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EXPORT-LED GROWTH (ELG) HYPOTHESIS: AN EMPIRICAL INVESTIGATION ON BANGLADESH

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Abstract

This paper investigates export-led growth hypothesis for Bangladesh over a period of last three decades using cointegration and multivariate Granger Causality technique. While conventional wisdom suggests that export growth contribute positively to economic growth, this study also provides strong evidence supporting the export-led growth hypothesis through bi-directional causality between export growth and economic growth in Bangladesh. Comparing the results between conventional bivariate model and multivariate model, this paper suggests that bivariate model to investigate ELG hypothesis (ELGH) gives the similar result as the multivariate model in the experience of Bangladesh. These findings indicate the importance of promoting exports in Bangladesh to enhance economic growth.

1. INTRODUCTION

Economic growth is an extremely complex process, which depends on many variables such as capital accumulation, trade, price fluctuations, technological advancement, political conditions and income distribution, and even on geographical characteristics. Export-led growth hypothesis (ELGH) suggests that export expansion is one of the main determinants of growth. That is, along with the increasing amounts of labour and capital within the economy, the expansion of exports can generate the overall growth of the countries. According to its advocates, exports can perform as an "engine of growth". It is often asserted that

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the association between exports and growth carries some possible positive externalities for the domestic economy arising from world market participation, for instance, from the better allocation of resources, use of more advanced technologies and of course higher productivity. Further gains are realised through higher capacity utilisation and greater economies of scale due to large markets. In addition, the accumulation of foreign exchange from exports allows the import of high quality inputs, mainly capital goods, for domestic production and exports thus expanding the economy's production possibilities. However, these mechanisms are frequently invoked without any theoretical support or any empirical proof.

Bangladesh followed a strategy of a highly restricted trade regime after the independence in 1971. The basis of this policy regime was the import substitution industrialisation strategy of government. Like in many other developing countries, the import-substituting trade and industrial policies pursued by Bangladesh were aborted to deliver the desired outcomes along with rising internal and external imbalances. As consequences, trade policy reforms were introduced in the early 1980s. However, by the early 1990s, a large scale trade liberalisation programme was implemented. Since then a generous promotional measure for exports was introduced as an important element of trade policy reform which has contributed to the impressive export growth performance afterwards. The objective of this paper is to investigate the causal relationship between such export growth and the changing pattern of economic growth in Bangladesh to examine the validation of ELGH in case of Bangladesh. Consequently, the study is expected to provide a small contribution in policy structure through adequate theoretical support and empirical evidence. The paper is organised as follows: Section 1 is the introduction. Section 2 presents the theoretical and empirical review. Section 3 covers the methodological issues regarding the study. Section 4 provides variable definitions and data sources, while Section 5 presents the estimation techniques. Section 6 outlines the estimation results and discusses the empirical findings. The study is rounded up with conclusion in Section 7.

2. THEORETICAL AND EMPIRICAL REVIEW

The relationship between trade and economic growth in developing countries has been of continuing interest both in theoretical and empirical literature. The theoretical links between trade and economic growth have been discussed for over two centuries, although controversy still persists regarding their real effects. The classical school of economic thought that started with Adam Smith and subsequently enriched by the work of Ricardo, Torrens, James Mill and John Stuart Mill provided the initial sign of favourable arguments with respect to trade. Since then, economic literatures like that of Bhagwati, Krueger and many more documented the justification for free trade and various benefits of international specialisation towards the productivity of nations in a very well

manner way.[1] Evolution of endogenous growth theory triggered the continuous effort of theoretical justification even more and led to some alternative models that stress the importance of trade in achieving a sustainable rate of economic growth. Although most models emphasised the coherent relationship between trade and growth, they repeatedly made the point clear that trade is only one of the variables that enter the growth equation.

By the early 1980s, a change from inward-oriented policies to export-led orientation and export promotion strategy secured a wide consensus among researchers and policy makers.[2] In fact, interestingly enough, while most of the theoretical literature focused on the relationship between trade and economic growth[3], the empirical works have frequently been guided towards the examination of the relationship between exports and growth.[4] A large number of empirical studies have been conducted during the last two decades to investigate the role of exports on economic growth or the ELGH.[5] The ELGH was suggested initially by Kindelberger in 1962. From the theoretical point of view, the export growth should contribute positively to economic growth which is indeed the rationale behind the ELGH. Several studies regarding this issue using either time-series or cross-section data have been conducted along a number of divergent lines. The earlier studies by Michaely, Balassa, Heller and Porter, suggested that there remains a high correlation between export growth and economic growth.[6] But the main weakness of these studies is that a high degree of positive correlation between the two variables was used as evidence supporting the ELGH. Feder, Balassa and Ram used a highly significant positive

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1 J. Bhagwati, "Anatomy and Consequences of Exchange Control Regimes", *Foreign Trade Regimes and Economic Development*, 11, 1978 and A. O. Krueger, "Liberalization Attempts and Consequences", *Foreign Trade Regimes and Economic Development*, 10, 1978, Mass: Ballinger, Cambridge.

2 W. Tyler, "Growth and Export Expansion in Developing Countries", *Journal of Development Economics*, 9, 1981, pp. 121-30; B. Balassa, "Exports, Policy Choices, and Economic Growth in Developing Countries after the 1973 Oil Shock", *Journal of Development Economics*, 18, 1985, pp. 23-35.

3 N. A. Adams, "A Note on Trade as a Handmaiden of Growth", *Economic Journal*, 83 (329) March, 1973, pp. 210-12; N. F. R. Crafts, "Trade as a Handmaiden of Growth: An Alternative View", *Economic Journal*, 83 (331), September, 1973, pp. 875-84.

4 R. Levine and D. Renelt, "A Sensitivity Analysis of Cross-Country Growth Regressions", *American Economic Review*, 82 (4) September, 1992, pp. 942-63.

5 ELG is considered one of the main pillars of the free trade school of thought that emerged in the 80s.

6 M. Michaely, "Exports and Growth: An Empirical Investigation", *Journal of Development Economics*, 4 (1), March, 1977, pp. 49-53; B. Balassa, "Exports and Economic Growth: Further Evidence", *Journal of Development Economics*, 5 (2), June, 1978, pp. 181-89; and P. S. Heller and R. C. Porter, "Exports and Growth: An Empirical Re-investigation", *Journal of Development Economics*, 5 (2), June, 1978, pp. 191-93.

value of the coefficient of export growth variable in the growth accounting equation and a significant improvement in the coefficient of determination with the inclusion of the export growth variable in the regression equation as evidence for the export led growth hypothesis.[7] But the methodological issue of these models has been criticised. There are another relatively recent group who have emphasised on causality between export growth and economic growth to assess whether or not individual countries exhibit evidence for export led growth hypothesis using Granger or Sims tests.[8] Jung and Marshall, Darrat, Chow, Serletis used such Granger and Sims causality tests and ended with a mixed and even conflicting result. The major shortcoming of these causality test results is that the Granger and Sims tests are only valid if the original time series are not cointegrated.[9] If the time series are cointegrated, then any inferences based on the traditional time-series modeling techniques will be invalid.[10] Finally, there have been relatively new studies which involve the application of techniques of cointegration and error-correction models conducted by Kugler, Ghatak, Milner and Utkulu, and Islam.[11] This relatively new methodology is free from the shortcomings found in methodologies of previous studies. Some studies have also been carried out in the recent past on Bangladesh that has provided mixed results. Ahmed et al. investigates the relationship between export and GDP growth for Bangladesh and found the base behind ELG hypothesis with bidirectional causality whereas Mamun and Nath suggests that there is a long-run

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7 G. Feder, "On Exports and Economic Growth", *Journal of Development Economics*, 12 (2), February/April, 1983, pp. 59-73; R. Ram, "Exports and Economic Growth in Developing Countries: Evidence from Time-Series and Cross-Section Data", *Economic Development and Cultural Change*, 36 (1), October, 1987, pp. 51-63.

8 R. F. Engle and C. W. J. Granjer, "Co-integration and Error Correction: Representation, Estimation and Testing", *Econometrica*, 55, 1987, pp. 1-87.

9 W. S. Jung and P. J. Marshall, "Exports, Growth and Causality in Developing Countries", *Journal of Development Economics*, 18 (1), May/June, 1985, pp. 1-12; A. F. Darrat, "Are Exports an Engine of Growth? Another Look at the Evidence", *Applied Economics*, 19 (2), February, 1987, pp. 277-83; P. C. Y. Chow, "Causality between Export Growth and Industrial Development: Empirical Evidence from the NICs", *Journal of Development Economics*, 26 (1), June, 1987, pp. 55-63; A. Serletis, "Export Growth and Canadian Economic Development", *Journal of Development Economics*, 38 (1), January, 1992, pp. 133-45.

10 M. E. Ekanayake, "Exports and Economic Growth in Asian Developing Countries: Cointegration and Error-Correction Models", *Journal of Economic Development*, 24, December 1999.

11 P. Kugler, "Growth, Exports and Cointegration: An Empirical Investigation", *Weltwirtschaffliches Archiv*, 127 (1), 1991, pp. 73-82; S. Ghatak, C. Milner and U. Utkulu, "Exports, Export Composition and Growth-Cointegration and Causality Evidence for Malaysia", *Applied Economics*, 29 (2), 1997, pp. 213-223; and M. N. Islam, "Exports Expansion and Economic Growth: Testing for Cointegration and Causality", *Applied Economics*, 30 (3), March, 1998, pp. 415-25.

unidirectional causality from exports to growth in Bangladesh.[12] The common idea though these studies share is that the level of development is an important factor in determining export-growth relationship. As such, although there is a vast collection of empirical literature, contradictory results obtain from these studies explain why this topic is still at the top of the agenda for both researchers and policy makers around the world.

3. METHODOLOGICAL ISSUES

The study has some distinctive features. In this study, the cointegration and multivariate Granger Causality technique developed by Toda and Yamamoto (1995) has been used. Since, some researchers believe that the mixed and conflicting evidence regarding ELG might result from the omitted variables; the authors went beyond the traditional bivariate approach by including imports as an additional variable in the system. This is in accordance with some recent studies of Serletis and Riezman which suggest that imports may contribute to the establishment of cointegration and thus have to be accounted for when testing ELGH.[13] Imports have been included in this study to capture the role of promoting exports in the accumulation of foreign exchange that is additionally used in financing capital import which in turn enhances economic growth. Findings by Riezman, suggest that omitting important variables from the system may sometimes either mask or overstate the effect of exports on income. These findings have been checked here in case of Bangladesh by comparing the result of bivariate and univariate model. To assess whether the export led growth hypothesis is valid or not in case of Bangladesh, two points should be noted:

First, along with two-variable model, this paper has also gone beyond the traditional two-variable relationship and has compared the empirical result which is expected to shed a more accurate light on the issue.

Second, the second point relates to some important aspects of cointegration and causality study. This refers to the use of vector autoregressive (VAR) and vector error correction model (VECM). The VAR model essentially suggests a short-run relationship between the variables. This shortcoming can be avoided if VECM, which can generate long-run relation, is used. So, this study's results refer to the long run.

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[12] Nasiruddin Ahmed, "Export Response to Trade Liberalization in Bangladesh: A Cointegration Analysis", *Applied Economics*, 32 (8), 2000, pp. 1077-1084; A.K. Mamun and K. H. Nath, "Export-led Growth in Bangladesh: A Time Series Analysis", *Applied Economics Letters*, 12, 2005, pp. 361-364.

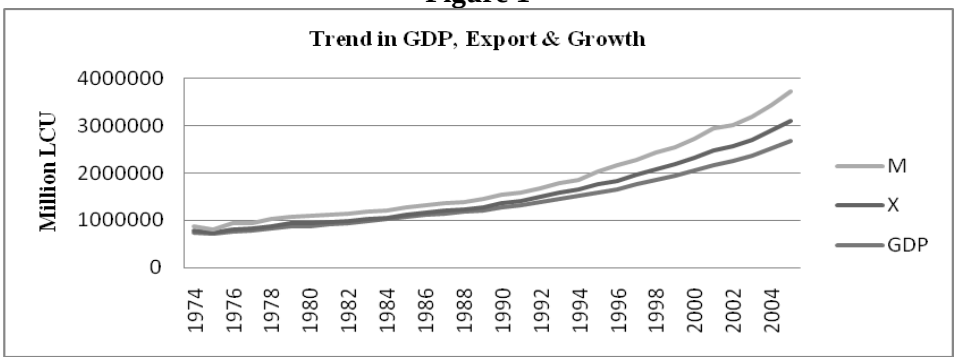
[13] A. Serletis, "Export Growth and Canadian Economic Development", *Journal of Development Economics*, 38 (1), January, 1992, pp. 133-45; R. G. Riezman, P. M. Summers and C. H. Whiteman, "The Engine of Growth or its Handmaiden? A Time Series Assessment of Export-led Growth" *Empirical Economics*, 21 (1), 1996, pp. 77-113.

So far, only a few studies have used this methodology to study the "Export-led Growth" hypothesis in developing countries like Bangladesh. Given the small number of studies conducted using this methodology, it is expected that this paper will make a modest contribution to empirical literature in Bangladesh.

4. VARIABLE DEFINITIONS AND DATA SOURCES

In this paper, annual time series data of real GDP, real export and real import of Bangladesh for the year 1974 to 2005 have been used. Here, all the time series have been transformed into logarithms. Log transformation can reduce the problem such as heteroscedasticity as it compresses the scale in which the variables are measured.[14]

Figure 1



Data for this study were sourced from World Bank's World Development Indicators,[15] and various issues of the Statistical Year Book of Bangladesh published by Bangladesh Bureau of Statistics. A full description of the definitions and the source for each variable is presented in Appendix-1.

5. ESTIMATION TECHNIQUE

This empirical study consists of the unit root tests, the cointegration test and finally causality test using an error correction model.

5.1. *Definition of Causality*

According to the Granger (1969) causality approach, a variable y, say economic growth is caused by x, say exports, if y can be predicted better from

[14] The inclusion of imports in the system allows us to capture the role of promoting exports in the accumulation of foreign exchange which makes it easier for the economy to finance to importation of capital goods which in turn boosts economic growth.

[15] "World Development Indicators 2007" on CD-ROM, *World Bank, 2007,* Washington D.C.

past values of y and x than from past values of y alone. For a simple bivariate model, it can be tested if x is Granger causing y by estimating equation (1) and then testing the hypothesis in equation (2), using the standard F test.

$$y_t = \alpha_1 + \sum_{j=1}^{P} \beta_{11j} y_{t-j} + \sum_{j=1}^{P} \beta_{12j} x_{t-j} + u_{1t} \quad \text{..... .(1)}$$

H_0: $\beta_{12j} = 0$ for j= 1, 2.....p …..... (2)

H_1: $\beta_{12j} \neq 0$ for at least one j

Here u_{1t} is a white noise process. Variable x (Granger) causes variable y if the null hypothesis (2) is rejected, where β_{12} is the vector of the coefficients of lagged values of the variable x. Similarly, it can be tested if y causes x by estimating equation (3) and testing null hypothesis (4) using the standard F test.

$$x_t = \alpha_2 + \sum_{j=1}^{P} \beta_{21j} y_{t-j} + \sum_{j=1}^{P} \beta_{22j} x_{t-j} + u_{2t} \quad \text{.....(3)}$$

H_0: $\beta_{22j} = 0$ for j = 1, 2.....p .....(4)

H_1: $\beta_{22j} \neq 0$ for at least one j

For a multivariate model, the idea is to test the joint influence of two variables (for trivariate model) on the third variable. The joint trivariate causality model is specified as:

$$y_t = \alpha_1 + \sum_{j=1}^{P} \beta_{11j} y_{t-j} + \sum_{j=1}^{P} \beta_{12j} x_{t-j} + \sum_{j=1}^{P} \beta_{13j} m_{t-j} + u_{1t} \quad \text{.....(5)}$$

$$x_t = \alpha_2 + \sum_{j=1}^{P} \beta_{21j} x_{t-j} + \sum_{j=1}^{P} \beta_{22j} y_{t-j} + \sum_{j=1}^{P} \beta_{23j} m_{t-j} + u_{2t} \quad \text{…....…… (6)}$$

Here, m denotes import. The import equation is omitted because causality of this variable is not studied here. In this case, for equation (5)

H_0: $\beta_{12j} = 0$ for j = 1, 2.....p

H_1: $\beta_{12j} \neq 0$ for at least one j

However, it has been argued that in a regression context for determining whether some parameters of the model are jointly zero, the traditional F test is not valid when the variables are cointegrated and the test statistics do not have a standard distribution. That is, the usual tests for exact linear restrictions on parameters (e.g. the Wald test) do not have their usual asymptotic distributions if the data are cointegrated. Studies based on above procedures as they do not check for cointegration, and, therefore, may have missed out on some of the "forecastability" which becomes available through the error-correction term. In the presence of cointegration, standard causality tests (SGC) may be misleading.

To deal with this issue VAR model with the Error Correction Model (VECM) is used to test the Granger causality.

5.2. *Unit Root Tests*

Since a causality test holds only for stationary variables, unit root tests have to be performed on all the variables involved. A time series is stationary (in the sense of weak stationary) if its mean, variance and covariance remain constant overtime. At a formal level, stationary can be tested by determining whether the data contain unit root. The Augmented Dickey-Fuller (ADF)[16] and Phillips-Perron tests supplemented by Ljung-Box test are adopted for this purpose. The ADF test is based on the estimate of the following regression[17] for any variable z:

$$\Delta z_t = b_o + b_1 t + \beta z_{t-j} + \sum_{j=1}^{P} \gamma_j \Delta z_{t-j} + u_t \qquad \text{…….....(7)}$$

H_O: β=0; variable z is non stationary. Where b_o is a drift, t presents time trend and p is a large enough lag length to ensure that u_t is a white nose process. If the series is not stationary a transformation of the variables, usually in the form of differencing, is needed to produce a stationary series on which causality tests can be conducted. (The logs of variables are taken so that, the first differences can be interpreted as growth rates). Since, it has been shown that, ADF tests are sensitive to the lag lengths chosen, by selecting an upper bound on the lag order an autoregression of that order has been run in this paper.[18] The last lag order has been chosen where it is found significant; where not the order has been reduced by one and is repeated until the last lag is significant. If no lag order is detected as significant, the Dickey-Fuller (DF) test has been run.[19] The critical values for the test are given by Mackinnon.[20] In case of non-stationary series, a transformation of the variable in the form of differencing has been done on which causality test can be conducted and the order of integration has been determined. If all the variables are found to be integrated of same order, cointegration test can be done.

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16 See Serletis (1992), *op.cit.*, and Riezman et. al., (1996), *op.cit*.

17 Thereby reducing a tenfold difference between two values to a twofold difference.

18 J. Y. Campbell and P. Perron, "Pitfalls and Opportunities: What Macroeconomists should know about Unit Roots", *NBER Technical Working Paper*, 100, 1991, NBER, Cambridge, M.A.

19 The t-statistic under the null hypothesis of a unit root does not have the conventional t-distribution. Dickey and Fuller (1979) showed that the distribution under the null hypothesis is nonstandard, and simulated the critical values for selected sample sizes.

20 J. G. Mackinnon, "Critical Values for Cointegration Tests", in R. F. Engle and C. W. J. Granger (eds.), *Critical Values for Cointegration Tests in Long-Run Economic Relationships: Readings in Cointegration*, Oxford University Press, Oxford, U.K., 1991, pp. 267-276.

5.3. *Cointegration Tests*

The presence of cointegration implies that a stationary long-run relationship among the series is present. That means, if a set of variable are cointegrated, the effects of a shock to one variable spread to others, possibly with time lags, so as to preserve a long run relation between the variables. In this paper, two tests have been performed to check cointegration although the focus is on Johansen test.

5.3.1. *Engel-Granger Test for Cointegration*

In the case of two variables, this can be done by estimating the following cointegrating equations by OLS and testing their residuals for stationarity.

$$LGDP_t = \alpha_0 + \beta_0 LX_t + u_{0t} \quad \text{…..... (8)}$$

In the case of more than two variables:

$$LGDP_t = \alpha_1 + \beta_1 LX_t + \gamma LM_t + u_{1t} \quad \text{.....(9)}$$

If LGDP and LX are both I (1), then for them to be cointegrated u should be stationary or I (0). To check whether there is a valid long-run relationship among the variables, the stationarity of residuals have to be tested from (8) and (9) employing the ADF test. The EG test has been criticised on several grounds. First, contradictory conclusions may come depending on which equations (8 or 9) are being utilised to obtain the residuals for the unit root test. Another serious defect of the EG test is that, any error introduced in the first step is carried out to the second step. Finally, the method only allows for a single cointegration equation. However, if there are more than two variables, there is a possibility that more than one equation may depict the long-run relationships among the various variables.

5.3.2. *Johansen Test for Cointegration*

Johansen's maximum likelihood estimators that consider as superior to the former since it corrects the above pitfalls of the EG test. Johansen's test enables estimating and testing for the presence of multiple cointegration relationships, r, in a single-step procedure. The method involves estimating the following VAR model:

$$Y_t = \alpha_0 + \sum_{j=1}^{P} A_j Y_{t-j} + u_t \quad \text{..... (10)}$$

Where Y_t is an n×1 vector of non-stationary I (1) variables, in this case Y_t = (LGDP, LX and LM) in case of three variable model and Y_t = (LGDP, LX) in case of two variable model. n = number of variables in the system. u_t is n×1 vector of iid innovations. Johansen provides two different test statistics that can be used to test the hypothesis of the existence of r cointegrating vectors, namely,

the trace test and the maximum eigenvalue test. Here, the trace test statistics have been used. Denoting the number of cointegration vectors by r, the trace statistics is calculated under the null hypothesis, r≤r* against the alternative of r>r*.

5.4. *Vector Error Correction Model (VECM)*

Once it is established that two variables are cointegrated, the next issue is that of which variable "causes" the other. As noted earlier that, the SGC test is likely to be misleading if variables are cointegrated since the standard test do not contain an error-correction term. So, with cointegrated variables, there must exist an error-correction representation that may make the following form:

$$\Delta LGDP_t = \alpha_{10} + \sum_{i=1}^{P} \gamma_{11,i} \Delta LGDP_{t-i} + \sum_{i=1}^{P} \gamma_{12,i} \Delta LX_{t-i} + \sum_{i=1}^{P} \gamma_{13,i} \Delta LM_{t-i} + \sum_{j=1}^{r} \lambda_{1j} u_{t-1,j} + e_{1t} \quad (11)$$

$$\Delta LX_t = \alpha_{20} + \sum_{i=1}^{P} \gamma_{21,i} \Delta LGDP_{t-i} + \sum_{i=1}^{P} \gamma_{22,i} \Delta LX_{t-i} + \sum_{i=1}^{P} \gamma_{23,i} \Delta LM_{t-i} + \sum_{j=1}^{r} \lambda_{2j} u_{t-1,j} + e_{2t} \quad (12)$$

Here, another equation of import can be omitted because the concentration in this paper is to find out the existence and nature of casual relation between growth and export only. For bivariate model, the above two equations are obtained by omitting the term of import (LM). Here, $u_{t-1,j}$ is the stationary residual from the cointegrating equations. By introducing error correction terms in the above equations, an additional channel is opened up through which causality is tested. For example, in equation (11), the growth of real exports is said to Granger cause real income growth either when the coefficients of lagged ΔLX, ΔLM and ΔLGDP are jointly significant through the F test or if λ_{1j} is significant or both. So, if the series are correlated, the coefficients λ_{1j} and λ_{2j} are expected to capture the adjustment (speed of adjustment) of ΔLGDP and ΔLX towards long run equilibrium, while the lagged changes in the independent variables are expected to capture the short-run dynamic of the model. There is evidence that, the causality tests are often sensitive to the choice of lag lengths. The most recommended AIC has been used to select the lag length of the VAR system, which is achieved by minimising the AIC.

So, the guidelines for testing for causality are the following. The first step would be to test unit roots in all the variables involved. In the case of stationary variables, the model would be estimated in levels and causality test can be applied. If all the variables are nonstationary, I (1) in levels and are stationary in first differences, I (0), then a cointegration test is carried out. Once cointegration is detected, causality tests have to be performed using VECM. If no cointegration is detected, then the model has to be estimated in first differences and the SGC is applied.

6. EMPIRICAL RESULTS

Our empirical findings consist of unit root tests, the cointegration test and finally the Granger causality tests. The variables used in this study are following: LGDP is the natural logarithm of real GDP; LX is the natural logarithm of the real exports; LM is the natural logarithm of the real imports.

6. 1. *Time Series Properties of the Variables*

The stationary research assumes the existence of a unit root. Its number gives also the integration order for each variable. Table-1 provides the results of unit root tests using ADF test supplemented by Phillips-Perron and Ljung-Box Q-test up to a lag order of 4. The length of lags in equation (7) is determined using general to specific method where the upper bound is chosen to be three. The results show that the LGDP, LX and LM become stationary at 5% level by transformation with the first difference.

Table 1: Augmented Dickey-Fuller Unit Root Test

Variables	**With a Time Trend**		**Without a Time Trend**		**Ljung-Box Q Test**
	Test Statistics	Critical Values	Test Statistics	Critical Values	P> Chi2 (4)
LGDP	-1.997	-3.576			0.0000
LX	-2.709	-3.576			0.0000
LM	-3.079	-3.576			0.0000
ΔLGDP			-7.657	-2.986	0.8650
ΔLX			-8.166	-2.986	0.2365
ΔLM			-10.244	-2.986	0.0026

Notes: Critical values are at 5% level of significance.

The integration order I (1) of the three variables has been determined according to the number of the unit roots. PP test (Table-2) also consistent with ADF test and concluded that all the variables are stationary at their first difference level.

Table 2: Phillips-Perron Unit Root Test and Ljung-Box Q Test

Variables	Lags	With a Time Trend		Without a Time Trend	
		Test Statistics	Critical Values	Test Statistics	Critical Values
LGDP	0	-1.979	-3.576		
LX	0	-2.700	-3.576		
LM	1	-1.665	-3.580		
ΔLGDP	0			-8.428	-2.986
ΔLX	0			-8.310	-2.986
ΔLM	0			-11.657	-2.986

Notes: Critical values are at 5% level of significance.

6.2. *Tests for Cointegration*

As mentioned earlier, the second step in the process of finding a causality direction is to test for cointegration among the variables applying EG and the Johansen maximum likelihood cointegration tests that are applied to both bivariate and multivariate model. Though the emphasis is on Johansen cointegration test.

6.2.1. *EG Test*

Using EG test, stationarity has been checked through ADF test of the residuals that are obtained from OLS regression of LGDP on LX in bivariate model and LGDP on LX and LM in multivariate model. Table-3 shows that residuals from equation (8) and (9) become stationary indicating that both models are cointegrated. Applying the Johansen test as presented below did not affect the findings.

Table 3: Engle-Granger Cointegration Test

Cointegrating Vectors	ADF of Residuals (without intercept)		Lags	Adjusted R-squared
	Test Statistics	Critical Values		
LGDP,LX	-3.115	-1.950	0	0.9489
LGDP,LX, LM	-2.935	-1.950	0	0.9494

Notes: Critical values are at 5% level of significance.

6.2.2. *Johansen Test*

Under multivariate model, trace statistic accepts the null hypothesis in favour of $r \leq 1$. Table-4 shows that, the empirical support for one cointegration vector implies that all three variables, namely, export, import and economic growth are cointegrated and follow a common long run path. Therefore, the cointegration

analysis provides a justification for the inclusion of imports in the analysis of ELG hypothesis for Bangladesh. So, the result of the Johansen cointegration test indicates that there exist long run relationship between economic growth and export for Bangladesh. That means economic growth and export may reach a long-run equilibrium that depicts a stable relationship.

Table 4: Johansen Cointegration Test

Trace Test (Lag 2)			
Cointegrating Vectors: LGDP,LX, LM			
Cointegration Rank		Test Statistics	Critical Values
Null	Alternative		
r = 0	r> 0	40.1446	29.68
r ≤ 1	r> 1	14.6982*	15.41
r ≤ 2	r> 2	4.8444	3.76

Notes: Critical values are at 5% level of significance.

Under bivariate model, Table-5 shows similar result as multivariate model. This also indicates that SGC test is not valid for both models since variables are cointintegrated.

Table 5: Johansen Cointegration Test

Trace Test (Lag 2)			
Cointegrating Vectors: LGDP, LX			
Cointegration Rank		Test Statistics	Critical Values
Null	Alternative		
r = 0	r> 0	17.9486	15.41
r ≤ 1	r> 1	3.5153*	3.76

Notes: Critical values are at 5% level of significance.

6.3. *Granger Causality Test*

The ultimate goal of this paper is to test the validity of ELG hypothesis in the experience of Bangladesh. To do so, the paper has emphasised to distinguish, if any, in two cases:

Case A: Bivariate model, relatively more used model

Case B: Multivariate model

6.3.1. *Case A*

In bivariate model, to determine the appropriate lag length, information criterion like Akike Information Criterion (AIC) or Schwarz Bayesian Information Criterion (SBIC) or Hannan-Quinn Information Criterion (HQIC)

can be used. Here using all these criteria, the optimal lag length is chosen to be 2 that is associated with their smallest possible value. Table-6 shows that the coefficient of lagged ΔLX and ΔLGDP are jointly significant at 5% level through the F test in both equations. Error correction terms are also significant in both equations for Bangladesh. These results imply both short-term and long-term bidirectional causality between GDP growth and export growth in case of Bangladesh. As the speed of adjustment coefficients are significant in the model, it can be stated that, a short run real GDP is corrected to a speed of 29% per annum. Although the individual impact of the variables may come out insignificant possibly because of the potential multicollinearity problem.

Table 6: Causality Test (Vector Error Correction Methodology)

Dependent Variables	Lags	Error Correction Term (E_{t-1})	t-Statistics (P>lZl)	F-Statistics (P>Chi2)
ΔLGDP	2	-3.34	0.001	0.000
ΔLX	2	4.98	0.000	0.000

Notes: Critical values are at 5% level of significance.

6.3.2. *Case B*

In multivariate model, using F test, bidirectional long-run causality between export growth and GDP growth (Table-7) can be seen. Using all information criteria, the optimal lag length is chosen to be 2. The coefficient of lagged ΔLX, ΔLM and ΔLGDP are jointly significant at 5% level through the F test in both equations (in equation 11 and 12). If the error correction terms are observed, they appear significant also in both equations for Bangladesh. It indicates that, a short run ΔLGDP is corrected to a speed of 40% per annum towards long run equilibrium. So that, these results imply both short-term and long-term bidirectional causality between export growth and GDP growth. Although the individual impact of the variables may come out insignificant possibly because of the potential multicollinearity problem.

Table 7: Causality Test (Vector Error Correction Methodology）

Dependent Variables	Lags	Error Correction Term (E_{t-1})	t-Statistics (P>lZl)	F-Statistics (P>Chi2)
ΔLGDP	2	-2.68	0.007	0.0003
ΔLX	2	2.39	0.017	0.000
ΔLM	2	4.62	0.000	0.000

Notes: Critical values are at 5% level of significance.

The overall findings suggest that, ELG hypothesis has been established by this paper through both long-run and short run bidirectional causality (GDP ->

Export; Export -> GDP) in the experience of Bangladesh. Similar result has been found from causality test in both bivariate and multivariate model in case of Bangladesh.

7. CONCLUDING REMARKS

The importance of international trade and economic growth has been debated over the decades. The suitability of trade policy- import substitution or export promotion- for growth and development has been also debated in the literature. This paper reinvestigated the export-led growth hypothesis using cointegration and multivariate Granger Causality procedure in case of Bangladesh. The results of the cointegrating technique suggest that there exists a long run relationship between export growth and real GDP growth while vector error correction methodology provides us with the bidirectional causality between export and economic growth. That is, in Bangladesh GDP growth and export growth are working in tandem proving the validation of ELG hypothesis. Hence, our findings lend support to an export-oriented growth strategy in promoting an enhanced growth potential in a small open economy like Bangladesh. Our government in this venture should implement effective macroeconomic policies in stabilising its trade balance and liberalising the country's trade avoiding the use of regulatory and restrictive policy measures as much as possible. Along with it, measures should also be taken to ensure the adequate supply of well-equipped labour, as this would lead to a higher level of economic growth. Government should also prioritise the sectors of export based on the expected gains to the whole economy for which further sectoral research would be necessary in near future.

Appendix 1: Data Definition and Sources

Variables	Notation	Definitions	Source
Gross Domestic Product	**Y**	GDP at purchaser's prices is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. Data are in current local currency (In Million).	World Bank National Accounts data and OECD National Accounts data files.
Export	**X**	Exports of goods and services represent the value of all goods and other market services provided to the rest of the world. They include the value of merchandise, freight, insurance, transport, travel, royalties, license fees, and other services, such as communication, construction, financial, information, business, personal, and government services. They exclude labor and property income (formerly called factor services) as well as transfer payments. Data are in current local currency (In Million).	World Bank National Accounts data and OECD National Accounts data files.
Import	**M**	Imports of goods and services represent the value of all goods and other market services received from the rest of the world. They include the value of merchandise, freight, insurance, transport, travel, royalties, license fees, and other services, such as communication, construction, financial, information, business, personal, and government services. They exclude labor and property income (formerly called factor services) as well as transfer payments. Data are in current local currency.	World Bank National Accounts data and OECD National Accounts data files.
GDP deflator		The GDP implicit deflator is the ratio of GDP in current local currency to GDP in constant local currency. The base year varies by country.	World Bank National Accounts data and OECD National Accounts data files.