RD

Working Paper Series: WP No. 1611

Does the Import of Capital Goods Spur Manufacturing Output Growth in Bangladesh?

Md. Abdul Wahab
Deputy General Manager

Nurun Nahar Sultana
Deputy General Manager

Md. Rezwanul Hoque
Deputy Director

September 2016

Research Department
Bangladesh Bank
Head Office, Dhaka, Bangladesh

Does the Import of Capital Goods Spur Manufacturing Output Growth in Bangladesh?

Md. Abdul Wahab*
Nurun Nahar Sultana
Md. Rezwanul Hoque

Abstract

Given the importance of manufacturing output growth in Bangladesh, this paper examines the relationship between capital goods imports and manufacturing output growth using annual data over the liberalized period FY1985-FY2014. Employing the Johansen cointegration method and vector error correction (VEC) techniques, this work finds a strong long run positive relationship between capital goods imports and manufacturing output growth in Bangladesh. The findings explore that imports of capital goods greatly promote manufacturing output growth in the long run, but this relationship does not hold in the short run. The possible interpretation stands out that capital goods take a fair amount of time to make the production process begin. Our results provide a set of policy recommendations to promote international trade as well as financial liberalization to enforce imports of capital goods to encourage private investment in Bangladesh.

JEL Classification: F31; O14; F41; C32

Keywords: Imports; capital goods; manufacturing output; cointegration

* The Authors, Md. Abdul Wahab and Nurun Nahar Sultana are Deputy General Manager, and Md. Rezwanul Hoque is Deputy Director of Research Department, Bangladesh Bank (central bank of Bangladesh). The authors gratefully acknowledge the guidance of Anupam Das and Khawaja Mamun. The authors are also thankful to Biru Paksha Paul and Md. Akhtaruzzaman for their valuable comments. The views expressed in this paper are those of the authors' own and do not necessarily reflect those of Bangladesh Bank and the Government of Bangladesh. Any comment or suggestion will be welcome to mabdul.wahab@bb.org.bd

1. Introduction

Capital accumulation and export promotion policies in emerging economies in Asia and Latin America contribute the economies to grow fast through industrialization process. The processes speed up by importing capital goods. Long-run growth process in China is mostly explained by capital goods imports (Herrerias and Orts, 2013). The development of imports of technologically improved capital goods started in the mid ’60 through reforms of the Chinese economy. In Taiwan, after the lifting of Martial Law in 1987 reforms program initiated through Taiwan-Japan-US trade nexus that has changed the scenario into import-led growth of the economy of Taiwan (Hsiao, S.T., Frank and Hsiao, M. W., 2014). Zang and Mark (2011) explore bidirectional causality between capital goods imports and economic growth for both Korea and Japan. Similar evidence observes for India, Malaysia, Thailand and Singapore. This scenario has triggered a question: how do the imports of capital goods effect manufacturing output growth in Bangladesh?

Bangladesh economy started to shift polices from an anti-export bias to an export promotion one since the late ’70s; major macroeconomic reforms were undertaken vigorously during the ’80s and continued afterwards (Bhattacharya and Titumir, 2001). With the advantage of trade liberalization, the Bangladesh economy started to grow rapidly since the early '90s and became one of the South Asian “*tiger-case*” economies (Paul, 2011). With an average annual growth rate of 6 percent, the overall performance of the manufacturing sector improved in the ’90s. This is largely dominated by large manufacturing industries. The share of manufacturing sector in GDP increased from 11.6 percent in the ’80s to around 15 percent in the ’90s (MoP, 2011). It registered at 19 percent of the total GDP in FY14 that recorded around 9 percent annual growth.

The growth of manufacturing output sped up export growth, which reached from 8.5 percent in the '80s to 16 percent in the following decade. Moreover, manufacturing products held the lion share of total export that jumped from 65 percent in FY85 to 87 percent in FY99. Notwithstanding that it recorded almost 96 percent in FY14. Nevertheless, the Bangladesh economy got a momentum during the ’90s and achieved a modest growth rate of 4.8 percent during that period (MoF, 2003 and 2015). The GDP growth rate crossed 6 percent mark in FY04 and continued until recently even though the recent past global financial crisis (GFC) of 2008 adversely affected most of the developed and developing economies (IMF, 2014).

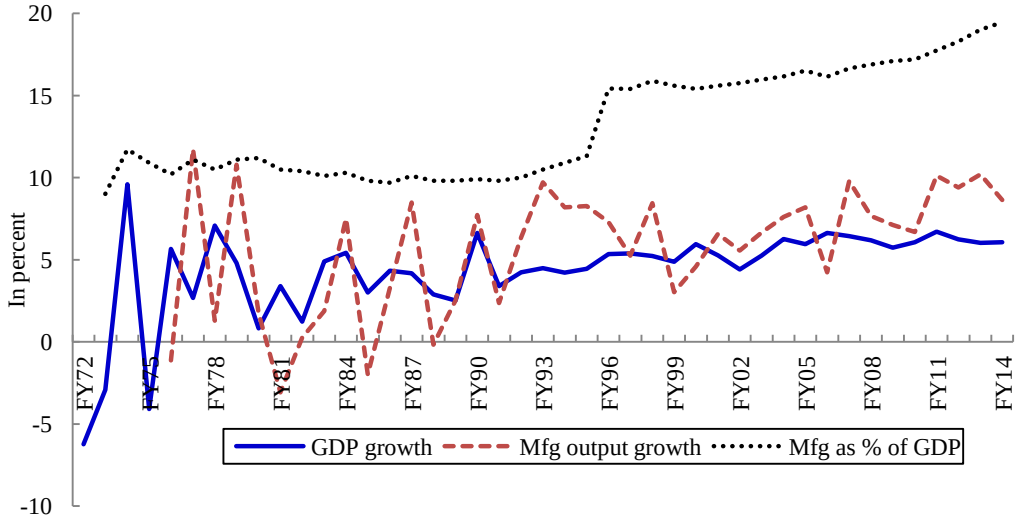
While capital goods are used as a proxy to measure for investment occurring in the industrial sector, Bangladesh is not a major producer of capital goods, rather depends heavily on imported capital machinery and equipment (Bhattacharya and Titumir, 2001; MoC, 2012). Strong macroeconomic performances along with significant policy changes such as reducing tariff, non-tariff barriers, and tariff rates encouraged such imports that contributed to the growth of manufacturing output of domestic industries over the last two decades. Consequently, GDP growth rate increased. Figure-1 illustrates the movements of GDP and manufacturing output growth in Bangladesh since its independence. Since the '90s, while growth in the manufacturing sector moves consistently with GDP growth, its contribution to GDP becomes larger. This indication has a significant importance of the manufacturing sector on economic growth in Bangladesh.

On this milieu, we attempt to investigate relationship between capital goods imports and manufacturing output growth for Bangladesh economy. We present a synthesis of cointegration to unveil the long-run relationship between manufacturing output and capital goods imports. We also analyze short-run dynamics among the variables. To preview the results, we find a long-run positive relationship between manufacturing output and imported capital goods where capital goods imports significantly promote manufacturing output. However, there does not have any relationship between the variables in the short run. The findings of this study will contribute to the literature of Bangladesh economy by providing new evidence on the role of capital goods imports in producing manufacturing goods that meets domestic demand as well as accelerates exports of the country.

The rest of the paper is organized in the following manner: a brief overview on the imports of Bangladesh by major sector is illustrated in Section 2. Literature review is discussed in Section 3. Section 4 provides the description of the variables considered and the methodology we used.

Estimating results of the cointegration and vector error correction model (VECM) are discussed in Section 5. Finally, conclusion is drawn in Section 6.

Figure 1: Historical trends of annual GDP growth rate in Bangladesh: FY72-FY14



Source: Bangladesh Bureau of Statistics (BBS), 2015.

2. Imports of Bangladesh by Major Commodities

It is well recognized that imports of capital goods and industrial raw materials have significant effects in domestic production process. Following that in Bangladesh capital goods imports experienced upward trend since ’80s. Capital goods imports witnessed an acceleration of an average 34 percent annual growth till the global financial crisis (GFC) 2008 along with around 7 percent share in total import (BB, 2015). The growth path continued except the break down event during GCF (FY08-FY09). The contribution of imported raw materials and intermediate goods in the total import jumped from 13 percent in the ’80s to 35 percent in the ’90s with an average of 23 percent growth per year. It posted around 40 percent of total imports during FY00 – FY07.

The continuous increase of imports of raw materials and capital machinery indicates that the degree of capacity utilization as well as industrial capacity in Bangladesh economy has been increasing over the period (Bhattachrya and Rashed, 2001). We argue that the increase of capacity utilization in the manufacturing industry is supported by the acceleration in imports of fabric and textile articles thereof by ready-made garments (RMGs) industry under the process of back-to-back letters of credit (L/Cs) and a large increase of imports by industries located in export processing zones (EPZs). Data shows that imports under back-to-back L/Cs increased from USD 1.5 billion (26 percent of total import) in FY95 to USD 2.0 billion (27 percent of total import) in FY00 that continued to rise and stood at USD 6.2 billion (15 percent of total import) in FY14 (BB, 2015).

The RMG sector is not only the major importer of industrial raw materials and intermediate goods along with capital machinery imports but also the largest exporter of the country (Bhattacharya, Rahman and Raihan, 2002 and Paul 2011). The RMG sector held the lion share of total export (81 percent of total exports) in FY14 which was 41 percent in FY90 (MoF, 1999 and BB, 2014). Hence, our study is very important to investigate the relationship between capital goods imports and manufacturing output growth in Bangladesh.

3. Literature Review

Theories and literature support that countries have comparative disadvantage in producing goods, imports of those goods from technologically advanced countries can be an efficient management in production process; both country (comparative advantage and disadvantage country)

can be benefited from the trade (Rcardo, 1817). In particular, there has been an extensive discussion in the existing literature that countries those have comparative disadvantages in producing capital goods, accelerating domestic manufacturing output by capital goods imports from aboard (Thangavelu and Rajaguru, 2004, Awokuse, 2007 and Awokuse, 2008).

Since the main objective of this study is to examine whether capital goods imports promote manufacturing output growth for Bangladesh, our attempts to focus most relevant works on this area. Using a panel dataset of a sample of manufacturing firms for the period 1977-87, Hassan (2000) finds a positive impact of imported technology and capital goods on manufacturing output in India. Veeramani (2009) tests the impact of imported intermediate and capital goods on economic growth by using disaggregated trade data for a large number of high income and low income group countries. This paper finds that higher productivity is associated with imports that leads to a faster growth rate on per capita income and vice versa. Uğur (2008) tests for causality between various categories of imports (imports of investment goods, raw materials, consumption goods and other goods) and GDP growth in Turkish economy. He discovers a bidirectional relationship between GDP and imported investment goods, and raw materials while there is a unidirectional relationship between GDP and imported consumption goods and other goods. Herrerias and Orts (2011) find that the rate of capital accumulation and the relative proportion of foreign capital goods over domestic capital goods used in the domestic production processes contribute to accelerate Chinese GDP growth and per capita income.

While studies on export-led growth are numerous, there has a small set of researches on imports and economic growth in Bangladesh but the results are inconclusive. Most focused studies are reviewed in this section. Dawson (2006) by using annual data for the period 1973-2003, discovers exports cause GDP to grow fast but imports cause negatively. Here pre and post reforms regimes of the country did not consider separately. Almost same result is observed in the study of Hossain, Haseen and Jabin (2009) for the period 1973-2008. Their findings explore that in long-run exports significantly promote imports. Paul (2011) also finds very similar outcomes in a study where he employs annual data of exports, imports and GDP growth rate for the period 1979-2010. This study finds a long term relationship between export and GDP growth but do not find any evidence between imports and output growth.

Likewise, Mamun and Nath (2005) work on Bangladesh economy. Their Engel-Granger casualty test finds unidirectional casualty from exports to GDP growth for the period 1976Q1–2003Q4 but could not find any impact of industrial production on GDP. Sultan, P. (2008) finds a cointegration long-run relationship between GDP and industrial value added. Using quarterly data for the period 1974-1985, Hossain (1995) estimates manufacturing production function by applying simple OLS. The estimated results show that real expenditure which is proxy of imported capital goods and private sector credit has a positive impact on manufacturing output.

Most studies conclude as that export promotes economic growth in Bangladesh, imports do not so. There have major shortcomings: selecting inappropriate variable, badly chosen samples, and dearth of suitable methodologies. Many studies overlook pre and post liberalized regime in selecting samples (Dawson, 2006; Sultan, P., 2008). Some studies use the IIP to proxy of GDP (Hossain, 1995) which is inappropriate for a country like Bangladesh. However, it has yet to be found any time series analysis that focuses on the relationship between capital goods imports and manufacturing output growth in Bangladesh. Because typically of theoretical relationship between imports and economic growth tends is more complicated than that directly be observed in the relationship between exports and economic growth. This paper attempts to fill this gap.

4. Data and Methodology

Following the objective of our study examine the existence of a long-run relationship among manufacturing output and imports of capital goods in Bangladesh economy. Thus, our interest variables are manufacturing output, and imported capital goods and raw materials. We also include exchange rate as an exogenous variable as demand for imports is sensitive to the fluctuation of exchange rates and to remove omitted variable bias. Hence, the model is developed as:

$$Y = f(M, E) \quad (1)$$

Where, Y denotes manufacturing output in GDP, M is imports of capital goods, and E is the exchange rate defined with respect to foreign currency. In our study we use exchange rate, i.e. amount of local currency against per unit US Dollar. Thus an increase in E means deprecation of local currency. Theoretically, we find that if local currency depreciates then exports increase and imports fall. In empirical literatures, it is widely acknowledged that imports play a central role in the countries whose manufacturing base is built on export oriented industries (Esfahani, 1991; Serletis, 1992; Riezman et. al, 1996; Liu et. al., 1997). Following that, statistically we observe that more than half of total imports in Bangladesh are capital machineries and raw materials that are mostly the fuel of manufacturing industries. Hence, imports are relatively less sensitive with deprecation of Bangladeshi Taka and if local currency depreciates, gross output rises through the channel of increasing exports. Therefore, expected signs for both the coefficients of M and E in equation 1 are positive.

Following equation 1, we develop the reduced form of the error correction equation that is to be estimated as follows,

$$\Delta (LnY_t) = \alpha + \Sigma \beta_1 \Delta (LnM_t) + \Sigma \beta_2 \Delta E_t + \varepsilon_t \quad (2)$$

Where, t=1,...T, ε_t is the white noise error term. α is the constant term, and β_i (i = 1 and 2) denotes estimated parameters.

To estimate the equation we take annual data of the variables of manufacturing output (Y), imports of capital goods and industrial raw materials (M) and exchange rate (E, Bangladeshi Taka against per unit of USD). We consider natural log for the variable Y and M, where, exchange rate is in normal form. For sample selection, we capture the period from FY85 to FY14. The series of data are collected from Bangladesh Bureau of Statistics (BBS) and Bangladesh Bank (BB).

There are two important reasons to start the dataset in FY85. First, during the immediate years of the independence of Bangladesh in 1971, most of economic policies were concerned to recover from a war-torn economy along with nationalization processes of banks and manufacturing industries under socialist planning of national economy. In addition, the famine of 1974 (Sen, 1981), political unrest for military coup and the oil-price shocks of 1973 and 1979 led to major macroeconomic disorders in Bangladesh during 1970s (Paul, 2011).

Secondly, in the early ’80s, macroeconomic policy regime changed into liberal policies that inclined towards market forces by denationalizing state-owned corporations, by encouraging private sector participation, and by reforming trade policies (Bhattacharya and Titumir, 2001). The undertaken policy reforms forced the economic activities towards up-turn and the economy gained a momentum during the late ’80s (Figure1). We also argue that examining the impact of imports of capital goods on manufacturing output requires a relatively liberalized regime. The estimates on the interaction of these variables are likely to be faulty if sample carelessly includes restricted regimes when trade controls were relatively high. Moreover, country’s GDP had accounted broadly considering base year 1985-86. Hence, taking into account the facts, we consider the sample period that begins in FY85 and ends in FY14.

In case of time series data, most of macroeconomic variables are characterized by a unit root processes i.e., non-stationary (Nelson and Plosser, 1982). In general, unit root tests precede cointegration test; otherwise, regression of non stationary variables may leads to spurious results. The most commonly used tests are the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests. However, the PP test has established a t-statistics on the unit root coefficient in a DF regression which corrected for autocorrelation and heteroskedasticity. Maddala and Kim (1998) argue that the DF test does not have serious size distortions, but less influential than the PP test. On the other hand, Choi and Chung (1995) report that for low frequency data like ours, the PP test emerges to be more persuasive than the ADF test. However, we will apply both the PP and ADF methodologies to test unit roots in the variables of the model.

If the variables are found to be I(1), i.e., series are stationary at the first difference level. Hence, cointegration test will be pursued. We will apply Johansen approach of cointegration (Johansen, 1988;

Johansen and Juselius, 1990). In our study where the three variables are introduced, the number of the cointegration relation must be less than three if the series are really cointegrated. We will apply both the trace and maximum eigenvalue tests to find out cointegration relationship of the variables in the model to prove the existence of the long-term relationship in the system. If we find cointegration relationship, then we will develop a Vector Error Correction Model (VECM) to estimate cointegration equation in the long term and to analyse short-run dynamics of the variables. Finally, model will be tested with the sequence of miss-specification tests without showing any autocorrelation or normality problems.

5. Estimation Results

5.1 Unit Roots Tests

We see in Panel A of Figure A1 in Appendix, that the variables that we use are most likely to have unit roots in levels. We apply both ADF and PP methods to check stationarity of the variables. The results are presented in Table 1, show that series of manufacturing output (Y), imports of capital goods (M) and exchange rate (E) have unit roots in level. However, in first differences of the variables, both the ADF and PP tests statistics reject unit roots and thus the variables are integrated of order one, i.e., I(1); the variables now qualify to examine cointegration.

Table 1. Unit root tests for the variables- manufacturing output, imported capital goods and exchange rate

Variable	Augmented Dickey-Fuller (ADF) test				Phillips-Perron (PP) test				Integration remarks
	In level		In first difference		In level		In first difference		
	Model A	Model B	Model A	Model B	Model A	Model B	Model A	Model B	
LnY	3.31	-1.03	-3.14	-4.16	2.48	-0.94	-3.34	-4.28	I(1)
	(1.00)	(0.92)	(0.03)**	(0.01)***	(0.92)	(0.93)	(0.02)**	(0.01)***	
LnM	-1.13	-3.01	-4.93	-4.99	-3.05	-2.68	-10.10	-13.96	I(1)
	(0.69)	(0.15)	(0.00)***	(0.00)***	(0.04)**	(0.25)	(0.00)***	(0.00)***	
E	0.41	-3.16	-5.57	-5.48	0.52	-2.12	-4.80	-4.20	I(1)
	(0.98)	(0.11)	(0.00)***	(0.00)***	(0.98)	(0.52)	(0.00)***	(0.01)**	

Note: Model A includes intercept, and Model B includes both intercept and trend.
The null hypothesis states that the variable has a unit root.
p-values shown in the parenthesises following each adjusted t-statistics.
*, **, *** denote the significance of the statistics at 10%, 5% and 1% levels respectively.
Source: Bangladesh Bureau Statistics (BBS) and Bangladesh Bank (BB), 2015.

5.2 Cointegration and Vector Error Correction Estimation

There are five options in the Johansen cointegration test (Johansen, 1995). Of these five, Option 3 has intercept in both cointegrating equations (CE) and tests VAR without trend in CEs, and Option 4 has intercept and trend in CE but no intercept in VAR under the assumption for linear deterministic trend in data. In our study, the data as presented in Figure A1 in Appendix shows that all the series used in the study have nonzero means and liner deterministic and stochastic trends, which allow us to use Options 3 and 4.

Before testing for cointegration, optimal lag length is required. For determining the lag length, the most common procedure is to estimate an unrestricted VAR with the variables and is to use the Akaike information criterion (AIC) or Schwartz Bayesian criterion (SBC). In this paper, we consider the AIC which suggests two lags for all variables to get the robust result (Table A1 in Appendix).

Table 2 displays the result of Johansen cointegration test. Both the trace and maximum eigenvalue tests exhibit an evidence of one cointegration relationship among the variables under the Option 3 whereas only trace test accords one cointegration relationship among the variables under Option 4. Following that we conclude that there is a long-run equilibrium relationship between manufacturing output, imports of capital goods and exchange rate.

Table 2: Johansen Cointegration Tests

Test indicator			Option 3			Option 4		
			λ Stat	CV	CE	λ Stat	CV	CE
λ_{trace} tests	H_O: r = 0	H_A: r > 0	30.46	29.80	1	49.17	42.92	1
	H_O: r ≤ 1	H_A: r > 1	8.14	15.49	0	24.06	25.87	0
λ_{max} tests	H_O: r = 0	H_A: r = 1	22.32	21.13	1	25.11	25.82	0
	H_O: r = 1	H_A: r = 2	9.93	14.26	0	17.54	19.39	0

Note: The λ_{trace} and λ_{max} are estimated as per Johansen (1988) and Johansen and Juselius (1990).
CV indicates critical values calculated for the 5 percent significance level.
CE stands for number of cointegration equation.
r denotes for the rank of the matrix, which indicates the number of the CE between the variables.
H_O and H_A indicate the null and alternative hypotheses respectively.
Option 3 includes an intercept without trend in the CE and the test VAR, whereas Option 4 includes an intercept and a trend in the CE without any trend in the VAR.
The λ_{trace} and λ_{max} test statistics under both models are calculated by allowing for linear deterministic trends in data.
Source: Bangladesh Bureau Statistics (BBS) and Bangladesh Bank (BB), 2015

Following equation 2 and using VEC model we find the estimated cointegrating equation is given in equation 3 and detail is attached in Table 3. The model supports all diagnostic tests that there is no either autocorrelation or normality problem in the model (Table A2 and A3 in Appendix).

Cointegrating equation:

$$LnY_{(t-1)} = 0.62\ LnM_{(t-1)} + 0.02\ E_{(t-1)} + 4.61 \quad (3)$$

The cointegrating equation illustrates positive relationship between imports of capital goods and manufacturing output in the long run which is statistically significant at the 1 percent level. However, the coefficient of exchange rate appears positive sign in the cointegrating equation but insignificant that indicates that there is no long-run relationship between exchange rate and manufacturing output.

In the short-run dynamics, the error correction term (top of Table 3) on the regression with first difference manufacturing output possess a negative sign and significant at the 1 percent level, addressing the adjustment behaviour of manufacturing output if by any means the long-run equilibrium relationship is stunned. In this part, the coefficient of the first difference imports of capital goods appear positive sign but insignificant, suggesting that in the short run imports of capital goods are weakly exogenous in the relationship of the model. Exchange rate is also insignificant in the short-run error correction dynamics.

Although, there is a long-run relationship between manufacturing output and imports of capital goods, the error correction model suggests that it is only manufacturing output performs to adjust any disequilibrium once the system is shocked; imports of capital goods and exchange rate do not so. The value of the coefficient of the first-differentiated manufacturing output (-0.1150) indicates that only 11.50 percent of the last year's disequilibrium is corrected current year and that requiring 8.7 years to bringing the system into the steady state once it distorted.

In the VEC model, the short-run interaction shows that only the coefficient of first-differenced imports of capital goods in the first differenced exchange rate equation is positive and statistically significant at the 5 percent level. The causes might be that the increase in imports demand of capital goods leads to push up foreign exchange demand and consequently, domestic currency becomes weak against foreign exchange and thus domestic currency depreciates. Noted that, exchange rate in Bangladesh is measured as an amount of Bangladeshi Taka against per unit of US dollar.

The justification of our findings is embodied as that capital goods and industrial raw materials are imported from technologically advanced countries reasonably at low prices that reduce the cost of production as well as increases scale of industries and productivity of domestic manufacturing industries. The process accelerates manufacturing output and exports. The multiplier effects of exports by receiving foreign exchange further promotes manufacturing output for both domestic and foreign markets as of income effect. Through the channels, Bangladesh manufacturing output grows faster and promotes GDP.

Table 3: Vector Error Correction Estimates

LHS variables → Regressors:	$\Delta Y_{(t)}$	$\Delta M_{(t)}$	$\Delta E_{(t)}$
$ecm_{(t-1)}$	-0.1150***	0.0971	-3.3932
	(0.0326)	(0.1423)	(2.0657)
$\Delta Y_{(-1)}$	0.166551	0.478108	-19.71829
	(0.20876)	-(0.90978)	(13.2055)
$\Delta Y_{(-2)}$	0.016217	0.229360	4.628566
	(0.17931)	(0.78144)	(11.3426)
$\Delta M_{(-1)}$	0.045916	0.016576	6.464499**
	(0.04153)	(0.18100)	(2.62720)
$\Delta M_{(-2)}$	0.040486	-0.123966	-0.313792
	(0.03782)	(0.16482)	(2.39242)
$\Delta E_{(-1)}$	-0.004357	-0.013379	0.149803
	(0.00320)	(0.01394)	(0.20240)
$\Delta E_{(-2)}$	-0.000543	-0.007047	-0.456191
	(0.00288)	(0.01256)	(0.18233)
C	0.084964***	0.241919***	2.959607**
	(0.02257)	(0.09836)	(1.42773)
R^2	0.49	0.21	0.46
Cointegrating equation:	$ect_{(t)} = LnY_{(t-1)} - 0.62^{***} LnM_{(t-1)} - 0.02E_{(t-1)} - 4.61$		
	(0.1396) (0.0119)		

Note: *, ** and *** refer that coefficients are significant at the 10 percent, 5 percent and 1 percent level respectively.
Values in parentheses against each coefficient indicate standard errors.
"Δ" stands for first-order difference operator.
"ect" stands for error correction term and "ecm" is error correction model.
Figures in parenthesises are standard errors.
Source: Bangladesh Bureau Statistics (BBS) and Bangladesh Bank (BB), 2015

6. Conclusion

In this article, we examine time series evidence of the impact of capital goods imports on manufacturing output growth in Bangladesh. Following the Johansen cointegration approach, we observe that there exists a long-run equilibrium relationship among these variables. By applying the VEC model, the estimated equation shows that in the long run imports of capital goods greatly promote manufacturing output growth in Bangladesh, but this relationship does not hold in the short run. The possible interpretation stands out that capital goods take a fair amount of time to make the production process commence. Hence, we hypothesize that the manufacturing industry in Bangladesh requires capital goods and raw materials to import to continue its production in order to meet both domestic and foreign demand.

We recommend that export diversification and promotion policies along with the development of infrastructure, energy and power supply are foremost policy priorities to policymakers for rapid and sustainable economic growth in Bangladesh. The result of this study suggests greater opening up of the economy, and financial liberalization to enforce greater integration of financial market segments and market resilience to encourage private investment. The strategy requires much more attention of the central bank to liberalize the policy rate and exchange rate channels. This finding has policy implications not only for Bangladesh, but also for other developing economies that desire to grow fast and aiming to sustain for a long term growth.

Finally, this paper raises an additional question such as: how to estimate the imports demand function for Bangladesh? These issues are left for future research.

References

Awokues, T.O. (2007). Causality between exports, imports, and economic growth: Evidence from transition economies. *Economic Letters* 94, pp.389-395.

Awokues, T.O. (2008). Trade openness and economic growth: is growth export-led or import-led? *Applied Economics* 40, pp.161-173.

BB (2000-2015). *Annual Report* (different issues). Dhaka: Bangladesh Bank (BB)

BB (June 2015). *Economic Trends*. Dhaka: Bangladesh Bank (BB)

BBS (2015). *National Accounts Statistics*. Dhaka: Bangladesh Bureau of Statistics (BBS)

Bhattacharya, D., Rahman, M., and Raihan, A. (2002). Contribution of the RMG Sector to the Bangladesh Economy. *Central for Policy Dialogue (CPD),* Dhaka; Paper-50.

Bhattacharya, D. and Titumir, R.A.M. (2001). Bangladesh's Experience with Structural Adjustment: Learning from a Participatory Exercise. *Central for Policy Dialogue (CPD), Dhaka*.

Cheung, Y.W., & Lai, K.S. (1993). Finite sample sizes of Johansen's likelihood ratio tests for cointegration. *Oxford Bulletin of Economics and Statistics.* Vol 55, pp. 313-328

Choi, I., & Chung, B. S. (1995). Sampling Frequency and the Power of Tests for a Unit Root: A Simulation Study. *Economics Letters,* Vol 49, pp.131-136

Dawson, P.J. (2006). The Export-income Relationship and Trade Liberalization in Bangladesh. *Journal of Policy Modeling.* Vol 28, pp. 889-896

Dicky, D.A., & Fuller, W.A. (1979). Distribution of the Estimates for Autoregressive Time Series with a Unit Roots. *Journal of the American Statistical Association*, Vol. 47, Issue 366, pp.427-431

Dicky, D.A., & Fuller, W.A. (1981). Likelihood Ratio Statistics for Autoregressive Time series with a Unit Roots. *Econometrica*, Vol. 49, no 4, pp. 1057-1072

Esfahani, H.S. (1991). Exports, Imports and Economic Growth in Semi-Industrialized Countries. *Journal of Development Economics.* Vol 35, pp. 93-116.

Golder, B. and Kumari, A. (2003). Import Liberalization and Productivity Growth in Indian Manufacturing Industries in the 1990s. *The developing Economics.* XLI-4 (December 2003), pp.436-60.

Hasan, R. (2000). The Impact of imported and domestic technologies on productivity: Evidence from Indian Manufacturing Firms. *East-West center Working Papers*. Economics Series, No. 6 (September 2000).

Herrerias, J. M. and Orts, V. (2013). Capital goods imports and long-run growth: Is the Chinese Experience relevant to Developing Countries? *Journal of Policy Modeling.* Vol. 35 (5), pp. 781-797.

Hossain, M. A. (1995). *Inflation, Economic Growth and Balance of Payments in Bangladesh*. Dhaka, Bangladesh: The University Press Limited. Pp.189-195

Hossain, M.A., Haseen, L. & Jabin, N. (2009). Dynamics and Causality among Exports, Imports and Income in Bangladesh. Bangladesh Development Studies, vol 32, no. 2, pp. 101-113

Hsiao Frank, S.T. and Hsiao Meichu, W. (2014). *Taiwan in the Global Economy- Past, Present and Future*. [pdf] Available at:
<https//www.colorad.edu/Economics/mcguire/workingpaper/Taiwan-GlobalEconomy.pdf>

IMF (2010-2015). *World Economic Outlook.* Washington, USA: International Monetary Fund (IMF).

Islam, M.N. (1998). Export Expansion and Economic Growth: Testing for Cointegration and Causality. *Applied Economics,* Vol 30, pp.415-425

Johansen, S. (1988). Statistical analysis of cointegration vectors. *Journal of Economic Dynamics and Control*. Vol 12, pp. 231-254

Johansen, S., & Juselius, K. (1990). Maximum likelihood estimation and inference on cointegration with application to the demand for money. *Oxford Bulletin of Economics and Statistics*. Vol 52, pp.169-209.

Liu, X., H. Song, P. Romilly (1997). An Empirical Investigation of The Causal Relationship Between Openness and Economic Growth in China. *Applied Economics*, Vol 29, pp.1679-1686

Maddala, G.S., & Kim, I.M (1998). Unit Roots, Cointegration, and Structural Change. *Cambridge University Press*.

Mamun, K.A.A and Nath, H.K. (2005). Export-led Growth in Bangladesh: A Time Series Analysis. *Applied Economics Letter*, Vol 12, pp.361-364.

Mazumder, J. (2001). Imported Machinery and Growth in LDCs. *Journal of Development Economies*, 65, pp. 209-224.

Mondal, W. (2000). Privatization and the Growth of Entrepreneurship in Bangladesh. *International Journal of Commerce and Management*. Vol 10, no. 2, pp. 60-74.

MoC (2012). *Industrial Policy Order (IPO), 2012-2015*. Dhaka: Ministry of Commerce (MoC), Government of the Peoples Republic of Bangladesh Government

MoF (1995-2014). *Bangladesh Economic Review*. Dhaka: Finance Division, Ministry of Finance (MoF), Government of the Peoples Republic of Bangladesh Government

MoP (2011). *The Sixth Five Year Plan (FY2011-FY2015)*. Dhaka: General Economics Division, Planning Commission, Ministry of Planning (MoP), Government of the Peoples Republic of Bangladesh Government

Muktada, M. (2014). Challenges of Price Stability, Growth and Employment in Bangladesh: The Role of the Bangladesh Bank. *International Labour Organization (ILO)*, Zeneva, Switzerland.

Nelson, C., & Plosser, C. (1982). Trends and Random Walks in Macroeconomic Time Series: Some Evidence and Implications. *Journal of Monetary Economics*. Vol 10, pp. 130-62

Paul Biru P. (2011a). Modelling Economic Growth in Bangladesh and the Role of Market Economy. *International Journal of Economics Issues*, Vol 4, No. 1, pp. 1-11.

Paul Biru P. (2011b). Revisiting Export-Led Growth for Bangladesh: A Synthesis of Cointegration and Innovation Accounting. *International Journal of Economics and Finance*, Vol 3, No. 6, November 2011.

Pesaran B. & Pesaran M.H. (2009). Time Series Econometrics using Microfit 5.0. *Oxford University Press*.

Pesaran, M.H., & Shin, Y. (1998). Generalized Impulse Response Analysis in Linear Multivariate Models. *Economic Letters*, Vol. 58. Pp. 17-29.

Phillips, P. C., & Perron, P. (1988). Testing for a Unit Root in Time Series Regression. *Biometrika*. Vol.75(2), pp. 335-46.

Ricardo, David (1817). *On the Principles of Political Economy and Taxation*. 1st ed. London: John Murray, pp. 146-185

Riezman, G. R., C.R. Whiteman, P.M. Summers (1996). The Engine of Growth or Its Handmaiden? A Time Series Assessment of Export-led Growth. *Empirical Economics*. Vol 12, pp. 77-110.

San, G. and Huang, Y. (2010). Innovation, Performance and Capital Investment: A Causal Analysis of Taiwan's High-Tech and Non-High-Tech Industries. *Journal of International and Global Economic Studies*, vol 3, no. 1, pp. 25-40.

Sen, A (1981). *Famine in Bangladesh. Poverty and Famines: An Essay on Entitlement and Deprivation*. London: Oxford University Press.

Serletis, A. (1992). Export Growth and Canadian Economic Development. *Journal of Development Economics.* Vol 38, pp. 135-145

Strassner, H. E., Yuskavage, E. R. and Lee, J. (2009). Imported Inputs and Industry Contributions to Economic Growth: An Assessment of Alternative Approaches. *U.S. Department of Commerce,* Bureau of Economic Analysis, Washington, DC.

Sultan P. (2008), Trade, Industry and Economic Growth in Bangladesh. *Journal of Economic cooperation.* Vol 4, pp. 71-92.

Thangavelu, S. M. and Rajaguru, G. (2004), Is there an export or import-led productivity growth in rapidly developing Asian countries? A multivariate VAR analysis. *Applied Economics.* vol 36, pp. 1083-1093.

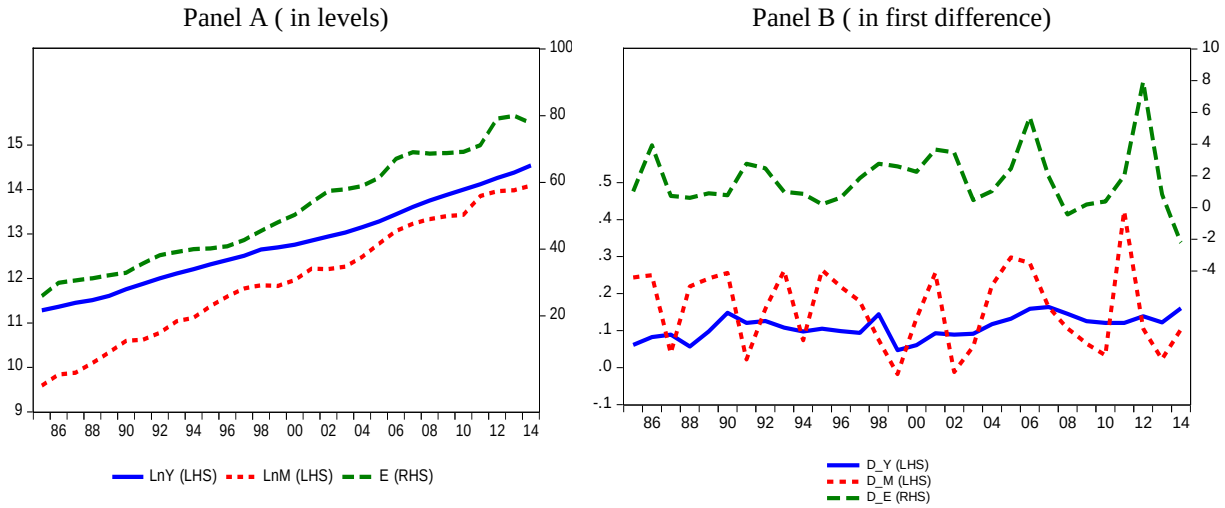
Uğur, A. (2008). Import and Economic Growth in Turkey: Evidence from Multivariate VAR Analysis. *East-West journal of Economics and Business.* Vol. XI – 2008, pp. 54-75.

Veeramani, C. (2009). Capital goods imports and economic growth: does the composition of imports matter? *Indira Gandhi Institute of Development Research*.

Zang, W., and Baimbridge, M. (2011). *Exports, Imports and Economic Growth in South Korea and Japan: A Tale of Two Countries*. Applied Economics. February 2011, iFirst, pp. 1-12.

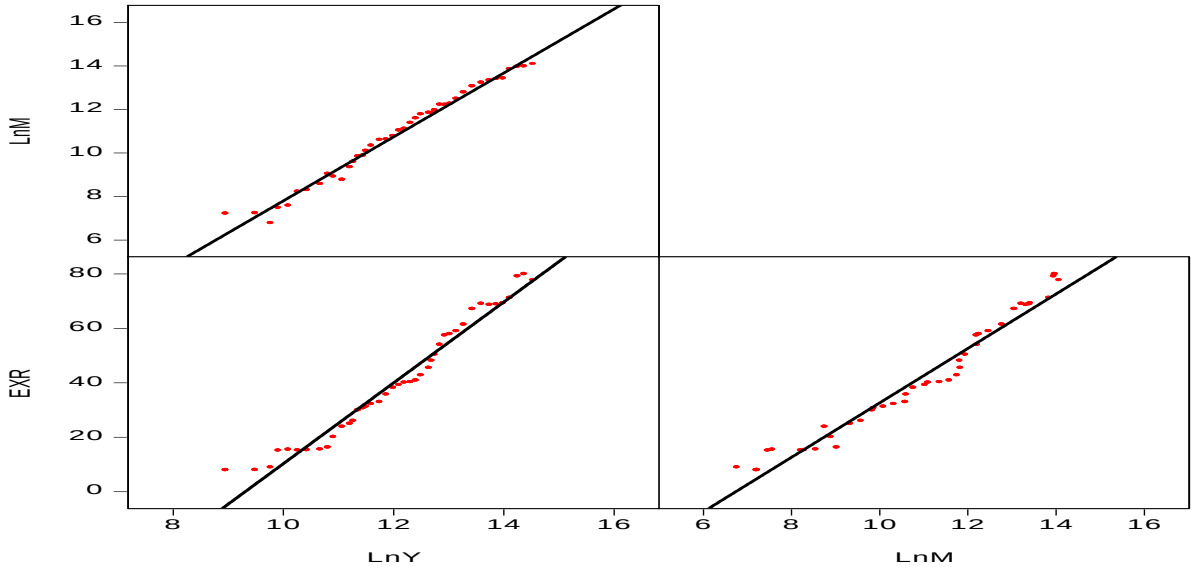
APPENDIX

Figure A1: Manufacturing output, imported capital goods and exchange rate movement



Source: Bangladesh Bureau of Statistics (BBS) and Bangladesh Bank (BB), 2015.

Figure A2: Scatter Plots with manufacturing output, Value of imported capital goods and Exchange rate in Bangladesh



Source: Bangladesh Bureau of Statistics (BBS) and Bangladesh Bank (BB), 2015.

Table A1: VAR Lag Order Selection Criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-92.63	NA	0.12	6.376	6.52	6.42
1	39.25	228.59	0.00	-1.82	-1.26*	-1.63
2	50.66	17.49*	0.00*	-1.98*	-0.99	-1.66*

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion
Source: Bangladesh Bureau of Statistics (BBS) and Bangladesh Bank (BB), 2015.

Table A2: Autocorrelation LM Tests

Lags	LM-Stat	Prob
1	11.86650	0.2209
2	11.78550	0.2257
3	10.70757	0.2963
4	10.77193	0.2917
5	5.590089	0.7801
6	3.919932	0.9166
7	4.913903	0.8417
8	8.727796	0.4628
9	4.436675	0.8804
10	5.779749	0.7617
11	11.54023	0.2405
12	6.929714	0.6444

Probs from chi-square with 9 df.
Source: BBS and BB, 2015

Table A3: Normality Tests

Component	Jarque-Bera	df	Prob.
1	0.464328	2	0.7928
2	0.430787	2	0.8062
3	1.900953	2	0.3866
Joint	2.796069	6	0.8340

Source: BBS and BB, 2015
