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Causal link between Export, Import, Remittance and Economic Growth in Bangladesh

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Abstract: Given the importance of the economic indicators on the economic growth in Bangladesh, this paper examines the short-run and long run causality between remittance, imports, exports and GDP growth of Bangladesh using the data over the liberalized period 1976-2016. Applying the Johansen co-integration and elasticity concept, this study finds that variables are co-integrated as well a long run nexus between exports, imports, remittances and GDP growth in Bangladesh. Besides, the Granger Causality test in a VECM (Vector Error Correction Model) framework, this study finds unidirectional causality from import to growth in Bangladesh. The hardly surprising result, remittance does not show any feedback effect/causality in both the short run and long run. The possible interpretation may be that remittances mainly benefit the individual receivers. The finding also explores that exports, imports and remittances endorse each other in the short run.

Keyword: Economic growth (GDP); Export; Import; Remittance; Granger Causality test; Vector Error Correction (VECM); Co-integration; Unit root test; ADF (Augmented Dicky-Fuller) test, Phillips-Perron (PP) test; elasticity.

1. Introduction

In Bangladesh over the four decades, economic growth has accelerated with substantial growth in its export of goods and services as well as in its import. Nevertheless, the country receives a large number of remittances. Over this period, GDP growth has been accelerated sharply was 5.66 percent in 1976, which rose to 8.15 percent in 2019[1]. From primary goods to manufacturing goods - Bangladesh has achieved a diversified proficiency in its export structure (Love and Chandra, 2005). In the year 1976, the country's total export amounted to $480.2 million which shot up to $3,686.5 million in 2016.[2] Export has contributed 4.7 percent in 1976 in GDP compared to 14.8 percent in 2018[3].

Bangladesh has imported only 8 percent of GDP in 1976, this figure has plunged at 21.3 percent in 2016 and 23.4 percent in 2018.[4] During these periods, the import of capital equipment, industrial raw materials and intermediate goods have increased sharply.

Remittance is the significant economic variable and second-largest source of financial inflow in the country. About 13 million Bangladeshi overseas workers are sending remittance to Bangladesh (BMET, 2019). These Bangladeshi unskilled and semi-unskilled workers are sending vast amounts of foreign currency each year which sometimes outdoes the exports earnings. In the year 1976, remittances of Bangladesh was $18 million (share of GDP is less than 1 percent), which reached $18.36 billion in 2019 (6.06 percent of the GDP).[5]

Due to the strong flow of remittance, the exchange rate of Taka against US$ remained broadly stable during the period. As a result, the foreign reserve stood at US$ 36.6 billion in August 2020. Overall in the last four decades, the country has observed significant growth in exports, imports as well as in remittances.

The stability, direction and strength of the correlation among economic growth, remittance, import and export of goods and services have an enormous role in Bangladesh economy. This paper tries to analyze both short-run and long run causality between imports, exports, remittance and economic growth of Bangladesh. The rest of the paper is organized as follows: Section 2 reviews the existing literature. The econometric methodologies are discussed in Section 3. Section 4 discusses the empirical results and Section 5 provides the concluding remarks.

2. Literature Review

Researchers have conducted studies on export and GDP growth and come up with mixed and contradictory outcomes on the nature and direction of the causal relationship between these two economic indicators. For example, Giles and Williams (2000) contributed an outstanding literature review of the export-led growth hypothesis up to late 1990s. From this wide-ranging survey, it is clear that the literature on the export-led growth hypothesis has been continuously scaling up which prove the contemporary studies such as Chandra (2003) for India, Love & Chandra (2005a) for South Asia, Mah (2005) for China, Awokuse (2005a) for Korea, and Awokuse (2005b) for Japan. Further, using quarterly data from 1976 to 2003, Mamun and Nath (2005) investigated the link between exports and economic growth in Bangladesh and found that manufacturing production and exports are co-integrated.

Using annual data on GDP, export and import, Love and Chandra (2005) investigated the export-led growth hypothesis in a multivariate framework and conclude that there is a short- and long run unidirectional link from income to exports in Bangladesh. Clarke and Ralhan (2005) showed the causality between exports and economic growth for Bangladesh using annual data from 1960 to 2003. Using co-integration and multivariate

Granger Causality tests, Shirazi and Manap (2005) have tested the export-led growth premise for five South Asian countries including Bangladesh and found the feedback effects between exports and economic growth as well as imports and economic growth.

Researchers have observed that remittance is the main source of overseas earnings for the least developed countries and the stable flow of remittances has enhanced the balance of payments, boost the foreign reserve and also escalate the national savings of the economy (Solimano, 2003, Aggarwal *et. al*., 2006, Ratha 2007, Pradhan *et. al*., 2008). In the same vein, Murshed *et.al*. (2000) found that national income could increase Tk 3.33 as a result of an increase in remittance by Taka 1. Moreover, expatriate workers remittances have a positive impact on the rural economy like consumption and productive investment for instance agriculture and livestock. (Latif & Ashfaq, 2013). On the flip side of the coin, using different econometric techniques, for example, Spatafora (2005) applied an instrumental variables approach; Chami *et al*. (2005) used 2SLS (Two-Stage Least Square) regression analysis; Siddique *et al*. (2010) put in Error Correction Method (ECM); Eckstein (2004) opine that remittances have no impact on investment. Further remittance-receiving countries could lose international competitiveness and export could be more expensive due to currency appreciation (Amuedo & Pozo, 2004). The existing literature unveils the different econometric methodologies and their application and use of different sample sizes - as a result the experimental results are diversified and even altered for the same country as well as findings are not definite to recommend for policy formulation for the countries.

To the best of our knowledge, so far no study has considered both the short run and long run nexus between imports, exports, remittance and economic growth of Bangladesh. Though the correlation between exports and economic growth in Bangladesh has been extensively researched which is explained in the literature review section but considering four important variables alone as import, export, remittance and economic growth and their causal relationship have never been pondered in the previous study. In this background, the specific objectives of the study are to:

i) To investigate the causal nexus between exports, imports, remittance and GDP growth of Bangladesh economy in the short run
ii) Examine the responsiveness of exports, imports, remittance and GDP growth of Bangladesh economy in long run.

3. Econometric Methodology, Data and Preliminary Analysis

Based on the annual data over the period 1976-2016 obtained from the World Bank[6], this study attempt to investigate both short-run and long

run relationship between economic growths (GDP per capita income), export of goods and services (EGS), Import of goods and services (IGS) and remittances (RMT) in Bangladesh. We present an amalgamation of co-integration to show the short-run relationship among the GDP growth of Bangladesh with the variables imports, exports, and remittance in a VECM (Vector Error Correction Model) framework. We also analyze the long run relationship dynamics among the variables by using the Ordinary Square (OLS) method. The findings of this study will contribute to the literature of Bangladesh economy by providing new evidence on the role of exports, imports, remittances on the economic growth of Bangladesh.

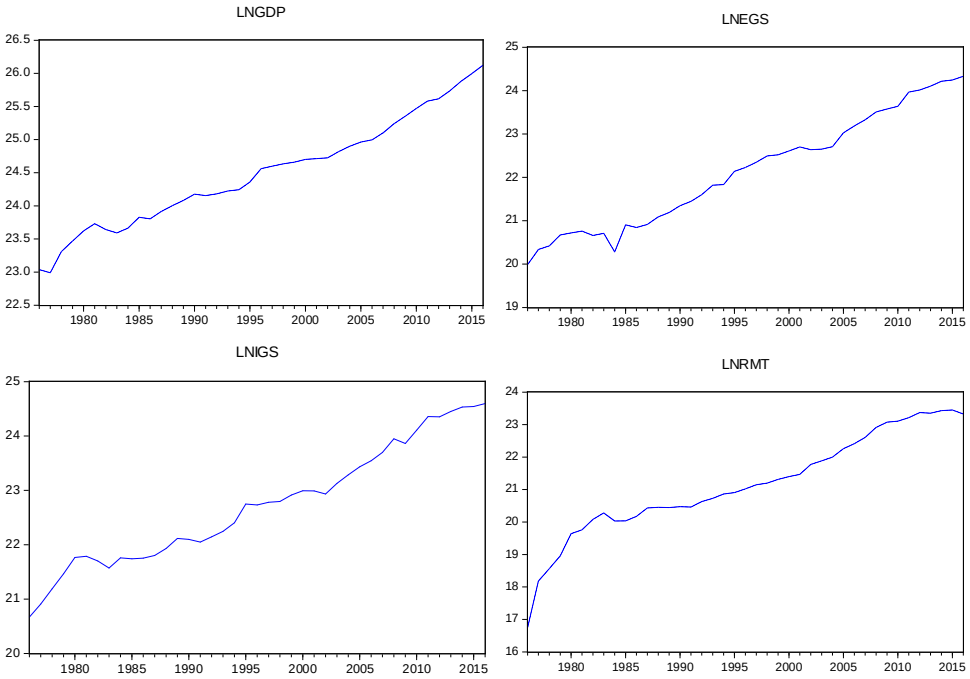

Figure 1: The logarithmic forms of export, import, remittance and GDP

All the data are transformed into logarithmic forms. As shown in Figure1, all variables demonstrate a strong upward trend which indicates long-term association among the variables.

The first step in our methodology is to check whether the used variables are stationary or not. So the unit root test has been performed by using the ADF (Augmented Dicky-Fuller) test and Phillips-Perron (PP) test. If the unit root presents (non-stationary time series data) - stationary is attained by the first differencing of the data. The first differences of logarithms of

original variables express the rate of change of these variables which ease the result of interpretation of the model (Meerza, 2012).

Next step is to check whether variables are co-integrated or not by using Johansen's (1988) co-integration framework. Then using VECM framework, we test Granger Causality test among the variables which ensures the short-run relationship with the direction among the variables.

Finally in the third step, using the OLS (Ordinary Least Square) technique in a double log model (logarithmic of the initial variables) to estimate the long run elasticity of economic growth of Bangladesh to export, import and remittance.

4. Analysis of the Estimated Results

4.1. Unit Root and Stationarity Test

In this study, the ADF test is used to check if the variables are stationary in their levels. Usually, the ADF test depends on the number of lag lengths.[7] Optimal lag lengths are selected using the Akaike's Information Criterion (AIC).[8] As shown in Table 1, the results indicate that at the level all the variables are non-stationary. However, all variables become stationary at their first differences at 1% level of significance. This result is also supported by the Phillips-Perron (PP) test shown in Table 2. Therefore, it is determined that the variables under consideration are integrated of order 1, I(1)(Gujarati, 2009, P.800).

Table 1: Augmented Dicky- Fuller Test

At level

Variables		*Test critical values t-statistic*			*t-statistic*	*Prob.**
		1%	*5%*	*10%*		
X	LNGDP	-3.61	-2.94	-2.61	0.4016	0.9806
	LNEGS				0.3108	0.9760
	LNRMT				-2.4338	0.1409
	LNIGS				-0.8252	0.8009

At First difference

Variables		*Test critical values t-statistics*			*t-statistic*	*Prob.**
		1%	5%	10%		
X(ΔX)	LNGDP	-3.61	-2.94	-2.61	-5.4807	0.000
	LNEGS				-9.1591	0.000
	LMRT				-8.1727	0.000
	LNIGS				-5.1773	0.0001

Table 2: Phillips-Parron Test

At level

Variables		*Test critical value t- statistics*				
		1%	*5%*	*10%*	*Adj-t-statistics*	*Prob**
X	LNGDP	-3.61	-2.94	-2.61	0.3682	0.9790
	LNEGS				-0.2117	0.9287
	LNRMT				-3.2703	0.0231
	LNIGS				-0.8252	0.8009

At first difference

Variables		*Test critical value t-statistics*				
		1%	*5%*	*10%*	*Adj-t-statistics*	*Prob**
X(ΔX)	LNGDP	-3.61	-2.94	-2.61	-5.4807	0.0000
	LNEGS				-9.0412	0.0000
	LNRMT				-8.3638	0.0000
	LNIGS				-5.1079	0.0001

4.2. The Vector Error Correction (VEC) Model

The Vector Error Correction (VEC) model is a unique situation of the VAR (Vector Autoregressive) model for variables that are stationary in their differences, i.e., I (1). Usually VAR model is a well-known framework used to explain the dynamic relationship between stationary variables. Besides we used the VEC model for two reasons:

(i) the time series is not stationary in their levels but stationary in their differences

(ii) the variables are co-integrated which showed in the next section.

In the following paragraphs, the broad contours of this approach are outlined.

$$\Delta LNGDP_t = \alpha_{10} + \alpha_{LNGDP}\hat{e}_{t-1} +$$

$$\sum_{i=1}^{m}\alpha_{11}(i)\Delta LNGDP_{t-i} + \sum_{i=1}^{m}\alpha_{12}(i)\Delta LNRMT_{t-i} + \sum_{i=1}^{m}\alpha_{13}(i)\Delta LNIGS_{t-i} + \sum_{i=1}^{m}\alpha_{14}(i)\Delta LNEGS_{t-i}$$

$$+ \varepsilon_{(LNGDP)t} \ldots\ldots\ldots\ldots\ldots(1)$$

The other three equations in the VEC model system are given below:

$$\Delta LNRMT_t = \alpha_{20} + \alpha_{LNRMT}\hat{e}_{t-1} + \sum_{i=1}^{m}\alpha_{21}(i)\Delta LNGDP_{t-i} + \sum_{i=1}^{m}\alpha_{22}(i)\Delta LNRMT_{t-i} + \sum_{i=1}^{m}\alpha_{23}(i)\Delta LNIGS_{t-i}$$

$$+ \sum_{i=1}^{m}\alpha_{24}(i)\Delta LNEGS_{t-i} + \varepsilon_{(LNRMT)t} \ldots\ldots\ldots\ldots(2)$$

$$\Delta LNIGS_t = \alpha_{30} + \alpha_{LNIGS}\hat{e}_{t-1} + \sum_{i=1}^{m}\alpha_{31}(i)\Delta LNGDP_{t-i} + \sum_{i=1}^{m}\alpha_{32}(i)\Delta LNRMT_{t-i}\sum_{i=1}^{m}\alpha_{33}(i)\Delta LNIGS_{t-i}$$

$$+ \sum_{i=1}^{m}\alpha_{34}(i)\Delta LNEGS_{t-i} + \varepsilon_{(LNIGS)t} \ldots\ldots\ldots\ldots(3)$$

$$\Delta LNEGS_t = \alpha_{40} + \alpha_{LNEGS}\hat{e}_{t-1} + \sum_{i=1}^{m}\alpha_{41}(i)\Delta LNGDP_{t-i} + \sum_{i=1}^{m}\alpha_{42}(i)\Delta LNRMT_{t-i} + \sum_{i=1}^{m}\alpha_{43}(i)\Delta LNIGS_{t-i} + \sum_{i=1}^{m}\alpha_{44}(i)\Delta LNEGS_{t-i} + \varepsilon_{(LNEGS)t} \ldots\ldots\ldots\ldots(4)$$

$\hat{e}_{t-1}$, is the error correction term, α_i is the adjustment coefficient, and ε_{it} is the white-noise disturbance terms. Table 3 shows that a negative and significant coefficient (C_1 = -0.127849 and a *P* value of 0.0006) in VEC model specifies the short-term fluctuations between the independent variables (export, import and remittance) and the dependent variable (GDP) which is likely to predict a stable long run correlation among the variables.

Table 3: Estimated Results of a VEC model

Dependent variable: D (LNGDP)

Method: Least Squares

Included observations: 36 after adjustments

D (LNGDP) = C(1)*D(LNGDP(-1) + 0.345161601881*LNRMT(-1) - 3.68513455556*LNIGS(-1) + 1.93930993587*LNEGS(-1) + 9.04935241027+ C(2)*D(LNGDP(-1)) + C(3)*D(LNGDP(-2)) + C(4)*D(LNGDP(-3)) + C(5)*D(LNGDP(-4)) + C(6)*D(LNRMT(-1)) + C(7)*D(LNRMT(-2))+ C(8)*D(LNRMT(-3)) + C(9)*D(LNRMT(-4)) + C(10)*D(LNIGS(-1)) + C(11)*D(LNIGS(-2)) + C(12)*D(LNIGS(-3)) + C(13)*D(LNIGS(-4)) +C(14)*D(LNEGS(-1))+ C(15)*D(LNEGS(-2)) + C(16)*D(LNEGS(-3)) + C(17)*D(LNEGS(-4)) + C(18)

C	*Coefficient*	*Std. Error*	*t-Statistic*	*Prob.*
C(1)	**-0.127849**	0.030947	-4.131247	**0.0006**
C(2)	0.138286	0.199569	0.692923	0.4972
C(3)	-0.485792	0.192475	-2.523923	0.0212
C(4)	0.004714	0.182717	0.025802	0.9797
C(5)	-0.535065	0.142413	-3.757130	0.0014
C(6)	0.031099	0.079191	0.392705	0.6991
C(7)	0.111175	0.072095	1.542064	0.1405
C(8)	-0.055487	0.080409	-0.690057	0.4990
C(9)	-0.046089	0.054750	-0.841803	0.4109
C(10)	-0.159135	0.113928	-1.396810	0.1795
C(11)	-0.240931	0.121990	-1.975008	0.0638
C(12)	-0.062836	0.113960	-0.551382	0.5882
C(13)	-0.068934	0.098043	-0.703099	0.4910
C(14)	0.122851	0.095704	1.283656	0.2155
C(15)	0.254999	0.113359	2.249476	0.0372
C(16)	0.175942	0.103236	1.704259	0.1055
C(17)	0.162189	0.064394	2.518686	0.0215
C(18)	0.103558	0.023348	4.435431	0.0003
R-squared	0.795673	Mean dependent var		0.069501
Adjusted R squared	0.602698	S.D. dependent var		0.061986
S.E.of regression	0.039071	Akaike info criterion		-3.340029
Sum square resid	0.027478	Schwarz criterion		-2.548269
Log likelihood	78.12052	Hannan-Quinn criter.		-3.063684
F-statistic	4.123189	Durbin-Watson stat.	Prob (F-statistic	2.5125 0.00230

4.3. Co-integration Test

As the variables are integrated of order 1, i.e. I(1), then we can apply the co-integration test on variables whether they are co-integrated or not. Co-integration means that though individually time series variable can be non-stationary but a linear combination between two or more time series can be stationary (Engel and Granger, 1987, p.251). If so, then co-integration of two or more time series suggests that there is a long run relationship among the variables (Engel and Granger, 1987, p.251). We test for the number of co-integrating relationships using the approach proposed by Johansen (1988). The optimal lag length of the level of VECM is determined by using the Akaike's Information Criterion (AIC).[9] The testing hypotheses are the null of no co-integration exists in contrast to the alternative is the presence of co-integration by using the maximum likelihood procedure (Johansen, 1988). Table 4 shows that the number of co-integrating relationships among the variables under consideration.

Table 4: Johansen Co-Integration Test

Hypothesized No. of CE(s)	*Eigen value*	*Trace Statistic*	*0.05 Critical Value*	*Prob.***	*Max-Eigen Statistics*	*0.05 Critical Value*	*Prob.***
None*	0.59617	61.54679	47.85613	0.0016	32.64350	27.58434	0.0102
At most 1	0.40189	28.90328	29.79707	0.0631	18.50378	21.13162	0.1121
At most 2	0.24354	10.39950	15.49471	0.2513	10.04819	14.26460	0.2088
At most 3	0.00971	0.351313	3.841466	0.5534	0.351313	3.841466	0.5534

N.B:*Denotes rejection of the hypothesis at the 0.05 level **MacKinnon-Haug-Michelis (1999) p-values. The Trace test and Max-Eigen value test indicate 1 cointegrating equation(s) at the 0.05 level.

Results of both Trace and Maximum Eigen value tests suggest the variables LNGDP, LNEGS, LNRMT and LNIGS are co-integrated in the series at 5% level of significance. So it indicates a long run relationship among the variables where one co-integrated vector or one error term be included (Gujarati, 2009, p.805). Therefore, it is clear that the economic growth of Bangladesh, export, import and remittances have a long run relationship. The causal relationships among the variables (unidirectional or bi-directional) are explained by using the Granger causality test (Gujarati, 2009) in the next section.

4.4. Granger Causality Test

We used the Vector Error Correction Model (VECM) to determine the Granger causality among the variables. The Granger causality test assumes that the time series data on these variables contain only facts that are related

to the forecast of the respective variables. The testing criteria are to test hypotheses of statistical significance of the specific groups of explanatory variables for each separate function with the F statistics (Wooldridge, 2016, p.658). Granger causality test can be assessed by regressing each variable on its own lagged values and the lagged values of the other variables in the model, which can be implemented as follow:

$$LNGDP_t = \alpha_1 + \sum_{h=1}^{n} \beta_{1h}{}^{n} LNGDP_{t-h} + \sum_{i=1}^{p} \beta_{2i} LNEGS_{t-i} + \sum_{j=1}^{q} \beta_{3j} LNRMT_{t-j} + \sum_{k=1}^{r} \beta_{4k} LNIGS_{t-k} + e_{1t}$$

$$LNEGS_t = \alpha_2 + \sum_{h=1}^{n} \gamma_{1h} LNEGS_{t-h} + \sum_{i=1}^{p} \gamma_{2i} LNGDP_{t-i} + \sum_{j=1}^{q} \gamma_{3j} LNRMT_{t-j} + \sum_{k=1}^{r} \gamma_{4k} LNIGS_{t-k} + e_{2t}$$

$$LNRMT_t = \alpha_3 + \sum_{h=1}^{n} \delta_{1h} LNRMT_{t-h} + \sum_{i=1}^{p} \delta_{2i} LNEGS_{t-i} + \sum_{j=1}^{q} \delta_{3j} LNGDP_{t-j} + \sum_{k=1}^{r} \delta_{4k} LNIGS_{t-k} + e_{3t}$$

$$LNIGS_t = \alpha_4 + \sum_{h=1}^{n} \lambda_{1h} LNIGS_{t-h} + \sum_{i=1}^{p} \lambda_{2i} LNRMT_{t-i} + \sum_{j=1}^{q} \lambda_{3j} LNEGS_{t-j} + \sum_{k=1}^{r} \lambda_{4k} LNGDP_{t-k} + e_{4t}$$

Where n, p, q, r denote the number of lagged variables, e_{it} are error terms that are assumed to be normally distributed and white noise.

Table 5 shows that there is a unidirectional causal relationship between import and GDP with the direction from import to GDP. This finding is also supported by Shirazi and Manap (2005). Besides a unidirectional relationship also appeared between import and export where the direction is from import to export. Consequently, import leads to the GDP growth of Bangladesh. The ready-made garments (RMGs) sector is one of the largest export sectors in Bangladesh. However the country heavily depends on imported capital machinery and equipment and the RMG (ready-made garment) sector is the major importer of industrial raw materials; capital machinery and equipment (Bangladesh Bank, 2016). As a result, the continued increase in import of capital machinery and raw materials added to physical capital stock which in turn enhanced the productive capacity of Bangladesh. Therefore, import has a significant role in the economic growth of Bangladesh in form of technology transfer. Nonetheless, the results do not show reverse causality between GDP growth and import.

Moreover, a bidirectional relationship has been observed between remittance and export. Bangladesh relies heavily on remittances as a form of export income. Usually, Bangladesh meets the demand for semi-skilled and unskilled workers in the Middle East countries (Kuthiala, 1986; Siddique, *et al.* 2012). The remittance was 8.64 percent of GDP and 56.09 percent of total export earnings during the year 2007-08. After one decade it decreased to 5.17 percent of GDP and 49.22 percent of total export earnings in the year 2016-17 (Ministry of Finance, 2017, p.37).

However, the study does not support the claim that remittance and exports are the two major significant contributors to the economic growth of Bangladesh. Hence, remittance does not show any feedback effect on the economic growth of Bangladesh in the short-run (shown in Table 5). The reasons may be that remittances mainly benefit the individual receivers. Apart from that overseas workers mainly come from rural areas. Most of them or their family members expense their overseas income on buying luxurious commodities like smartphones, TV, house, agricultural land as well as on marriage, dowry etc. To a great extent, remittances result in an increase in consumption, per capita income of individual receivers which reduce poverty and inequality in the society - an argument also supported by Matin (1994); Barai (2012). It might happen that remittances have not been invested in the productive sector; thus it does not have any direct

Table 5: Granger Causality Test

Null Hypothesis	*Alternative Hypothesis*	*F-Statistics*	*Prob.*	*Remarks*
Export does not Granger Causes GDP	Export Granger Causes GDP	2.2485	0.0892	Do not reject Null Hypothesis
	GDP Granger Causes Export	2.3206	0.0815	
GDP does not Granger Causes Export				
Remittance does not Granger Causes GDP	Remittance Granger Causes GDP	0.6967	0.6006	Do not reject Null Hypothesis
	GDP Grange Causes	1.8418	0.1488	
GDP does not Granger Causes Remittances.	Remittances			
Import of goods & services does not Granger Causes GDP	Import Granger Causes GDP	3.2319	0.0267	Import→GDP
	GDP Granger Causes			
GDP does not Granger Causes Import of goods & services.	Import.	0.3447	0.8454	
Export does not Granger Causes Remittance	Export Granger Causes Remittance	3.0050	0.0351	Export→ Remittance
Remittance does not Granger Causes Exports.	Remittance Granger Causes Exports.	3.1491	0.0295	Remittance→ Export
Import does not Granger Causes Remittance.	Import Granger Causes Remittance.	0.9599	0.4447	Do not reject Null Hypothesis
Remittance does not Granger Causes Import	remittance Granger causes Import	1.7162	0.1744	
Export does not Granger Causes Import	Export Granger Causes Import	1.5833	0.2062	
Import does not Granger Causes export	Import Granger Causes export	3.0675	0.0325	Import→Export

impact on GDP growth. These arguments are also supported by Carrasco and Ro (2007); Ahmed (2010). Moreover, there is no evidence of short-term causality in either direction between exports and economic growth.

4.5. Long-Run Relationships

Table 6 presents the results from the Ordinary Least Squares (OLS) estimation which shows the relationship between GDP growth, exports, imports and remittances. It appears from these results that the GDP growth variable and other variables are positively correlated over the time of 1976 to 2016. Here, the elasticity estimates of exports, imports, remittances and economic growth of Bangladesh are as follows:

$$LNGDP = 8.8873 + 0.0476\ LNRMT + 0.4744\ LNIGS + 0.1724\ LNEGS \quad (5)$$

Therefore, equation (5) indicates that in the long run, all the independent variables have a positive impact on LNGDP. The impacts of LNIGS and LNEGS are significant (t= 3.62 and 2.07 respectively) and their corresponding elasticity estimates are 0.4744 and 0.1724 respectively. It implies that if LNEGS and LNIGS go up by 1 percent, LNGDP go up by 0.1725% and 0.4744% respectively. However, the long run impact of the variable remittance is not statistically significant. Therefore, the study concludes that there is a long-term one-way causality among exports, imports, and economic growth of Bangladesh.

Table 6: Long Run Relationships

Dependent Variable: LNGDP
Method: Least Squares
Sample: 1976 2016
Included observations: 41

Variable	*Coefficient*	*Std. Error*	*t-Statistic*	*Prob.*
C	8.887342	0.762047	11.66246	0.0000
LNRMT	0.047652	0.043612	1.092618	0.2816
LNIGS	0.474429	0.130803	3.627034	0.0009
LNEGS	0.172497	0.083272	2.071487	0.0453
R-squared	0.98679	Mean dependent var		24.49738
Adjusted R-squared	0.985719	S.D. dependent var		0.820248
S.E. of regression	0.098023	Akaike info criterion		-1.714755
Sum squared resid	0.355517	Schwarz criterion		-1.547577
Log likelihood	39.15248	Hannan-Quinn criter.		-1.653878
F-statistic	921.2882	Durbin-Watson stat Prob (F-statistic)		0.733372 0.0000

4.6. Diagnostic Test Results

4.6.1. Testing for Normality

One of the key assumptions of the classical linear regression model is that the residuals are normally distributed (Gujarati, 2009,p.106). The hypothesis tests, the coefficients obtained by OLS. Jarque-Bera (JB) test is used in the study to detect whether the residuals are normally distributed or not. Fig 2 presents the computed p-value of the JB statistic is reasonably high, so we cannot reject the null hypothesis that residuals are normally distributed (Gujarati, 2009, p.177).

4.6.2. Testing for Serial Correlation

Serial correlation is a statistical term used to describe the situation whether the residuals are correlated or not. Serial correlation can occur due to incorrect model specification for example omitted variables, use of incorrect functional form and incorrect transformation of data (Gujarati, 2009, p.439-441). To test the autocorrelation in the residual, we used the Breusch-Godfrey (BG) serial correlation LM test. Using the BG serial correlation test, the decision is that if the p-value of the Obs*R-squared is greater than the 0.05; so the null hypothesis accepted that there is no serial correlation between residuals. The results of the BG serial correlation test are presented in table 6 (Appendix).

Therefore, the diagnostic test proved that the model is correctly specified because Breusch-Godfrey (BG) serial correlation LM test suggest that no problem of serial correlation in the model. The Jarqua-Bera (JB) test also ensures that normality of errors.

5. Conclusion

Despite the variables depicting an increasing trend, the time series analysis of this study indicates that exports, imports and remittances do not cause economic growth (GDP) in the short run but they have long run impacts. Furthermore, causality is unidirectional. However, the causal nexus between exports and remittance is bidirectional in the short run. Besides, imports cause GDP growth in the short run but this effect is unidirectional. This study investigates the long run nexus using the elasticity concept. This result is hardly surprising as the contribution of remittance to GDP growth in Bangladesh is not reflected in either the short run or the long run. On other hand, after the independence in 1971, Bangladesh has mounted on the import-substituting model to achieve economic advancement and the reforms the external sectors which are ongoing yet. Albeit exports as the part of GDP have doubled since 1990 but in the study,

the impact of exports to GDP is not observed in the short run while the reverse causality is seen between imports and exports. The study, however, suggests that there is a long term relationship among the variables and yet the direction of the long run causality is unidirectional.

Notes

1. https://data.worldbank.org/country/bangladesh
2. https://www.indexmundi.com/facts/bangladesh/exports-of-goods-and-services
3. https://data.worldbank.org/country/bangladesh
4. https://data.worldbank.org/country/bangladesh
5. https://www.indexmundi.com/facts/bangladesh/workers'-remittances-and-compensation-of-employees
6. https://data.worldbank.org/country/bangladesh
7. Generally, the lag length is dictated by the frequency of the data (as well as sample size), e.g. for annual data 1or two lags usually suffice(Wooldridge 2015, p.642).
8. 9 maximum lag lengths are selected in the ADF test.
9. To run the Johansen co-integration test, we have chosen 4 lag length out of 6 in Akaike Information Criterion (AIC).

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Appendix

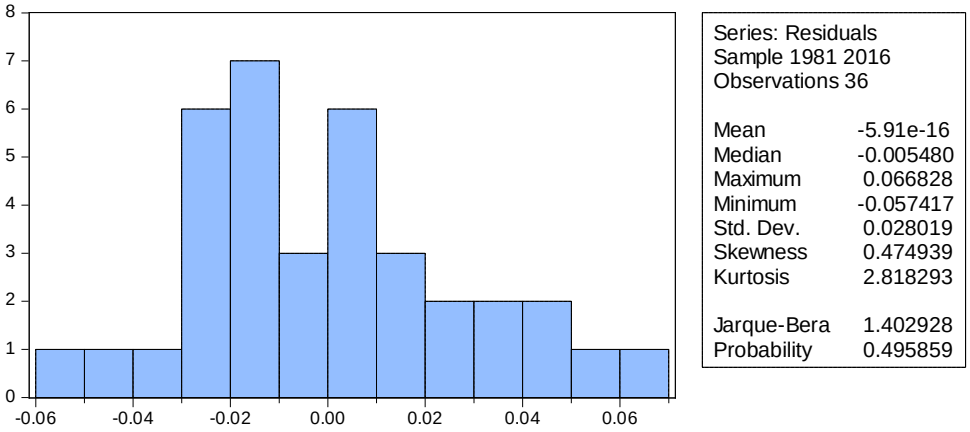

Figure 2: Normality Test

Table 7: Breusch-Godfrey Serial Correlation LM Test

F-statistcs	*0.954191*	*Prob. F(4, 14)*	*0.4623*
Obs*R-squared	7.712035	Prob. Chi-Squared (4)	0.1027