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Is Export-led Economic Growth Significant in LDCs? Evidence from Bangladesh

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Abstract

Purpose of the study: The purpose of this piece of work is to find out whether there persists any long-run relationship between the exports and economic growth in Bangladesh as a member of the LDCs. In this connection, the export-led growth hypothesis has been assessed for the Bangladeshi economy for the last three decades of timeframe.

Methodology: Time-series econometric approach, the Johansen Cointegration test is followed in the study to find out the long-run relationship among the variables. The Granger casualty test was done to find the direction of the casualty. The Time-series data from the period 1991 to 2020 are analyzed through several econometric test procedures. The gross domestic product is regarded as the dependent variable, whereas the Exports of goods & services and the Gross Capital Formation are considered independent variables. The estimated model is examined for a structural break using the Chow Test. The Breusch–Godfrey and Durbin-Watson tests are performed to figure out whether autocorrelation exists.

Findings: It is recognized that export-led economic growth has no long-term significance for Bangladesh's economy. The findings are consistent with those of Li et al. (2010) on low-income nations. The R-squared value of the estimated model (83%) shows that the model fits the data quite well.

Implications: As Bangladesh is likely to become a middle-income country very soon, the study is highly pertinent to the country's current development dynamics.

Limitations and Future direction: This study simply revisited the traditional export-led growth hypothesis through the latest contemporary dataset. Future work may include investigating the reasons why LDCs do not sustain export-induced growth in the long run.

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1. Introduction

Bangladesh is experiencing a remarkable and consistent growth for the last decade. Consequently, the country is also expected to be a soon-to-be graduate of LDC (least developed countries). Bangladesh is a country whose large portion of the annual budget depends on export. Bangladesh's major export products constitute the RMG (readymade garments). Besides, pharmaceuticals, leather and leather products, paper yarn, footwear, fish, etc. are there. Recently, the country's exports have hit an all-time high which is over 52 billion USD for the FY 2021-22 (Business Standard, 2022). The South Asian nation has just celebrated its fifty years of independence and has been striving for sustaining its growth potential for many years. The nexus between export and economic growth has always been a matter of interest for economists. A net positive value of exports and imports can increase the GDP which is supposed to be a primary measure of development. But whether an economic growth of a country is solely export-led or not, is a matter of long discussion and several intensive studies. Economic growth depends on a broad number of issues. In today's borderless economy where free trade among countries is being implemented, the notion of export as a lever of growth is very much verifiable. An increase in export not only comes with economic growth but also assists in several other things. Export improves the balance of payment (BoP) which indicates well economic performance. Again, exports increase the foreign exchange reserves and contribute to creating employment. Export is a prospective weapon for budding the economy of a country. Bangladesh, being a labor-intensive country, can use exports as a medium for accumulating physical capital. The Export Account of Bangladesh has increased substantially over the last few years. In 2012, the total export of Bangladesh amounted to 150 billion BDT which rose to about 240 billion BDT in 2018. Consequently, the GDP growth rate increased from 6.5% in 2012 to an all-time high of 7.9% in 2018. Based on this statistic, a relation between growth and export can be assumed. But to claim such export-led growth, it must be supported by econometric analysis. This study has attempted to find out whether the export-led growth phenomenon is significant in Bangladesh or not. The following sections contain thorough econometric analyses and tests employing time-series applications to portray the long-run scenario of the Bangladesh economy concerning growth and export. Bangladesh is a good example of well-performing LDCs. Though the growth dynamics and development environment are unique for each country, a case study of a notable country from a particular group can bring out new avenues of thought and policy objectives for the policymakers of the concerned countries. That is why, in this piece of literature, the Bangladeshi perspective has been taken as a proxy for the LDCs.

2. Literary Framework

While talking about exports, we cannot avoid discussions on imports. The foreign exchange earned via exports is used in financing the import of technology and other necessities. Thus, imports also have a significant role in deciding the nexus between growth and exports (Kim et al., 2009). All the exporting countries are not sufficient with raw materials and types of machinery which are imported with the help of foreign exchange from exports. According to Dritsakis (2005), economists are divided into four different opinions on the discussion about economic growth, exports, and imports. Some of them found a significant positive relationship for many countries where exports caused economic growth. Some found the same for imports and economic growth, while others saw the relationship as collectively casual that comes from exports and imports on the growth of an economy. There is also a group that mentioned that it will depend on the growth dynamics of a given country and the timeframe of observation. The state of a nation's economy tends to fluctuate throughout time. In the short run, exports unquestionably boost economic expansion. But whether it is valid eventually, needs to be examined. In this context, country-specific fundamentals are also crucial which may show us various outcomes for different analyses.

Export-led growth is viewed as a method for a nation's economic development based on exports. The world saw export-led growth across the economies throughout the post-1970 period i.e. the age of trade liberalization. Before this age, import substitution was the main ambition of most economies to be self-sufficient. The world's top politicians took notice of the four Asian Tigers, and the policy was progressively emulated by the then-

developing countries[1]. However, since the dynamics of growth vary between periods, experts have investigated to pin down the true causes. Here, both the exports and imports are examined while carrying out the studies by different researchers, since the net value of export is crucial. According to a report issued by the Federal Reserve Bank of Cleveland, authored by Humpage (2000), imports contributed to economic growth and raised living standards in the United States. Though it is not clear that imports always help growth and that every economy is not like the USA, the study proved the benefits of technological knowledge exchange, an increase in rivalry, and specialization of production in this environment.

Vohra (2001) did a study on GDP growth and exports in Malaysia, Thailand, the Philippines, India, and Pakistan. The study's span ranged from 1973 to 1993 i.e. a total of twenty years. In other words, exports were found to have a beneficial effect on economic expansion in these countries. At that time, all of these countries were experiencing nearly identical levels of development perspectives. While Export-led Growth Hypothesis was gaining acceptance in Asia, there were also contemporary studies that indicated no major impact of export on the growth in other regions of the world. The hypothesis was found invalid for Greece (Panas & Vamvoukas, 2002). Error-correction modeling and a multivariate Granger Causality approach were implemented to find out the nexus which showed that the long-run export performance of Greece was caused by output growth. Subasat (2002) tried to present some cross-sectional shreds of evidence on the promotion of export and the consequent growth. But the study brought out doubts about the export-led growth hypothesis. It is said that only middle-income countries enjoy the fruits of export promotion in terms of growth while the low and high-income ones do not succeed with it. It agreed on the hypothesis was true for India as a middle-income nation at that time.

The important research work by Mah (2005) showed bi-directional causalities of exports and growth for China during the years stretching from 1979 to 2001. Tang (2006) then elaborated on this work, but this time, the model was tri-variate and also added employed import as a variable and found no long-run nexus between real GDP and exports using the Granger Causality test. Furthermore, there was no short-run influence of exports on the economy of China. Applying the multivariate cointegrated VAR (vector autoregression) method, Awokuse (2007) applied a neoclassical expansion model to investigate the situation of Poland, the Czech Republic, and Bulgaria. Here, the role of both i.e. exports and imports were explored. It supported the idea that trade boosts growth but did not end the findings by saying the function of export as the engine of growth. Later Li et al. (2010) again analyzed China's case for 28 year-timeframe where the unit root, time-series cointegration, and error-correction methods were used. This time for China, both long and short-term causality were seen mutually between GDP and exports. It also found little evidence to support long-term stable causation between GDP and imports. Among others, depicted a two-way causal relationship between Libya's exports and economic growth from 1980 to 2007 (Elbeydi et al., 2010). Mishra (2011) looked at the Indian economy again from 1970 to 2009 and found the same long-term link between exports and growth (Vohra, 2001; Subasat, 2002).

Exports, imports, and GDP growth have all been shown to go hand in hand over the long term for Bangladesh, according to the work of Chaudhary et al. (2007). All three of its key metrics— export growth, output growth, and import growth—showed evidence of feedback effects among them. Khan and Kundu (2012) used the Box-Jerkins method to analyze time-series data for 30 years (1980-2010), and they discovered that the future influence of exports on GDP will be significant. Using the ARDL (autoregressive distributive lag) bound approach, Paul (2014) discovered considerable evidence of export-led development in Bangladesh in the short and long horizons. It has been recently noted that in the short run in Bangladesh, exports cause growth and growth causes imports (Miyan & Biplob, 2019). The topic that is prevalent across the pieces of literature on Bangladesh's economy is investigated in the following parts of this work from the perspective of the long run.

3. Data & Methodology

This study follows econometric analysis under the quantitative approach of research. Stata (version 12) and EViews (version 10) have been used in the data analysis. The prime research question of this literature is-

[1] Singapore, Taiwan, South Korea, and Hong Kong.

⇒ Can we infer that exports lead to long-term GDP growth in Bangladesh?

To investigate the premise, we have sampled time series data from 1991 through 2020. The WDI (global development indicators) dataset supported by the World Bank is the source of all the data (The World Bank, 2022).

3.1. Econometric Model

GDP is taken as the dependent variable since it writes down economic growth. Exports of goods & services (EXP) are taken as the explanatory variables. Furthermore, some control variables- Gross Capital Formation (GCF) and Imports (IM) in the current LCU (local currency unit) are considered in the model for productive analysis. The affiliation between dependent and independent variables resulted in the following function:

$$\mathbf{GDP_t = \mathit{f}(EXP_t, GCF_t, IM_t)}$$

After the conversion of the econometric model into a log-log econometric model, the following regression function stands:

$$\mathit{ln}\mathbf{GDP_t} = \mathit{ln}\beta_0 + \beta_1 \mathit{ln}\mathbf{EXP_t} + \beta_2 \mathit{ln}\mathbf{GCF_t} + \beta_3 \mathit{ln}\mathbf{IM_t} + \mathbf{U_t}$$

Where,

GDP_t = GDP (current LCU)

EXP_t = Exports of Goods & Services (current LCU)

GCF_t = Gross Capital Formation (current LCU)

IM_t = Import (current LCU)

U_t = Stochastic Disturbance Term

β_0 = Constant Term

β_n = Coefficients

Both the adjusted R-squared and the R-squared are utilized in the process of determining whether or not the estimated regression model is a good match. To confirm each independent variable's influence on the dependent variable, parameters and signs are utilized in the verification process. The significance of the coefficients of the variables is checked using the T-test, and the significance of the effects of the independent factors on the dependent variable under study is assessed with the F-statistic.

3.2. Methodology

The Johansen co-integration test is used in this analysis to decide the long-run relationship between the variables being studied. To figure out the location of the casualty, the Granger casualty test is carried out. OLS (Ordinary Least Square) estimators are used here so that the offered tests may be displayed (Gujarati, 1995). The Augmented Dickey-Fuller (ADF) test and the Philips-Perron (PP) test are both performed to verify stationarity. Using the Augmented Dickey-Fuller (ADF) and Phillip-Perron (PP) tests for the unit root, the variables are integrated for the order-I (1) at the first difference. The descriptive statistics of the data, tests of normality, checks of fitness, and several other econometric tests are all elements of other types of testing methodologies. To apply the empirical model to the dataset, the log-log format, also known as the double log format, is used. The following is a list of the added econometric tests that have proven to be helpful throughout this investigation.

To evaluate structural break, Chow Test is used. A chain of information will typically embrace a structural break, because of any sudden shock or changes in the policies (Gujarati, 1995). That is why, splitting the dataset into two parts, separate regressions are run, and F-statistic is used to compare the two to find out whether there exists a structural break or not.

$$F = \frac{RSS_R - \frac{RSS_1 + RSS_2}{k}}{\frac{RSS_1 + RSS_2}{n - 2k}}$$

Here, RSS_1 is the residual sum of squares of part one and RSS_2 is that of the second part. RSS_R stands for the Restricted Residual Sum of Squares. The null hypothesis (H_0: there will not be a structural break) is considered to be incorrect when the value of the F-statistic being calculated is found to be higher than the value that was tabulated.

The cointegration method examines the relationship that has existed between the variables throughout an extended period. The order of integration is identical to that found in Johansen's technique, which examines the cointegration among variables. It carries out its primary purpose in the context of the VAR (vector autoregression) model of order p through the following:

$$Y_t = \mu + A_1 Y_{t-1} + \ldots\ldots\ldots + A_p Y_{t-p} + \epsilon_t \text{ [for t = 1, 2, …, t]}$$

Here, Y_t, Y_{t-1}, Y_{t-p} are the vectors of level and lagged values of p variables severally that is one within the model; A_1, A_p are constant matrices having "PxP" dimensions; μ is the intercept vector and ϵ_t is the vector of random errors. Using the Eigenvalues, trace statistics are achieved.

The Granger Causality test is carried out next to determine the directions of the causal relationships that exist among the variables. Following equations are estimated here assuming no correlations between U_{1t}, U_{2t}, U_{3t}, and U_{4t}:

$$GDP_t = \sum_{i=1}^{n} \alpha_i EX_{t-i} + \sum_{j=1}^{n} \beta_j + GCF_{t-j} + \sum_{k=1}^{n} \gamma_k IM_{t-k} + \sum_{i=1}^{n} \Phi_i GDP_{t-i} + U_{1t} \ldots\ldots\ldots\ldots \textbf{(1)}$$

$$EX_t = \sum_{i=1}^{n} \delta_i EX_{t-i} + \sum_{j=1}^{n} \Omega_j + GCF_{t-j} + \sum_{k=1}^{n} \text{?}_k IM_{t-k} + \sum_{i=1}^{n} \sigma_i GDP_{t-i} + U_{2t} \ldots\ldots\ldots\ldots \textbf{(2)}$$

$$GCF_t = \sum_{i=1}^{n} \tau_i EX_{t-i} + \sum_{j=1}^{n} \psi_j + GCF_{t-j} + \sum_{k=1}^{n} \omega_k IM_{t-k} + \sum_{i=1}^{n} \varphi_i GDP_{t-i} + U_{3t} \ldots\ldots\ldots\ldots \textbf{(3)}$$

$$IM_t = \sum_{i=1}^{n} \mu_i EX_{t-i} + \sum_{j=1}^{n} \Pi_j + GCF_{t-j} + \sum_{k=1}^{n} \epsilon_k IM_{t-k} + \sum_{i=1}^{n} \lambda_i GDP_{t-i} + U_{4t} \ldots\ldots\ldots\ldots \textbf{(4)}$$

Breusch-Godfrey Test and *Durbin-Watson Test* are performed for autocorrelation. Autocorrelation or serial correlation tells us the degree of correlation that exists within the same variable's observations between its original form and a lagged version (Wooldridge, 2018). The *Breusch-Godfrey Test* (Lagrange Multiplier Test) involves estimating the regression of residuals on the original regressors as well as the lagged values of residuals. Breush & Godfrey's developed test statistic, $(n-p)*R^2$ is used for decision making. In the *Durbin-Watson Test*, only the first-order autocorrelation is tested with a null hypothesis assuming the existence of no autocorrelation among the residuals of time-series data (Wooldridge, 2018). Here, the *Durbin-Watson d statistic* is used for decision-making. The Durbin-Watson d statistic's value ranges from 0 to 4. A value nearby 2 is considered a very low level of autocorrelation and nearby 0 is considered very high. A value closer to 4 tells that there is strong negative autocorrelation.

Heteroskedasticity is a situation that violates an assumption of OLS that explained that disturbance/error terms have equal/constant variance across all observations (Gujarati, 1995). So, it refers to unequal variances of disturbance terms. *White's Heteroskedasticity Test* and *Breusch-Pagan-Godfrey Test both are conducted in this analysis.* White has proved that, under the null hypothesis that error variances are homoscedastic, sample size multiplied by the R^2 derived from the regression of residual squared on explanatory factors follows the chi-square distribution for specific forms. After estimating the linear model of regression, auxiliary regression is run from which White Test Statistic is calculated (Wooldridge, 2018). For instance:

The linear model of regression: $\widehat{Y_i} = \widehat{\beta_1} + \widehat{\beta_2} X_{2i} + \widehat{\beta_3} X_{3i}$

Auxiliary regression: $e_i^2 = A_0 + A_1 x_{2i} + A_2 X_{3i} + A_3 X_{2i}^2 + A_4 X_{3i}^2 + A_5 X_{2i} X_{3i} + V_i$

White test statistic from auxiliary regression: $nR^2 \sim \chi^2 df$

The decision on heteroskedasticity is completed by calculating the critical value from the Chi-squared distribution (where; df = number of explanatory variables in the auxiliary regression). The null hypothesis that there is no heteroskedasticity is rejected if the value of the test statistic is larger than the critical value. The Breusch-Pagan-Godfrey (BPG) Test is an alternative test for the heteroskedasticity of regression errors. Here, a new regression model is fitted from the squared residuals of the first regression. After that, a new R^2 is figured out using the Chi^2 test statistic. Here, "H_0 = homoscedasticity" is invalidated if and only if the chi-squared test statistic exceeds the critical value.

4. Descriptive Statistics of Variables

Before conducting the empirical analysis, hints about the characteristics of the variables can be obtained from the graphical inference of the data. On top of that, it helps to predict the problems of the data and makes the analysis easier too to take the proper preventive measures. Table 1 displays the descriptive statistics obtained from these records. All the variables are broken down into their means, standard deviations, extreme values, and middle values. This table explains the dataset's dispersion.

Table 1: Descriptive Statistics

Variables	Mean	Standard Deviation	Minimum	Maximum
GDP_t	5.47012	2.7301212	2.310123	1.140313
EX_t	13.85688	3.760205	6.662612	20.16159
IM_t	19.70217	4.524862	12.22721	27.94933
GCF_t	25.0270	4.254419	16.89595	31.5703

It is seen that all the variables are almost normally distributed. Figure 1 shows the distributions of the variables in the form of histograms. Also, no evidence of abnormal skewness among the variables is seen. On the other hand, it is found that two variables'- GDP and Gross Capital Formations'- kurtosis are normal and that the remaining two are a little bit abnormal.

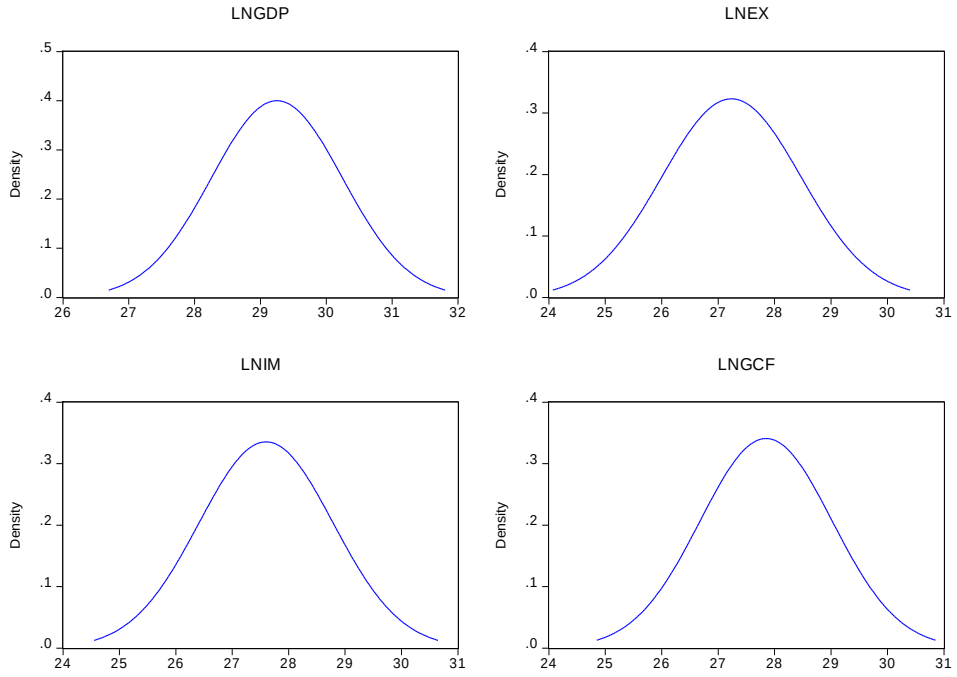

Figure 1: Histograms reflecting the normal distributions of the variables

The histograms' results are cross-checked with the help of box-plot graphs. From Figure 2 i.e. figures of the boxplots, it is observed that all the variables are nearly normally distributed. Therefore, weighing both graphical methods of normality, it can be opined that the taken variables are normally distributed.

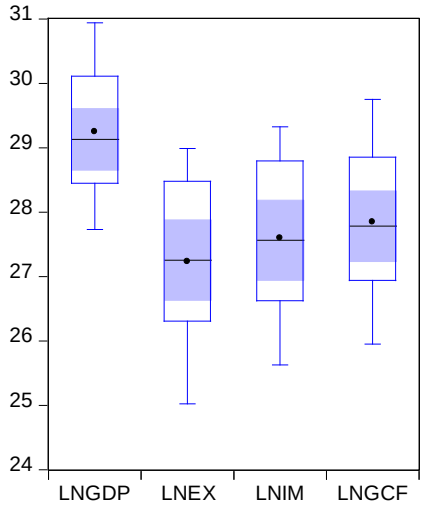

Figure 2: Box plots reflecting the normal distributions of the variables

At the very outset of the quantitative investigation, the fitness of the data is justified in an informal way which leads to figuring out whether the data are eligible to predict any hypothesis or not. Figure 3 highlights that the lion's share of our individual variable's data coincides with the fitted line. It becomes clear that the fitness of the data is particularly good to predict the research objectives.

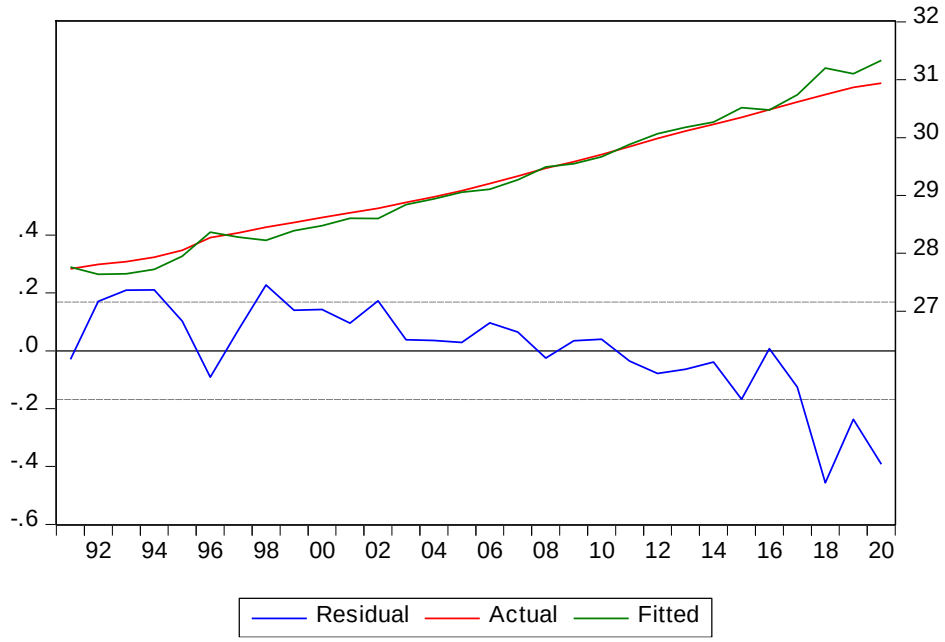

Figure 3: Autocorrelations of the variables representing the fitness

4.1. Tests for Normality

Tests for overall normality, skewness, and kurtosis are presented in Tables 2, 3, and 4, respectively. In Table 2, the p-values for the first two variables here are higher than the 5% probability threshold. Since the alternative hypothesis is not true and the data are normally distributed, we must accept the null hypothesis. In contrast, neither of the first two variables has a p-value higher than 5%. Therefore, the alternative hypothesis (that the

data are not normally distributed) holds, and the null hypothesis (that the data are normally distributed) can be rejected.

Table 2: Test for Normality

Variables	P-value	Decision
lngdp	0.0750	Do not reject null
lngcf	0.1098	Do not reject null
lnex	0.0394	Reject null
lnim	0.0235	Reject null

In Table 3, the null hypothesis is considered as the Skewness is Normal. Here, all the p-values are greater than the 5% probability value. So, we cannot reject the null, and the data are normally distributed with standard skewness.

Table 3: Test for Normality (skewness)

Variable	P-value	Decision
lngdp	0.7013	Do not reject null
lngcf	0.9235	Do not reject null
lnex	0.6823	Do not reject null
lnim	0.8891	Do not reject null

The null hypothesis is considered as the Kurtosis is Normal (Table 4). Here, the last two variables' p-values are greater than the 5% probability value. So, we cannot reject the null, and data are normally distributed with standard kurtosis for Exports and Imports.

Table 4: Tests for Normality (kurtosis)

Variable	P-value	Decision
lngdp	0.0229	reject null
lngcf	0.0381	reject null
lnex	0.0084	reject null
lnim	0.0035	reject null

On the other hand, it is seen that all the variables' p-values are less than the 5% probability value. So, we can reject the null. That means our alternative null is true and data are not normally distributed with standard kurtosis. As a result, a little bit of abnormality is in kurtosis. Yet, this will be significant, as overall normality is supported for all variables.

5. Results and Discussions

5.1. Chow Test

In the structural break test, the formula of the F-statistic is-

$$F = \frac{RSS_R - \frac{RSS_1 + RSS_2}{k}}{\frac{RSS_1 + RSS_2}{n - 2k}}$$

Here,

RSS_1 is for group 1 data, if t <= 2000

RSS_2 is for group 2 data, if t > 2001

Now,

$RSS_1 + RSS_2 = 0.008501483$; $RSS = 0.004922$;

$RSS_1 = 0.00708979$; $RSS_2 = 0.001417693$

$K = 3$; $T = 28$; $N_1 = 8$; $N_2 = 20$

Then, $F = -0.00121761/0.00035478458$

So, $F = -3.434933$

Since, the critical value (F_c) is 2.96 and F-value (−3.434933) is less than the F_c-value, we cannot reject the null. Therefore, there is no structural break.

5.2. Unit Root Tests

This process is done to see whether data are stationary at level or first difference. As mentioned earlier, both the Augmented Dicky-Fuller test and the Philips Perron test are conducted.

Augmented Dicky Fuller Test (trend): Here, the test is done at level form (trend). In Table 5, the Augmented Dicky Fuller Test is symbolized as ADL and H_0 is the existence of a unit root.

Table 5: Augmented Dicky Fuller Test (trend)

Name of variable	Test name	Test statistics Z(t)	5% critical value	Decision
lngdp	ADL	−2.199	−3.584	Do not reject null
lnex	ADL	−2.476	−3.584	Do not reject null
lngcf	ADL	−3.493	−3.584	Do not reject null
lnim	ADL	−3.601	−3.584	Do not reject null

It is observed that the z(t) statistics values are less than the 5% critical value. So, we cannot reject the null. The alternative is not true and there is a unit root in the data. In another way, it can be said that data are not stationary at level form.

Philips Perron Test (trend): Here, the test is done at level form(trend). In Table 6, Philips Perron Test is symbolized as PP and H_0 is the existence of the unit root. Philips Perron (PP) test is conducted to check the validity of the results of the Augmented Dicky Fuller (ADL) test.

Table 6: Philips Perron Test (trend)

Name of variable	Test name	Test statistics Z(t)	5% critical value	Decision
lngdp	PP	−2.242	−3.584	Do not reject null
lnex	PP	−2.569	−3.584	Do not reject null
lngcf	PP	−3.471	−3.584	Do not reject null
lnim	PP	−3.718	−3.584	Do not reject null

The z(t) statistics values are less than the 5% critical value. So, we cannot reject the null. It means- there is a unit root in the data, or the data are not stationary at level form. The result is consistent with the Augmented Dicky Fuller (ADL) test.

Augmented Dicky Fuller Test (drift): For cross-checking the results of the above two tests, we will do it under only drift for Augmented Dicky Fuller (ADL) test, as we will not get any outcome if we do so for Philips Perron (PP) Test. In Table 7, all the values under Augmented Dicky Fuller Test(drift)are given and H_0 is the same i.e. existence of unit root.

Table 7: Augmented Dicky Fuller Test (drift)

Name of variable	Test name	Test statistics Z(t)	5% critical value	Decision
lngdp	ADL	−1.005	−1.682	Do not reject null
lnex	ADL	−1.381	−1.682	Do not reject null
lngcf	ADL	−2.252	−1.682	Do not reject null
lnim	ADL	−0.380	−1.682	Do not reject null

The z(t) statistics values are less than the 5% critical value here. So, we cannot reject the null and the data are not stationary at level form. All the results are consistent at level form. Now, unit root tests at first difference are run. All variables from the level form to at first difference are converted.

Augmented Dicky Fuller Test (trend) at the first difference: Here, the test is done at the first difference form (trend). The Augmented Dicky Fuller Test is symbolized as ADL and the null hypothesis is considered as there is a unit root (Table 8).

Table 8: Augmented Dicky Fuller Test (trend) at First Difference

Name of variables	Test name	Test statistics Z(t)	5% critical value	Decision
dlngdp	ADL	−7.008	−3.588	reject null
dlnex	ADL	−9.603	−3.588	reject null
dlngcf	ADL	−3.629	−3.588	reject null
dlnim	ADL	−5.542	−3.588	reject null

Here, the z(t) statistical values are greater than the 5% critical value. So, we can reject the null. So, the alternative is true and there is no unit root in the data at first difference.

Philips Perron Test (trend) at the first difference: In Table 9, Philips Perron Test is symbolized as PP and H_0 is the existence of a unit root.

Table 9: Philips Perron Test (trend) at First Difference

Name of variables	Test name	Test statistics Z(t)	5% critical value	Decision
dlngdp	PP	−6.958	−3.588	reject null
dlnex	PP	−9.758	−3.588	reject null
dlngcf	PP	−2.982	−3.588	reject null
dlnim	PP	−5.632	−3.588	reject null

Here, the z(t) statistical values are greater than the 5% critical value. So, we can reject the null. So, the alternative is true, and the data are stationary at first difference.

Augmented Dicky Fuller Test (drift) at the first difference: Now, to cross-check the results of the above two tests, we will do it under only drift for Augmented Dicky Fuller (ADL) test. In Table 10, all the values under this test are given with a null hypothesis (there is a unit root).

Table 10: Augmented Dicky Fuller Test (drift) at First Difference

Name of variables	Test name	Test statistics Z(t)	5% critical value	Decision
dlngdp	ADL	−6.707	−1.950	reject null
dlnex	ADL	−9.489	−1.950	reject null
dlngcf	ADL	−2.386	−1.950	reject null
dlnim	ADL	−5.108	−1.950	reject null

The z(t) statistics values are greater than the 5% critical value, which means we can reject the null. So, there is no unit root in the data and the data are stationary at first difference form. Therefore, at the first difference, all the results are also consistent.

5.3. Johansen Cointegration Test

Before conducting the Cointegration test, we need to find out the optimum lag of the variables. We assume that the time series data are to some extent influenced by the earlier data.

Table 11: Identifying Optimum Lag

Lag	LL	LR	FPE	AIC	HQ	SC
0	71.27169	--	9.62e-08	−4.805121	−4.614806	−4.614806
1	223.5690	250.2027*	5.78e-12*	−14.54064	−14.24974*	−13.58907*
2	239.9457	22.22553	6.09e-12	−14.56755*	−14.04392	−12.85471

However, assessing all criteria such as LR, FPE, AIC, and HQIC, we get the optimum lag is one (Table 11). This is done to decide the long-term link that exists between the variables. Since all of the variables are found to be stationary after the first difference, we decided to do the Johansen Cointegration test. In any other case, we would have carried out the Bound Test derived from the ARDL (autoregressive distributive lag) to figure out whether or not some variables were stationary at the level, while other variables were stationary at the 1st difference.

The results of the Johansen Cointegration test under trace statistic, where the null hypothesis is the existence of Cointegration (Table 12).

Table 12: Johansen Cointegration Test explanation under Trace Statistics

Max rank	Trace statistic	5% critical value	p-value
0	62.41292	47.85613	0.001
1	19.54691*	29.79707	0.4541
2	7.479345*	15.49471	0.6388
3	0.630108*	3.8414	0.4273

Here, trace statistics at the rank (0) = 62.41292 is greater than the 5% critical value (47.85613), so we can reject the null. This means our alternative hypothesis is true and there is no Cointegration among the variables at a rank of zero (0). Therefore, in the short run, we cannot see any relationship among the variables. However, trace statistics at the rank of one (1) to three (3) is less than the 5% critical value (15.41). Hence, we cannot reject the null and there is long-run Cointegration among the variables.

The results of the Johansen Cointegration test under max statistic, where the null hypothesis is the existence of Cointegration (Table 13).

Table 13: Johansen Cointegration Test explanation under Max Statistics

Max rank	max statistic	5% critical value	p-value
0	42.86601	27.58434	0.0003
1	13.06757	21.13162	0.4460
2	5.849237	14.26460	0.6326
3	0.630108	3.841466	0.4273

Here, max statistics at the rank (0) = 42.86601 is greater than the 5% critical value (27.58434), which is why we can reject the null. So, there is no Cointegration among the variables at the rank zero (0). In the short run, we cannot see any relationship among the variables. However, max statistics at the rank one (1) to three (3) is less than the 5% critical value, which is why we cannot reject the null. Here, the alternative hypothesis is not true and there is long-run Cointegration among the variables. Investigating Johansen Cointegration tests by both trace statistic and max statistic, it can be said that though variables do not show any Cointegration in the short run, they have substantial relationships in the long run.

5.4. Granger Causality Test

Here, we check whether we can find any bidirectional relationships from GDP to all other variables and from Export to all other variables. The equations are given to show the direction mathematically and Table 14 shows the results.

$$GDP_t = \sum_{i=1}^{n} \alpha_i EX_{t-i} + \sum_{j=1}^{n} \beta_j + GCF_{t-j} + \sum_{k=1}^{n} \gamma_k IM_{t-k} + \sum_{i=1}^{n} \Phi_i GDP_{t-i} + U_{1t} \ldots\ldots\ldots\ldots \textbf{(1)}$$

$$EX_t = \sum_{i=1}^{n} \delta_i EX_{t-i} + \sum_{j=1}^{n} \Omega_j + GCF_{t-j} + \sum_{k=1}^{n} \square_k IM_{t-k} + \sum_{i=1}^{n} \sigma_i GDP_{t-i} + U_{2t} \ldots\ldots\ldots\ldots \textbf{(2)}$$

$$GCF_t = \sum_{i=1}^{n} \tau_i EX_{t-i} + \sum_{j=1}^{n} \psi_j + GCF_{t-j} + \sum_{k=1}^{n} \omega_k IM_{t-k} + \sum_{i=1}^{n} \varphi_i GDP_{t-i} + U_{3t} \ldots\ldots\ldots\ldots \textbf{(3)}$$

$$IM_t = \sum_{i=1}^{n} \mu_i EX_{t-i} + \sum_{j=1}^{n} \Pi_j + GCF_{t-j} + \sum_{k=1}^{n} \epsilon_k IM_{t-k} + \sum_{i=1}^{n} \lambda_i GDP_{t-i} + U_{4t} \ldots\ldots\ldots\ldots \textbf{(4)}$$

Table 14: Granger Causality Test

No. of observations	P-Value	Null Hypothesis	Decision
28	0.1610	lnex does not Granger cause lngdp	Do not reject
	0.810	lngdp does Granger cause lnex	
28	0.0677	lnim does not Granger cause lngdp	Do not reject
	0.8981	lngdp does Granger cause lnim	
28	0.7634	lngcf does not Granger cause lngdp	Do not reject
	0.5037	lngdp does not Granger cause lngcf	
28	0.4431	lnim does not Granger cause lnex	Do not reject
	0.3999	lnex does not Granger cause lnim	
28	0.8579	lngcf does not Granger cause lnex	Do not reject
	0.307	lnex does not Granger cause lngcf	
28	0.8821	lngcf does not Granger cause lnim	Do not reject
	0.1712	lnim does not Granger cause lngcf	

Analyzing the results, it is seen that the p-values are greater than the 5% probability value. So, we cannot reject the nulls. As a result, we cannot find any bidirectional causality situation at lag (2).

5.5. Tests for Autocorrelation

Durbin-Watson Test: In this test, the null hypothesis is considered as there is a serial correlation. The Durbin-Watson d-statistic (4,30) = 1.051393 which is in between dL = 0.941 and dU = 1.5111. So, at a 1% significance level, the test is inconclusive. We know that, when d-statistic is between dL and dU, we cannot take any further decisions about autocorrelation.

Breusch-Godfrey LM Test: The findings of the Durbin-Watson d-test are inconclusive, so we will go on to the next step, which is to test for autocorrelation using the BG method. The null hypothesis being considered in this context is that there is no evidence of a serial correlation. Table 15 shows the results of the BG LM test at lag (4).

Table 15: Breusch-Godfrey LM Test for Autocorrelation at lag (4)

Lag	Chi²	df	Prob > Chi²
4	10.120	4	0.0385
6	10.206	6	0.1162

Here, P-value (0.0107) is less than 0.05, for which we can reject the null hypothesis. We chose lag (4) as our optimum lag value is 4. But we are having different results at lag 6.

After taking the lag value up to (6), the P-value stands at 0.1162 which is greater than the 5% probability value. Therefore, we cannot reject the null. The alternate hypothesis is not true and there is no evidence of autocorrelation. The value is statistically significant.

5.6. Heteroskedasticity Test

Breusch-Pagan/Cook-Weisberg Test: Holding the null hypothesis as there is constant variance, the Breusch-Pagan Heteroskedasticity test is performed. Here, P-value (0.3665) is greater than the 0.05 value, which is why we cannot reject the null hypothesis. The test result is also statistically significant.

White Test: To cross-check the Breusch-Pagan/Cook-Weisberg test of heteroscedasticity white test is conducted, holding a null hypothesis as there is homoscedasticity. Here, P-value (0.4064) is greater than the 0.05 value which is why we cannot reject the null hypothesis i.e. the alternative hypothesis is rejected. So, the test result is statistically significant, and the variance is fixed. Analyzing both results of heteroskedasticity tests, it can be expressed that research variables do not have the heteroskedasticity problem.

5.7. Estimated Econometric Model

Finally, the econometric model is to be estimated. Table 16 and Table 17 respectively are the ANOVA table and results of the multivariate regression model.

Table 16: ANOVA table for Multi-variate Regression Model

Source of Variation	SS	df	MSS
Due to regression (ESS)	28.8173961	3	9.6057987
Due to residuals (RSS)	0.031857695	26	0.001225296
TSS	28.8492538	29	0.994801855

Here, ESS = Explained Sum of Squares, RSS = Residual Sum of Squares, TSS = Total Sum of Squares, and df = Degrees of Freedom.

Table 17: Regression Results

Explanatory Variables	Coefficients	t-value	P-value	5% Critical value
$\ln EXP_t$	−0.4774084	−5.13	0.000	−.6686193
$\ln GCF_t$	0.8390525	17.06	0.000	.7379328
$\ln IM_t$	0.5066171	4.57	0.000	.278613
Constant	4.902385	24.50	0.000	4.491106
F-statistics = 7839.57		P-value = 0.0000		
R-squared = 0.9989		Adjusted R-squared = 0.9988		

The following regression equation demonstrates the outcome of the expected model based on the data and methodology:

$$\ln GDP_t = 4.902385 - 0.4774084 \ln EXP_t + 0.8390525 \ln GCF_t + 0.5066171 \ln IM_t$$

As the calculated t-statistic of the explanatory variables are above the 5% level critical value, we can discard "H_0: $\beta_0 = 0$"; "H_0: $\beta_1 = 0$"; "H_0: $\beta_2 = 0$" as well as "H_0: $\beta_3 = 0$". So, our hypothesis testing is statistically significant and different from zero. Priori expectations are just in favor of our results without the exports. Minus sign on the coefficient of EX_t states that an increase in exports decreases the GDP growth rather than increases. Our priori expectation from the theory of GDP, developed by Simon Kuznets and measured using the expenditure technique as GDP = C + I + G + (X − M), is that there prevails a positive relationship between GDP and exports; between GDP and gross capital formation- broadly known as private investment in the LDC enlisted countries. An increase in the volume of an economy's exports would lead to a rise in that economy's Gross Domestic Product (GDP), which is achieved through the rise in either capital formation or private investment. But, except for the exports, our predicted model is consistent with this premise. The fact that both estimated slope coefficients have t-values and p-values that are significantly different from zero indicates that the slope coefficients are independently significant. When total gross capital formation and imports are held constant during the time, an increase of 1% in the volume of goods and services that are exported results in a

GDP that is, on average, 47.74084% lower. Again, if export and import levels stay unchanged, an increase of one percentage point in gross capital formation results in an increase of 83.90525% in GDP on average. In a similar vein, if exports and gross capital creation will remain unchanged, an increase of 1% in imports will, on average, result in a growth of GDP of 50.66171%. The model's significance can be reliably decided by examining its F-statistic.

The computed regression model supplies a very good fit to the available data when viewed from a statistical perspective. A value of R squared of 0.9989 writes down that the variations in GDP can be explained by exports, gross capital formation, and imports to a greater extent than 99 percent. The value of the adjusted R-squared, which was calculated to be 0.9988, informs us that the estimated model explains 99.88 percent of the variation in GDP after the number of regressors is regarded. The high values of R-squared and adjusted R-squared are because of taking time-series data. As a result of conducting a review of the relevant literature, it has come to light that many countries all over the world find varying degrees of relationship between economic growth and export. Although some researchers, such as Li et al. (2010) have found that exports have a negative correlation with the expansion of the economy (Humpage, 2000; Vohra,2001; Mishra, 2011; Elbeydi et al., 2010). They found that exports have a positive correlation with the expansion of the economy. Some studies, such as Subasat (2002) have concluded that there is no connection between growth and exports, particularly in the nations that are the least developed as well as the developed ones. Tang (2006) also believes that no long or short-term connection between growth and exports exists. In addition, Awokuse (2007) found an ambiguous relationship between growth and exports. Weighing the above opinions, it can be elucidated that our findings coincide with the faiths of researchers who had shown a reverse link between GDP and exports in lower-income countries. Since Bangladesh is still a member of LDCs, she is not showing a positive connection between growth and exports. Therefore, the findings on Bangladesh also do not support the normal economic thought related to exports and economic growth.

6. Conclusion

In this investigation, an examination of data spanning a total of thirty years (1991-2020) proved a departure from a premise that is fundamental to macroeconomics, namely that exports raise the level of aggregate domestic product. The sole aim of this research was to evaluate the impact that higher exports have on the rate of economic growth in a low-income nation by using Bangladesh as a stand-in for the LDC in question. Research findings confirmed that in expanding aggregate demand of the economy, exports have no discernible effect on GDP growth and have the opposite connection. As a result, Bangladesh's export performance has been negatively correlated with its GDP growth since 1991. Therefore, the proposal that should be made to policymakers to influence economic growth is to place importance on the diversification of exports. There are some added costs that Bangladesh faces with exports. The increased shipping costs associated with exporting goods and services act as a barrier to export promotion. Another significant element that works against the diversification of Bangladesh's exports is the tariff that other countries place on Bangladesh's exportable goods. A deeper investigation into the reasons why LDCs' long-run phenomena do not reveal any positive association between export and GDP development is something that can be pursued in future research. This will open a new door for think tanks and politicians, allowing them to accelerate low and middle-income country growth around the globe.

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