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The Causal Relationship among Export, Imports, Capital Formation and Economic Growth in Bangladesh

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ABSTRACT: The Gross Domestic Product (GDP), exports, imports, and capital formation are the most important macro-economic indicators for a country. These indicators are an integral part of the overall developmental effort and national growth of all countries including Bangladesh. This study is conducted is to investigate the dynamic relationship among exports, imports, capital formation, and economic growth in Bangladesh using annual time series data from 1972 to 2018. To achieve this objective, the study is used the Johansen Co-integration test and Vector Error Correction Model (VECM) and Granger-causality test. The Johansen Co-integration test results confirm that there is a statistically significant long-run equilibrium relationship among exports, imports, capital formation, and economic growth. The results of the VECM show that the disequilibrium in long-run economic growth is corrected or adjusted by 47% in the short-run following the next year. Furthermore, the study finds short-run causality running from exports to economic growth and imports to economic growth and capital formation to economic growth. The results from Granger causality test reveal that there exists a unidirectional causal relationship from exports to economic growth (GDP), from capital formation to GDP and from exportstoimports while a bi-directional causal relationship between imports and GDP; capital formation and exports; capital formation and imports in Bangladesh. Therefore, the government of Bangladesh should rethink the current policies regarding the exports, imports, gross capital formation (investment), and economic growth.

KEY WORDS: Economic Growth, Exports, Imports, Capital Formation, Johansen Co-Integration test, VECM, Granger Causality.

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I. INTRODUCTION

Bangladesh is a developing country.Tradeis an integral part of the entire development and national growth of all economies including Bangladesh(Akhter, 2015). Trade increases specialization in productions which results in efficient productions and optimum allocations of resources(Albiman & Suleiman, 2016). Furthermore, the Neoclassical growth theories led by Solow insisted that trade (imports and export) is a major determinant of growth and has long-run relationships with economic growth. The theoretical and empirical relationship between exports, imports, and economic growth have long been a topic of much interest and controversy in international trade literature because every nation wants to increase GDP and improve the quality of life for the citizen (Bakari&Mabrouks,2017; Hossain, Haseen, & Jabin, 2009).Export can play a potential role in the development of Bangladesh. Many economists believe that increase in export leads to an increase in economic growth rate because export is directly related to economic growth (Dey, 2018; Saaed & Hossain, 2015).The exports of goods and services increase foreign exchange earnings that ease the pressure on the balance of payments, reduce unemployment problems, facilitate imports of capital goods, increase competition in production, and in turn will lead to efficiency in productions and optimum allocation of resources.This would result in economies of scale through specializations in productions and accelerate technological progress and thus enhance economic development(Balassa, 1978; Grossman &Helpman, 1991; Stait, 2005; Ramos, 2011).Readymade garments (RMG) sector isthe main source of our export revenue. 75% of our export revenue comes from this sector(Dey, 2018).

Again, imports play an important role in the relationship between export and economic growth (Kim, Lim & Park, 2009)**.** Many researchers find that imports cause higher exports by providing a high quality of goods and services. On the opposite hand, the imports of capital goods, intermediate goods, and inputs and advanced technology can expand the capacity for utilization of domestic resources and production which causeshigher exports (Baharumshah& Rashid, 1999). Furthermore, if we consider the endogenous growth

theory, it emphasizes the role of imports in economic growth (Romer, 1986; Lucas, 1988). The theory suggests that imports can attract foreign technology into the domestic economy and increase the supply of intermediate goods and inputs including machines, human capital, skilled laborers, equipment which generally increase productivity in the economy. In this case, imports received considerable attention in determining long-run economic growth, especially for developing countries. Even so, one key subject is ignored in determining the connection between export and economic growth which is capital formation. This example necessitates the need for new empirical justifications which is the main purpose of our study. As a result, many economists think exports and imports are the "Engine of Growth" for a country (Medina-Smith, 2001).

Capital formations refer to the net additions of stock of capital in the economy, which present the real scenario of the level of investment. Investment helps expand productive capacity and increase potential output, thus stimulating future economic growth, employment creation, and a rise in living standards. Capital formations (investment) can have a relationship with the exports because when the investment demand increases, the export demand also increases.Rising exports imply large foreign earning. It reduces dependence on foreign countries. The level of capital formation is also likely to influence the economic growth rate of a country as well. The Neo-classical growth model postulates that developing countries with a lower initial stock of capital can generate a higher marginal rate of returns (productivity) andrateof growthwhen additional capital is supplied into the productive sectors(Adhikary, 2010).Similarly, a higher level of human capital (skilled and knowledgeable human force) tends to push the expansion of aggregate output, prevent the falling of marginal product, increase cross-sharing of knowledge, and reverse engineering, thereby fostering economic growth (Habiyaremye&Ziesemer, 2006).The new endogenous growth theories further postulate that export, imports, and capital formation have a long-run relationship with economic growth (Romer, 1986). Thus economists consider capital formation as the instrumental factor of the economic development of the country. This needs empirical justifications especially for the rapidly developing countries like Bangladesh.

Several studies have been conducted to investigate the nexus between exports and growth in Bangladesh (Ahmed & Uddin, 2009; Akhter, 2015; Dey, 2018; HOSSAIN et al., 2009; Islam & Hossain., 2015; Khan & Kundu, 2015; Miyan & Biplob, 2019) However, none has taken the relationship between exports, imports, capital formation, and economic growth in the context of Bangladesh. In this study we intend to investigate the short and long-run dynamic relationship among exports, imports, capital formation, and economic growth of Bangladesh, using the Johansen Cointegration test, and Vector Error Correction Model and Granger Causality test.The remaining sections of this study are arranged as follows: Section 2 discusses the objectives of the study and Section 3 represent data and research methodology. Section 4 presents the results and discussion. Finally, Section 5 provides the conclusion of the study.

II. OBJECTIVES OF THE STUDY

The general objective of this study is to investigate the dynamic relationship among exports, imports, capital formation,and economic growth in Bangladesh over the periods from 1972 to 2018. Subsequently, the specific objective of this study is as follows:

i. To examine if there is a long-run relationship among exports, imports, capital formation, and economic growth.
ii. To investigate whether there is any causal relationships among exports, imports, capital formation, and economic growth.
iii. To determine the direction of the causality among exports, imports, capital formation, and economic growth.

III. DATA AND RESEARCH METHODOLOGY

3.1 Data Sources

This study uses annual time series data covering the period from 1972 to 2018 in Bangladesh. The data set consists of observation for GDP (current US$), exports of goods and services (current US$), imports of goods and services (current LCU), and gross capital formation (current US$). All data are collected from World Development Indicators published by the World Bank.The gross domestic product is used as a proxy for economic growth. Capital formation is expressed asa gross capital formation.All variables are taken in their natural logarithms to avoid the problems of heteroscedasticity and denoted as LNEXP, LNIMP, LNGCF, and LGDP.

3.2 Methodology

To trace the dynamic relationship among export, imports, capital formation, and economic growth in Bangladesh, the study uses modern techniques of time series analysis.The estimation methodologies employed in the present study are unit root tests, the Johansen cointegration test, Vector Error Correction Model, and Granger Causality test. Unit root tests are employed to determine whether the variables in the model are

stationary or non-stationary by using the Augmented Dickey-Fuller tests and Phillips Perrontest.To test the long-run relationship among export, imports, capital formation, and economic growth, the Johansen cointegration test is used. Also,VectorError Correction Model is used to verify short-run dynamics with long-run equilibrium. To determine the direction of the causality among export, imports, capital formation, and economic growth in Bangladesh, this study is used the Granger Causality test.Finally, stability and several diagnostic tests are conducted to examine the validity and reliability of these models.

3.3 Model Specification

To investigate the dynamic relationship among exports, imports, capital formation, and GDP, we have specified following the econometric model where GDP is dependent variable and exports, imports, capital formation are independent variables. As part of the empirical design, the estimating equation in the log-linear form is specified as follows:

$$LNGDP_t = \beta_0 + \beta_1 LNEXP_t + \beta_2 LNIMP_t + \beta_3 LNGCF_t + \varepsilon_t \quad (1)$$

Where, GDP is the Gross Domestic Product, EXP is exports, IMP isimports, GCF is the Gross Capital Formation and β_0 isconstant, β_1, β_2, β_3, are parameters to be estimated and lnindicates the natural logarithm form of the variable; ε is the error term and t is the period.

3.4. Econometric Model Estimation

3.4.1Unit Root Test

A unit root test is a test of stationarity or non-stationarity in a time series. To analyze the long-run relationship among the variables, Johansen and Julieu's (1990) procedure suggests the use of a co-integration test that requires whether the variables are stationary or not. This is done by the application of theAugmented Dickey and Fuller (ADF) test (Dickey and Fuller, 1979) and the Phillips-Perron (PP) test (Phillips-Perron, 1988).

The general form of the ADF test is computed by the followingequation:

$$\Delta Y_t = \beta_0 + \delta Y_{t-1} + \sum_{i=1}^{n} \lambda \Delta Y_{t-1} + \varepsilon_t \quad (2)$$

Where Δ is the difference operator, t is a time trend, Y_t is the time series, n is the number of lags and ε_t is the stochastic error term. In addition to the ADF test, the study is also used by Phillips and Perron (PP) tests to remove the illness of serial correlation and heteroskedasticity of the error term.

The general form of the PP test is computed by the followingequation:

$$\Delta Y_t = \beta_0 + \delta \Delta Y_{t-1} + u_t \quad (3)$$

3.4.2 Cointegration Tests

The cointegrationtest requires a time series to be non-stationary in their levels. If a non-stationary series has to be differenced d times to become stationary, then it's said to be integrated of order d: i.e. I (d), (Engle and Granger, 1987). Thus, for instance, if two economic variables $X_t$and $Y_t$are non-stationary and are of the same order I (1), there may exist a number β such that the error term series $\varepsilon_t = (Y_t - \beta X_t)$ is stationary. In this case, $X_t$and$Y_t$are said to be cointegrated with a cointegrating factor of β. To test for the long-run relationship among the variables this study applies the Johansen Maximum Likelihood Estimation process since it is the preferred process because of its ability to determine the number of multiple cointegrating vectors.

To determine the number of co-integration vectors, Johansen and Juselius suggest the use of two statistical tests which are the Trace test and Maximum Eigenvalue test. These two tests are estimated with the following equation

$$\lambda_{trace}(r) = -T \sum_{j=i+1}^{n} ln(1 - \lambda_i) \quad (4)$$

$$\lambda_{max}(r, r+1) = -T\, ln(1 - \lambda_{r+1}) \quad (5)$$

Where

λ_{trace} test the null hypothesis r = 0 against the alternative hypothesis of r > 0

T = number of usable observations

λ_i = Eigenvalues or estimated characteristics root

λ_{max} test the null hypothesis r = 0 against the alternative hypothesis of r =1

3.4.3 Vector Error Correction Model (VECM)

If there exists a cointegrating relationship, then we apply a vector error-correction model (VECM) to estimate the long-run causality and short-term dynamics. The objectives of the VECM model is to indicate the speed of adjustment from the short-run equilibrium to the long-run equilibrium state. Considering equation (1), the VECM model is specified as follows:

$$\Delta LNGDP_t = \beta_0 + \sum_{i-1}^{k} \beta_1 \Delta LNEXP_{t-j} + \sum_{i-1}^{k} \beta_2 \Delta LNIMP_{t-j} + \sum_{i-1}^{k} \beta_3 \Delta LNGCF_{t-j} + \lambda ECM_{t-1} + \varepsilon_t \quad (6)$$

Where Δ is the first difference operator, k denotes the lag length, $\lambda$is the speed of adjustment, and ECM_{t-1} is the lagged error term and all other variables are described as earlier. In this specification, a long-run convergence process works between variables if the parameter (λ) of the error correction term is negative and statistically significant in terms of its associated-t value.

3.4.4Granger Causality Test

To determine the direction of the causality among export, imports, capital formation, and economic growth in Bangladesh,this study is used the granger causality test. Engel and Granger (1987) state that if the cointegration relationship exists between two variables in the model, there must either bi-directional or unidirectional causality between them.

The Granger causality test for two stationary variables can be performed to test for the following hypothesis:

H_0: X_t does not cause Y_t
$H_{1:}X_t$ does cause Y_t

To determine which hypothesis holds, the Granger Causality test is using the following equations:

$$X_t = \alpha_1 + \sum_{i=1}^{p} \beta i Y_{t-i} + \sum_{j=1}^{q} \gamma_i X_{t-j} + \mu_{1t} \quad (7)$$

$$Y_t = \alpha_2 + \sum_{i=1}^{p} \delta i X_{t-i} + \sum_{j=1}^{q} \theta_i Y_{t-j} + \mu_{2t} \quad (8)$$

Where α_1 and α_2 are constants, μ_{1t} and μ_{2t} are the white noise error terms, t denotes time period, and q are respectively the number of lags for Y and X. These equations are based on the assumption that μ_{1t} and μ_{2t} are uncorrelated white noise error terms.

IV. RESULTS AND DISCUSSION

4.1. Descriptive Statistics

Descriptive analysis is conducted to determine the statistical properties of the variables. Table 1 shows descriptive statistics of the variables of the estimation model. The mean and median values for all variables are much close to each other depict minor symmetry. The maximum, minimum, and standard deviation explain the measure of the dispersion of the data; here the data are not widely scattered. The standard deviation for each variable is also found low as compared to the mean value, showing a small coefficient of variation.Similarly, the low numeric of skewness confirm normality. The value of the gross domestic product (LNGDP) and exports (LNEXP) are low and positively skewed while imports (LNIMP) and gross capital formation (LNGCF) are negatively skewed. The value for kurtosis in each variable is below 3 which confirms near normality. On the other hand, the Jarque-Bera test statistics for each variable indicates normality of the distribution since the probability values of the JarqueBera test are greater than 0.05. Thus, the normality of the distribution is ensured in the present study.

Table 1: Descriptive Statistics of the variables

	LNGDP	LNEXP	LNIMP	LNGCF
Mean	24.453	22.051	26.225	22.763
Median	24.359	22.140	26.301	22.705
Maximum	26.336	24.426	29.294	25.173
Minimum	22.562	19.693	22.368	19.504
Std. Dev.	0.956	1.452	1.866	1.356
Skewness	0.164	0.131	-0.115	-0.183
Kurtosis	2.271	1.729	2.095	2.410
Jarque-Bera	1.251	3.300	1.708	0.944
Probability	0.535	0.192	0.426	0.624
Observations	47	47	47	47

Source: Author's estimate

4.2 Unit Root Test

To identify the order of integration in time series data, the study is used ADP and PP test and their results are presented in Table 2. The results find that all of the variables are non-stationary (has a unit root) at their level but stationary at first difference i.e. integrated of order 1, I (1). This result allows for the estimation of the Johansen co-integration test to determine the existence of long-run relationships that exists between the dependent variable and its explanatory variable.

Table 2: Unit Root Tests Using (ADF) and Phillip Perron Test at Levels and First Difference

Variables	ADF		PP		Order of Integration
	Level	First difference	Level	First difference	
LNGDP	-0.565	-3.585***	-0.323	-10.726***	I(1)
LNEXP	0.332	-10.976***	-0.213	-10.775***	I(1)
LNIMP	-1.742	-8.744***	-1.995	-8.744***	I(1)
LNGCF	-0.263	-5.280***	-2.115	-8.455***	I(1)

Notes. ***, **, * indicates significance level of 1%, 5%, 10%, respectively.To test ADF and PP, for the level and difference form of the variables we take intercept. The 95% critical values both for ADF and PP testsare-2.927 (with intercept) and -2.928 (with intercept) at the level form and the difference form respectively.
Source: Author's estimate

4.3 Optimal Lag Length Selection

Before conducting with the Johansen's co-integration test and the Vector Error Correction Model, the optimal lag selection criteria are applied to determine the lag length to be used in carrying out the estimation. The lag selection can be done through the basis of Final Prediction Error (FPE), Akaike Information Criteria (AIC), Schwartz Information Criteria (SC), and Hanna and Quinn Information Criteria (HQ) are presented in Table 3. All the criteria, the maximum lag length of 4 is selected and it is used throughout the analysis of the present study.

Table 3: VAR Lag Order Selection Criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	13.088	NA	7.7E-06	-0.423	-0.259	-0.362
1	175.820	287.620	8.4E-09	-7.247	-6.428	-6.945
2	207.237	49.683	4.2E-09	-7.965	-6.490	-7.421
3	259.545	72.988	8.2E-10	-9.653	-7.523	-8.868
4	294.353	42.092*	3.78e-10*	-10.528*	-7.743*	-9.501*

Notes. * 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: Author's estimate

4.4 Johansen Co-Integration Test

Based on the optimum lag length of 4, the Johansen co-integration test is employed to examine the long-run relationship among exports, imports, capital formation, and economic growth.This technique uses two test statistics which are known as the Trace statistics and the Maximum Eigen-value statistics to assist in evaluating the null hypothesis of r = 0 in contrast to the alternatives of r > 0, 1, 2, or 3. If the calculated values for Trace statistics and the Maximum Eigen-value statistics are greater than the critical values then it confirms the existence of long-run relationships among the variables and vice versa. The results obtained from the analysis are presented in Table 5 as follows.

Table 5: Cointegration test using the Trace Test and the Maximum Eigenvalue Test

Hypothesized No. of CE(s)	Eigen Value	Trace Statistic	0.05 Critical Value	Prob.**	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.705	66.228	47.856	0.000	51.312	27.584	0.000
At most 1	0.234	14.916	29.797	0.786	11.223	21.132	0.625
At most 2	0.08	3.693	15.495	0.927	3.488	14.265	0.909
At most 3	0.005	0.205	3.841	0.651	0.205	3.841	0.651

Notes. Trace test and Max-eigenvalue test indicates 1cointegratingeqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values
Source: Author's estimate

The co-integration test result of both Trace and Maximum Eigenvalue statistics indicates that the number of co-integrating equations (vectors) is one at a 5% level of significance. Thus, these results confirm that there exists a long-run relationship among exports, imports, gross capital formation, and economic growth in Bangladesh. Therefore these results allow in estimating the Vector Error Correction Model.

4.5 Vector Error Correction Model (VECM)

Since the Johansen co-integration test results show the long-run relationship among the variables, it is time to observe whether there any short-run deviation exists or not from the long-run equilibrium path. This study is used the VECM framework to check the disequilibrium considering the rate of convergence to the long-run equilibrium path.

Table 6: The results of the short-run dynamic relationship among the variables (VECM)

Variables	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-0.469	0.088	-5.337	0.000
C(2)	1.454	0.350	4.154	0.000
C(3)	-0.187	0.248	-0.754	0.458
C(4)	0.590	0.198	2.981	0.007
C(5)	-0.111	0.201	-0.550	0.587
C(6)	-0.362	0.107	-3.386	0.002
C(7)	-0.096	0.100	-0.953	0.350
C(8)	-0.212	0.067	-3.147	0.004
C(9)	0.017	0.062	0.276	0.785
C(10)	0.183	0.094	1.935	0.065
C(11)	0.170	0.101	1.691	0.104
C(12)	0.183	0.074	2.478	0.021
C(13)	-0.121	0.091	-1.319	0.200
C(14)	-1.133	0.335	-3.381	0.003
C(15)	0.072	0.296	0.242	0.811
C(16)	-0.449	0.212	-2.115	0.045
C(17)	0.155	0.245	0.636	0.531
C(18)	0.108	0.027	4.049	0.001
R-squared	0.830	Akaike info criterion		-3.307
Adjusted R-squared	0.710	Schwarz criterion		-2.562
F-statistic	6.901	Hannan-Quinn criteria.		-3.034
Prob. (F-statistic)	0.000	Durbin-Watson stat		1.911

Source: Author's estimate

Table 6 shows the results of VECM where there are a stable long-run equilibrium relationship and short-run dynamics among the variables. The coefficient of the error correction term C (1) is negative, as expected and also statistically significant which confirms the existence of long-run causal relationship running from the exports, imports, and capital formation to economic growth (GDP).This also implies that exports, imports, and level of gross capital formation jointly promotes economic growth (GDP) in the long-run in Bangladesh. The speed of adjustment of the error correction term is -0.469 which implies that about 47 percent of the disequilibrium in the previous year shock adjusts back to the long-run equilibrium in the current year. So, after two years (1/ 0.469 = 2.13), the disequilibrium between the short-run and long-run values is fully corrected or adjusted.

Wald Test

We use Wald Statistics to check the short-run causality. Here, the null hypothesis is as follows:

Ho: C(6)=C(7)=C (8)=C (9)=0 (There is no short-run causality from exports to GDP).
Ho: C(10)=C(11)=C(12)=C(13)=0 (There is no short-run causality from imports to GDP).
Ho: C(14)=C(15)=C(16)=C(17)=0 (There is no short-run causality from capital formation to GDP).

Exports to GDP

Table 7 shows the results of the Wald test for the lagged values of the exports. Since the P-value is less than 5%, we can reject the null hypothesis and concludes that there is short-run causality running from exports to GDP.

Table 7: Wald Test (Exports to GDP)

Wald Test: Equation: Untitled			
Test Statistic	Value	df	Probability
F-statistic	6.864	(4, 24)	0.000
Chi-square	27.456	4	0.000
Null Hypothesis: C(6)=C(7)=C(8)=C(9)=0			
Null Hypothesis Summary:			

Normalized Restriction (= 0)	Value	Std. Err.
C(6)	-0.362	0.107
C(7)	-0.096	0.100
C(8)	-0.212	0.067
C(9)	0.017	0.062

Source: Author's estimate

Imports to GDP:

Table 8 shows the Wald test for the lagged values of the imports. According to test results (Table-8), we can reject the Null hypothesis, since the p-value is less than 5% level of significance (0.014) < 0.05. So there is short-run causality from imports to GDP.

Table 8: Wald Test (Imports to GDP)

Wald Test: Equation: Untitled			
Test Statistic	Value	df	Probability
F-statistic	3.913	(4, 24)	0.014
Chi-square	15.650	4	0.003
Null Hypothesis: C(10)=C(11)=C(12)=C(13)=0			
Null Hypothesis Summary:			
Normalized Restriction (= 0)		Value	Std. Err.
C(10)		0.183	0.094
C(11)		0.171	0.101
C(12)		0.183	0.074
C(13)		-0.121	0.091

Source: Author's estimate

Capital Formation to GDP

Table 9 shows the results of the Wald test for the lagged values of capital formation. Since the P-value is less than 5%, we can reject the null hypothesis and concludes that there is short-run causality running from capital formation to GDP.

Table 9: Wald Test (Capital Formation to GDP)

Wald Test: Equation: Untitled			
Test Statistic	Value	df	Probability
F-statistic	6.775	(4, 24)	0.0008
Chi-square	27.100	4	0.0000
Null Hypothesis: C(14)=C(15)=C(16)=C(17)=0			
Null Hypothesis Summary:			
Normalized Restriction (= 0)		Value	Std. Err.
C(14)		-1.133	0.335
C(15)		0.072	0.296
C(16)		-0.449	0.212
C(17)		0.155	0.245

Source: Author's estimate

Based on the VECM conducted using the Wald coefficient test, we can conclude that there is short-run causality running from the lagged values of the exports, imports, and capital formation to the economic growth (GDP). From Table 6, the Coefficient of Determination R^2 is 0.830 means that about 83 percent of the variation of economic growth is explained by the explanatory variables exports, imports, and gross capital formation. Therefore the model is a good fit for the relationship. The Durbin-Watson statistics value of 1.91 shows that there is no autocorrelation in the model. The result has an F-statistic value of 6.901 with an associated probability of (0.000) less than 5 % indicating that the overall model is statistically significant and concludes that exert significant impact of exports, imports, and capital formationon economic growth in Bangladesh.

4.6. Pair-wise Granger Causality Test

The Pairwise Granger Causality test is employed to analyze the cause and the effect relationship between variables used in the study and to further analyze the causal relationship among exports, imports, and capital formation and economic growth. The results of the pairwise granger causality test are shown in Table 10.The result based on the significant probability values less than or equal to 0.05 shows that there exists a unidirectional causal relationship from exports to economic growth (GDP), from capital formation to GDP and from exports to imports. The results also show a bi-directional causal relationship between imports and GDP;

capital formation and exports; capital formation and imports in Bangladesh.Besides, there is no uni or bi-directional causal relationship between GDP to exports; GDP to capital formation and imports to exports.

Table 10: Pairwise Granger Causality Tests

Null Hypothesis:	Obs.	F-Statistic	Prob.	The decision about the direction of Causality
LNEXP does not Granger Cause LNGDP	43	4.961	0.030	Reject H0
LNGDP does not Granger Cause LNEXP		0.912	0.468	Accept H0
LNIMP does not Granger Cause LNGDP	43	2.825	0.04	Reject H0
LNGDP does not Granger Cause LNIMP		6.897	0.00	Reject H0
LNGCF does not Granger Cause LNGDP	43	4.311	0.006	Reject H0
LNGDP does not Granger Cause LNGCF		1.774	0.157	Accept H0
LNIMP does not Granger Cause LNEXP	43	1.225	0.319	Accept H0
LNEXP does not Granger Cause LNIMP		3.616	0.015	Reject H0
LNGCF does not Granger Cause LNEXP	43	2.635	0.05	Reject H0
LNEXP does not Granger Cause LNGCF		3.284	0.022	Reject H0
LNGCF does not Granger Cause LNIMP	43	3.366	0.02	Reject H0
LNIMP does not Granger Cause LNGCF		6.161	0.001	Reject H0

Source: Author's estimate

4.7 Diagnostic Tests

This study also conducted diagnostic tests for the VECM model. The test results are presented in Table 11.

Table 11: Diagnostics Test Result

Test Type	Null Hypothesis	Statistic	Probability	Inference
Normality Test (Jarque-Bera Statistics)	Errors are normally distributed	Jarque-Bera Statistics = 3.693	Probability = 0.158	Fail to reject Ho
Serial Correlation (Breush-Godfrey Serial Correlation LM Test)	No serially correlated errors	F-statistics =38.5	Prob. Chi-Square = 0.491	Fail to reject Ho
ARCH Test (Autoregressive Heteroskedasticity Test)	ARCH effect does not characterize model's errors	F-statistics =0.108	Prob. Chi-Square = 0.974	Fail to reject Ho
Heteroskedasticity Test (Breush-Pagan-Godfrey)	Homoscedasticity	F-statistics =0.368	Prob. Chi-Square = 0.949	Fail to reject Ho

Source: Author's estimate

The result of the diagnostic tests reveal thatthe model is free from the problems of non-normality of the errors, serially correlated errors, ARCH effect, and heteroskedasticity from the probability values are greater than 5%. The result of stability test considering both the CUSUM and CUSUMQ plots lie within the bounds of the critical line at 5% significant level which confirms the stability of the coefficients and therefore the correct specification of the VECM model. Hence, the study concludes that the model has passed all the specifications and efficiency tests and can be accepted.

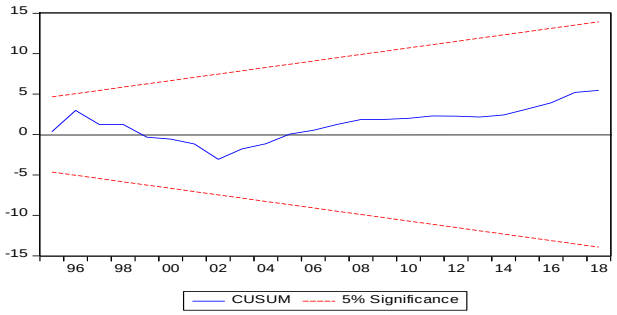

Figure 1: Plot of Cumulative Sum (CUSUM); Source: Author's Estimates

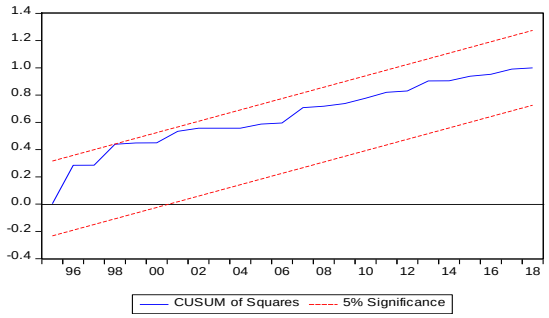

Figure 2: Plot of Cumulative Sum of Squares (CUSUMQ); Source: Author's Estimates

V. CONCLUSION

The environment of international trade is changing day by day due to the globalization effect.This study investigates the long-run causal relationship among exports, imports capital formation, and economic growth in Bangladesh using annual time series data over the period of 1981 to 2017.The study follows an econometric approach in which various tests are performed to avoid spurious regression results. Economic growth (GDP) is taken as a dependent variable while exports, imports capital formation as explanatory

variables. We implement the ADF and PP tests for checking stationary of the time series data and the Johansen's Cointegration approach for a long-run relationship and the vector error correction model (VECM) for both the long run and short-run dynamics relationship among the variables. Moreover, the Granger Causality test is used to determine whether the causal relationship among variablesisuni or bi-directional.The results of the unit root test show that all the variables are found to be stationary after first differencing under the ADF and PP stationary tests. The Johansen's cointegration test result shows that the variables are cointegrated and thus have a long-run relationship among exports, imports, and economic growth in Bangladesh. The VECM results confirm the existence of long-run causal relationship running from the exports, imports, and capital formation to economic growth (GDP). This also implies that exports, imports, and level of gross capital formation has significant impact on the economic growth (GDP) in Bangladesh. Furthermore, based on the Wald test, the study finds short-run causality running from exports to economic growth and imports to economic growth and capital formation to economic growth. The results of the Granger Causality test reveal that there is a unidirectional causal relationship from exports to economic growth (GDP), from capital formation to GDP and from exports to imports while a bi-directional causal relationship between imports and GDP; capital formation and exports; capital formation and imports in Bangladesh.Thus, we conclude that there is a dynamic relationship among domestic demand, export, and economic growth in Bangladesh. Therefore, the government should formulate export-led policies and ensure a higher degree of capital formation to enhance economic growth and development in Bangladesh.

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