}^r \varphi_{1i} \Delta EXP_{t-i} + \sum_{i=1}^r \varphi_{2i} \Delta IPI_{t-i} + \varepsilon_{2t} \quad (1)$$

where, IPI_t and EXP_t represent industrial production index and exports, respectively, ε_{1t} and ε_{2t} are uncorrelated stationary random process, and subscript t denotes the time period. Failing to reject $H_0 : \beta_{21} = \beta_{22} = \dots = \beta_{2q} = 0$ implies that exports do not Granger cause industrial production activities. On the other hand, failing to reject $H_0 : \varphi_{21} = \varphi_{22} = \dots = \varphi_{2r} = 0$ implies that industrial production do not Granger cause exports.

Empirical works based on time series data assume that the underlying time series is stationary. However, many studies have shown that majority of time series variables are nonstationary or integrated of order 1 (Engle and Granger, 1987). The time series properties of the data at hand are therefore studied in the outset. In addition to applying traditional augmented Dickey–Fuller (ADF) tests, Phillips and Perron (PP) tests are also

applied as the latter tests are more efficient in the presence of a one–time structural break in the data.

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

$$\Delta IPI_t = \beta_0 + \sum_{i=1}^q \beta_{1i} \Delta IPI_{t-i} + \sum_{i=1}^q \beta_{2i} \Delta EXP_{t-i} + \alpha_1 Z_{t-1} + \varepsilon_{1t} \quad (3)$$

$$\Delta EXP_t = \varphi_0 + \sum_{i=1}^r \varphi_{1i} \Delta EXP_{t-i} + \sum_{i=1}^r \varphi_{2i} \Delta IPI_{t-i} + \lambda_1 Z_{t-1} + \varepsilon_{2t} \quad (4)$$

where Z_{t-1} is the ECT obtained from the long run cointegrating relationship between industrial production and exports earnings. The above error correction model (ECM) implies that possible sources of causality are two: lagged dynamic regressors and lagged cointegrating vector. Accordingly, by equation (3), exports Granger causes industrial production index, if the null of either $\sum_{i=1}^q \beta_{2i} = 0$ or $\alpha_1 = 0$ is rejected. On the other hand, by equation (4), industrial production index Granger causes exports, if λ_1 is significant or $\sum_{i=1}^r \varphi_{2i}$ are jointly significant. Industrial production and exports cause each other (i.e. presence of bidirectional causality), if causality exists in both directions. The results obtained are in contrast to other papers cited above that examined exports–led growth hypothesis for Bangladesh and mostly found unidirectional causality running from exports to economic growth.

4. Empirical Results

This section begins with an examination of time series properties of the variables. In addition to traditional augmented Dickey–Fuller (ADF) test, another more powerful test,

namely KPSS³ test, is also applied. The results of these tests are presented in Table 2. For ADF tests, both with constant and constant and trend, one is unable to reject the null at level, is able to reject when first differenced series is used. Similarly, for KPSS tests, again both with constant and constant and trend, the null (of stationarity) is rejected at levels but accepted when applied to first differenced data. In total, it emerges from the unit root test results that both the variables are integrated of order 1. Therefore, standard Granger causality tests will be invalid and one needs to apply the ECM as explained before.

Table: Unit Root Test Results

	ADF		KPSS	
	Constant	Trend	Constant	Trend
<i>LIPI</i>	0.799	-2.236	6.239*	1.364*
Δ <i>LIPI</i>	-13.781*	-13.964*	0.085	0.008
<i>LEX</i>	-1.276	-1.199	6.638*	0.694*
Δ <i>LEX</i>	-11.894*	-11.931*	0.0271	0.0195

Note: * denotes significance at 5% level. Optimal lag length for ADF is selected using testing down method from a maximum lag equal to 8. The lag truncation parameter for the KPSS test is selected using the formula $4(T/100)^{1/4}$.

Once it is established that variables are $I(1)$, the next step is to test for existence of any cointegrating relationship between industrial production index and exports earnings. The Johansen (1991) LR test of cointegration is applied and results are showed in Table 3. The appropriate VAR lag length is selected using BIC. The λ -trace statistic rejects the null of $r \leq 0$ but cannot reject $r \geq 1$ and also, the λ -max statistic rejects the null of $r = 0$ but fails to reject $r = 1$ at 5% level. These Eigenvalue tests based on stochastic matrix indicate existence of the cointegrating relationship between industrial production and exports. So, the Granger causality tests will be modeled using ECM as explained in Equations (3) and (4).

³ Unlike the ADF test, KPSS test has the null of stationarity against a nonstationary alternative. See, Kwiatkowski *et. al.* (1992) for details and critical values of the KPSS test.

Table 3: Cointegration LR Test Results

$X' \equiv [LIPI, LEXP]; [\text{VAR lag } k = 2]$					
Null	Eigenvalues	Trace Test		Max Eigenvalue Test	
		$\lambda - \text{trace}$	$p\text{-value}$	$\lambda - \text{max}$	$p\text{-value}$
$r \leq 0$	0.054208	22.448	0.0031	22.070	0.0018
$r \leq 1$	0.00095336	0.37771	0.5388	0.37771	0.5388

Notes: The r denotes the number of cointegrating vectors.

Table 4 presents the Granger causality tests results. The F statistic on linear restriction on lagged values of IPI rejects the null hypothesis that exports do not Granger cause industrial production index (IPI). On the other hand, the coefficient of the lagged ECT has desirable negative sign and is also statistically significant reinforcing F -test results. In other words, it is found that exports earnings of Bangladesh can explain movements in the industrial production index. Next, we consider the other null hypothesis that industrial production index does not Granger cause exports earnings. Again, it appears from F statistic that lagged IPI terms are jointly significantly different from zero and lagged ECT term is carrying desirable negative sign and also significant: the null is hence rejected. The last results establish feedback or bidirectional causality between exports and industrial production activities in Bangladesh.

Table 4: Granger Causality Test Results

Null Hypothesis	$F\text{-stat } [p\text{-value}]$	$ECT_{t-1} [t\text{-ratio}]$	Decision
$LEXP \rightarrow LIPI$	4.622 [0.032]	-0.084* [-3.695]	Rejected
$LIPI \rightarrow LEXP$	6.443 [0.011]	-0.027** [-2.175]	Rejected

Notes: Optimal lags are selected using Bayesian Information Criteria (BIC). *(**) denote rejection at 5%(10%) levels of significance. The Symbol \rightarrow means “does not Granger cause”.

5. Concluding Remarks

The paper aimed to examine the pattern of long run relationship between exports earning and industrial activities in Bangladesh. It chooses to apply Granger causality tests to find the direction of causality between exports and industrial production index. Given that the variables are $I(1)$ and are cointegrated, Granger causality tests incorporating an error

correction model was selected. Results obtained reveal that there exists bidirectional causality between exports and industrial activities in Bangladesh.

References

- Anwar, M., and R. Sampath (2000) Exports and Economic Growth. *Indian Economic Journal* 47:3, 79–88.
- Bahmani–Oskooee, Mohsen; Hamid Mohtadi; and Ghiath Shabsigh. (1991). “Exports, Growth and Causality in LDCs: A Re–examination.” *Journal of Development Economics* 36, no.2: 405–15.
- Balassa, Bela (1985). “Exports, Policy Choices, and Economic Growth in Developing Countries after the 1973 Oil Shock,” *Journal of Development Economics* 18, no. 1: 23–35.
- Bangladesh Economic Review (2003) and (2007) Ministry of Finance, Dhaka
- Bhat, S. (1995) Export and Economic Growth in India. *Artha Vijana* 37:44, 350–358.
- Chow, P. (1987) Causality between Export Growth and Industrial Development: Empirical Evidence from the NICs. *Journal of Development Economics* 26, 55–63.
- Darrat, Ali F. (1986). “Trade and Development: The Asian Experience.” *Cato Journal* 6, no. 2: 695–99.
- Darrat, Ali F.. (1987). “Are Exports an Engine of Growth? Another Look at the Evidence.” *Applied Economics* 19, no. 2: 277–83.
- Dodaro, Santo. (1993). “Exports and Growth: A Reconsideration of Causality.” *Journal of Developing Areas* 27, no. 2: 227–44.
- Engle, R. and Granger, C. (1987), “Co integration and error correction representation: estimation and testing”, *Econometrica*, Vol. 55, pp. 251-276.
- Feder, Gershon. (1982). “On Export and Economic Growth.” *Journal of Development Economics* 12, nos. 1–2: 59–73.
- Ghatak, Subrata, and Stephen Wheatley Price. (1997). “Export Composition and Economic Growth: Cointegration and Causality Evidence for India.” *Weltwirtschaftliches Archiv* 133, no.3: 538–53

- Granger, C. W. J. (1988) 'Some Recent Developments in the Concepts of Causality', *Journal of Econometrics*, 39:199–211
- IFS (2008) International Financial statistics, IMF
- Johansen, S. (1991). "Estimation and hypothesis testing of cointegration vectors in Gaussian vector autoregressive models", *Econometrica* 59 (6), pp. 1551–1580
- Jung, W., and P. Marshall (1985) Exports, Growth and Causality in Developing Countries. *Journal of Development Economics* 18, 1–12.
- Kemal, A. R., M. Din, U. Qadir, L. Fernando, and S. Colombage (2002) Exports and Economic Growth in South Asia. A Study prepared for the South Asia Network of Economic Research Institutes.
- Khan, A. H.; A. Malik; and L. Hassan. (1995) "Exports, Growth and Causality: An Application
- Krueger, Anne O. (1990). *Perspectives on Trade and Development*. Chicago: University of Chicago Press.
- Kwiatkowski, D., Phillips, P. C. B., Schmidt, P. and Shin, Y. (1992). Testing the Null of Stationarity Against the Alternative of a Unit Root: How Sure Are We That Economic Time Series Have a Unit Root?, *Journal of Econometrics*, 54, 159–78.
- Love, J and Chandra, R. (2005), "Testing export-led growth in Bangladesh in a multivariate VAR framework", *Journal of Asian Economics*, Vol. 15, Issue 6, pp.1155–1168
- Mamun, K. A. Al and Nath, H. K. (2005), "Export-led growth in Bangladesh: a time series analysis", *Applied Economics Letters*, Vol.12, Issues 6, pp.361 –364
- Mollik, A. (1996) Export Led Growth and Causality in Bangladesh. *Asian Economic Review* 38:2, 297–307.
- Nandi, Sukumar, and Basuded Biswas. (1991). "Export and Economic Growth in India: Empirical Evidence." *Indian Economic Journal* 38, no. 3: 53–59.
- Rashid, M. A. (2000) "Impact of Trade Reforms on Industrial Productivity and Employment," in Centre for Policy Dialogue, Structural Adjustment Participatory Review Initiative, Bangladesh (a report prepared for presentation in the Second National Forum of Bangladesh SAPRI held in Dhaka, March 13-15, 2001).

- Tyler, William G. (1981). "Growth and Export Expansion in Developing Countries: Some Empirical Evidence." *Journal of Development Economics* 9, no. 1: 121–30.
- World Bank. (1987). *World Development Report 1987*. New York: Oxford University Press
- World Bank. (1993). *The East Asian Miracle: Economic Growth and Public Policy*. New York: Oxford University Press
- Xu, Z. (1996) On the Causality between Export Growth and GDP Growth: An Empirical Re–investigation. *Review of International Economics* 4:2, 172–184.