

# Relationship between Export Revenue and Gross Domestic Product in Bangladesh: An Econometric Analysis

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## ABSTRACT

Export revenue is an important issue for Bangladesh. So analysis the relationship between export revenue and gross domestic product (GDP) is very crucial for the policy makers to develop our domestic economy as well as to create a good economic relationship with the global economy. The main object of this article is to investigate the relationship between export revenue and GDP in Bangladesh. To test stationary correlogram test is used. In this study, I used Granger causality and cointegration test to test the long-run relationship between GDP and export revenue in Bangladesh from 1981-2015. I found the maximum lag length for the model by using vector autoregressive (VAR) lag order selection criteria. In the model GDP was dependent variable and three variables (Remittance, Foreign direct investment, Export revenue) were the independent variables. In correlogram test, I have seen all of my variables were non-stationary at level, but after taking first difference, they became stationary. According to Granger causality test, there was bidirectional causality from export revenue to GDP in Bangladesh. Johansen cointegration test investigated that there was a long-run equilibrium relationship between export revenue and GDP but by using vector error correction model (VECM) I have seen there is no statistically significant long-run relationship between export revenue and GDP. Wald test indicated a statistically significant short-run relationship between the two variables.

**Key words:** Export revenue, GDP, VAR, Cointegration, Vector Error Correction Model (VECM)

## INTRODUCTION

Bangladesh is a developing country. Export can play a potential role for development of Bangladesh. Economic growth is directly related to export. Exports are component of aggregate demand (AD) and rising export will help increase AD and cause higher economic growth. For Bangladesh export can play a significant role to build up physical capital, reduce unemployment problem, develop productive capacity and help integrate the domestic economy. Readymade garments (RMG) sector is the main source of our export revenue. 75% of our export revenue comes from this sector. An estimated 4.2million people are employed in this sector and most the employers are women, half of whom come from villages. By 2013 there were approximately 5000 factories, part of Bangladesh's US\$19 billion a year export-oriented RMG industry has revolutionized the country in terms of its contribution to GDP growth. Bangladesh exports goods and services to UK, USA, Canada, Japan, Australia, New-Zealand and Russia etc. Markets are also opening in the Middle East, Latin America and Africa.

## LITERATURE REVIEW

Saaed and Hussain (2015) found that there is unidirectional causality between exports and economic growth in Tunisia. These results provide that growth in Tunisia was propelled by a growth-led import strategy as well as export-led import and imports are the main source of economic growth of Tunisia. Quddus and Saeed (2005) examined if export and GDP are cointegrated by the using Johansen approach; whether export Granger cause GDP growth; whether Granger cause investment. A positive Granger causal relationship running from export to economic growth is suggested by the test results for the long-run period. Hussain (2014) found that there is Granger causality relationship between exports and economic growth in Pakistan. The relationship between exports and economic growth has long been a subject of great interest in the development literature. Javed *et al.* (2012) proved that export has a positive and significant impact on the economy of Pakistan and the results showed that international trade is an important factor for Pakistani economy. Akter (2015) revealed that the impact



of export on economic growth is positive but it is negative for import. Ahmed and Uddin (2009) examined that time series analysis indicate exports, imports and remittances cause GDP growth in the short-run but has no long-run impact. The causal nexus unidirectional long-run GDP growth causes short run income growth but this affect is once again unidirectional. By using Johansen’s multivariate frame work they found real GDP, real exports, real imports and real remittances were cointegrated for long-run. Sri Lankan economists Thirunavukkarasu and Achchuthan investigated that export and import have positive and significant relationship for each other and they (export, import) also have significant impact on GDP. Ismail *etal.* (2010) examined a long-run relationship between export and GDP by using Johansen’s cointegration test and error correction model was applied to streamline of the variables on economic growth. Rai and Jhala (2015) found a positive relationship between growth rate and exports. Zaheer *etal.* (2014) indicated that exports and imports have significant relationship economic growth rate. They also suggested that government should move towards more exchange rate liberalization policy for increasing economic growth. In this paper, I want to investigate the relationship between export revenue and GDP in Bangladesh using the time series analysis with different kinds of econometric models.

**METHODOLOGY**

We know causality is the foundation of any study to examine an economic relationship. So I started the empirical analysis with Granger causality test to examine if export revenue Granger causes GDP and / or inversely GDP Granger causes export revenue. Correlogram test is used for testing the time series data are stationary or not. For optimal lag length selection, I used Vector Autoregressive (VAR), model. To test the long-run relationship between GDP and export revenue Johansen cointegration test is run. Vector error correction model has used whether the variables have a long-run significant relationship or not. All of the econometric tests are done by Eviews-7 and SPSS-20.

**DATA SOURCES**

Time series data are used for the model over the 1981-2015 periods in Bangladesh, which are collected from various primary sources. Data on GDP is taken from World Bank. Data on remittances and export revenue are collected from Bangladesh Economic Review, and data on foreign direct investment (FDI) is taken from Bangladesh Bureau of Statistics.

**MODEL SPECIFICATION**

To examine the relationship between export revenue and GDP, I have specified following the econometric model where GDP is dependent variable and remittance, FDI and export revenue are independent variables. The model is stated as follows:

$$GDP = f(Remittance, FDI, Export\ revenue)$$

$$GDP_t = \alpha + \beta Rem_t + \delta FDI_t + \sigma Exr_t + U_t$$

Where, GDP = Gross Domestic Product, Rem = Remittances, FDI = Foreign Direct Investment, Exr = Export revenue. All the variables are counted in Million \$US,  $\alpha, \beta, \delta, \sigma$  = parameters to be estimate, U = Stochastic term, and t = 1, 2, 3, …, 35 (time period from 1981-2015).

**RESULTS AND DISCUSSION**

**Correlogram Test**

Correlogram test is used to check the variables are stationary or not. The results have shown that all the variables are non-stationary at level. But when these variables are tested at first difference, then the null hypothesis is accepted, and the alternative hypothesis is rejected. Because all variables’ p-values > 0.05 (5%). That means all variables are stationary at first difference and their integrated order is one or I (1).

**Optimal Lag Length Selection**

After the correlogram test, I got the maximum lag length by running vector autoregressive (VAR) lag order selection. From table 1 the maximum lag length is 3, and it is chosen on different criterions’ minimum value. All criteria are asking to take 3lag. So my optimum lag would be 3, and I will use it in Johansen cointegration test and vector error correction model.

Table 1: VAR Lag Order Selection Criteria

Endogenous variables: GDP REM FDI EXR  
 Exogenous variables: C; Date: 01/05/17 Time: 7:37  
 Sample: 1 35; included observations: 32

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-1159.305	NA	4.43e+26	72.70658	72.88979	72.76731
1	-1049.686	184.9827	1.29e+24	66.85537	67.77145	67.15902
2	-1017.410	46.39651	4.90e+23	65.83813	67.48708	66.38471
3	-948.0863	82.32190*	2.01e+22*	62.50539*	64.88721*	63.29490*

\* 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

**Granger causality test**

First I used Granger causality test to examine the relationship between GDP and export revenue for Bangladesh from 1981 to 2015. It is a technique to consider both lagged and endogenous relationship. The results of causality between GDP, Rem, FDI, and Exr are contained in table 2. The results show a bidirectional relationship between GDP and Export revenue in Bangladesh. The results of the test are given in the table 2.

Table 2: Pair wise Granger Causality Tests

Date: 01/05/17 Time: 11:58

Sample: 1 35; Lags: 3

Null Hypothesis:	Obs	F-Statistic	Prob.
D(REM) does not Granger Cause D(GDP)	31	1.30757	0.2949
D(GDP) does not Granger Cause D(REM)		15.5761	8.E-06
D(FDI) does not Granger Cause D(GDP)	31	1.59136	0.2175
D(GDP) does not Granger Cause D(FDI)		8.83668	0.0004
D(EXR) does not Granger Cause D(GDP)	31	38.1572	3.E-09
D(GDP) does not Granger Cause D(EXR)		26.6660	8.E-08
D(FDI) does not Granger Cause D(REM)	31	4.22304	0.0156
D(REM) does not Granger Cause D(FDI)		5.44588	0.0053
D(EXR) does not Granger Cause D(REM)	31	9.77387	0.0002
D(REM) does not Granger Cause D(EXR)		6.24278	0.0028
D(EXR) does not Granger Cause D(FDI)	31	5.64386	0.0045
D(FDI) does not Granger Cause D(EXR)		19.8485	1.E-06

**Johansen Test of Cointegration**

The precondition for Johansen cointegration test is, the variables must be non-stationary at level but when we convert all the variables into the first difference, and then they will become stationary. Only then we can run the Johansen cointegration test. Here all of my variables are stationary at first difference, and we can run the cointegration test. Table 3 shows the presence of cointegration for the variables adopted in this study, where it is statistically valid. This implies that there is a long-run relationship amongst GDP, remittance, FDI and export revenue. Max Eigenvalue test indicates 1 cointegrating equation at the 0.05 level. Trace indicates 1 cointegrating equation at the 0.05 level. \* denotes rejection of the hypothesis at the 0.05 level. The results of the Trace tests indicate the presence that the two variables are cointegrated vectors.

Table 3: Unrestricted Cointegration Rank Test (Trace)

Date: 12/30/16 Time: 04:56

Sample (adjusted): 5 35

Included observations: 31 after adjustments

Trend assumption: Linear deterministic trend

Series: GDP REM FDI EXR

Lags interval (in first differences): 1 to 3

Hypothesized		Trace	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.953238	118.9662	47.85613	0.0000
At most 1	0.433196	24.02277	29.79707	0.1995
At most 2	0.153862	6.422759	15.49471	0.6455
At most 3	0.039319	1.243513	3.841466	0.2648
<i>Trace test indicates 1 cointegrating eqn(s) at the 0.05 level</i>				
<i>* denotes rejection of the hypothesis at the 0.05 level</i>				
<i>**MacKinnon-Haug-Michelis (1999) p-values</i>				
<b>Unrestricted Cointegration Rank Test (Maximum Eigenvalue)</b>				
Hypothesized		Max-Eigen	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**

None *	0.953238	94.94344	27.58434	0.0000
At most 1	0.433196	17.60001	21.13162	0.1455
At most 2	0.153862	5.179246	14.26460	0.7190
At most 3	0.039319	1.243513	3.841466	0.2648
<i>Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.05 level</i>				
<i>* denotes rejection of the hypothesis at the 0.05 level</i>				
<i>**MacKinnon-Haug-Michelis (1999) p-values</i>				

**Vector Error Correction Model**

Since four variables are cointegrated, I can run VECM model. In the previous test, I have seen that the variables are cointegrated and there is a long-run relationship among the variables. So, in this case, I can run VECM. In this paper I used a multivariate framework, which is given below:

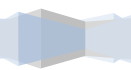
$$\Delta GDP_t = \alpha_{10} + \alpha_{GDP} \hat{e}_{t-1} + \sum_{i=1}^m \alpha_{11}(i) \Delta GDP_{t-i} + \sum_{i=1}^m \alpha_{12}(i) \Delta Rem_{t-i} + \sum_{i=1}^m \alpha_{13}(i) \Delta FDI_{t-i} + \sum_{i=1}^m \alpha_{14}(i) \Delta Exr_{t-i} + \epsilon_{(GDP)t} \dots\dots\dots(1)$$

Table 4: Dependent Variable: D(GDP)

Method: Least Squares				
Date: 12/30/16 Time: 04:59				
Sample (adjusted): 5 35				
Included observations: 31 after adjustments				
D(GDP) = C(1)*( GDP(-1) - 26.5640629593*REM(-1) + 229.12319484*FDI(-1) - 4.70907382612*EXR(-1) + 2237.39742401 ) + C(2)*D(GDP(-1)) + C(3)*D(GDP(-2)) + C(4)*D(GDP(-3)) + C(5)*D(REM(-1)) + C(6)*D(REM(-2)) + C(7)*D(REM(-3)) + C(8)*D(FDI(-1)) + C(9)*D(FDI(-2)) + C(10)*D(FDI(-3)) + C(11)*D(EXR(-1)) + C(12)*D(EXR(-2)) + C(13)*D(EXR(-3)) + C(14)				
	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-0.022020	0.116494	-0.189026	0.8523
C(2)	0.144955	0.194823	0.744033	0.4670
C(3)	0.067075	0.226821	0.295719	0.7710
C(4)	0.046506	0.588714	0.078996	0.9380
C(5)	-4.582433	4.269568	-1.073278	0.2981
C(6)	-4.023298	4.945088	-0.813595	0.4271
C(7)	-0.416980	4.623882	-0.090180	0.9292
C(8)	0.746194	24.52954	0.030420	0.9761
C(9)	0.862665	16.92070	0.050983	0.9599
C(10)	-15.02848	17.49347	-0.859091	0.4022
C(11)	1.408499	2.245559	0.627238	0.5388
C(12)	-0.400249	1.750651	-0.228629	0.8219
C(13)	10.42977	2.043848	5.103004	0.0001
C(14)	-660.5104	1303.875	-0.506575	0.6190
R-squared	0.938037	Mean dependent var	5536.903	
Adjusted R-squared	0.890654	S.D. dependent var	11442.86	
S.E. of regression	3783.867	Akaike info criterion	19.61733	
Sum squared resid	2.43E+08	Schwarz criterion	20.26494	
Log likelihood	-290.0687	Hannan-Quinn criter.	19.82844	
F-statistic	19.79682	Durbin-Watson stat	1.946862	
Prob(F-statistic)	0.000000			

The other three equations in the ECM model system are:

$$\Delta Rem_t = \alpha_{20} + \alpha_{Rem} \hat{e}_{t-1} + \sum_{i=1}^m \alpha_{21}(i) \Delta GDP_{t-i} + \sum_{i=1}^m \alpha_{22}(i) \Delta Rem_{t-i} + \sum_{i=1}^m \alpha_{23}(i) \Delta FDI_{t-i} + \sum_{i=1}^m \alpha_{24}(i) \Delta Exr_{t-i} + \epsilon_{(Rem)t} \dots\dots\dots(2)$$



$$\Delta FDI_t = \alpha_{30} + \alpha_{FDI} \hat{\epsilon}_{t-1} + \sum_{i=1}^m \alpha_{31}(i) \Delta GDP_{t-i} + \sum_{i=1}^m \alpha_{32}(i) \Delta Rem_{t-i} + \sum_{i=1}^m \alpha_{33}(i) \Delta FDI_{t-i} + \sum_{i=1}^m \alpha_{34}(i) \Delta Exr_{t-i} + \epsilon_{(FDI)t} \dots \dots \dots (3)$$

$$\Delta Exr_t = \alpha_{40} + \alpha_{Exr} \hat{\epsilon}_{t-1} + \sum_{i=1}^m \alpha_{41}(i) \Delta GDP_{t-i} + \sum_{i=1}^m \alpha_{42}(i) \Delta Rem_{t-i} + \sum_{i=1}^m \alpha_{43}(i) \Delta FDI_{t-i} + \sum_{i=1}^m \alpha_{44}(i) \Delta Exr_{t-i} + \epsilon_{(Exr)t} \dots \dots \dots (4)$$

$\hat{\epsilon}_{t-1}$  Is the error- correction term,  $\alpha_i$  is the adjustment coefficient, and  $\epsilon_{it}$  is the white-noise disturbance terms.

If the variables have long-run relationship, the coefficient of  $\alpha_i$  must be statistically significant. In table 4 C (1) is the speed of adjustment towards long- run equilibrium but it must be significant, and the sign must be negative. From our results (Table-4) we can see that C (1) is negative (-0.0220220) but the p-value, (0.8523) > 0.05. So, there is no long-run significant causality from the three independent variables (Rem, FDI, Exr). Meaning that Rem, FDI, and Exr have no statistically significant influence on the dependent variable GDP in the long- run. In other words, there is no statistically significant long-run causality running from Rem, FDI, and Exr to GDP. The results are given in the table 4 above.

**Wald test**

I used Wald Statistics to check the short run causality. Here, the null hypothesis Ho: C (11)=C(12)=C(13)=0 ( There is no short-run causality from export revenue to GDP). According to test results (Table-5), we can reject the Null hypothesis, because of our p-value (0.000) < 0.05. So there is short-run causality from export revenue to GDP. The results of the test are given below:

Table 5: Wald Test

Equation: Untitled			
Test Statistic	Value	df	Probability
F-statistic	13.11311	(3, 17)	0.0001
Chi-square	39.33934	3	0.0000
Null Hypothesis: C(11)=C(12)=C(13)=0			
Null Hypothesis Summary:			
Normalized Restriction (= 0)	Value	Std. Err.	
C(11)	1.408499	2.245559	
C(12)	-0.400249	1.750651	
C(13)	10.42977	2.043848	
Restrictions are linear in coefficients.			

**FINDINGS AND CONCLUSION**

The main objective of this study was to investigate the relationship between export revenue and GDP in Bangladesh. We know export revenue is an important factor for economic progress and GDP is a good criterion for measuring this progress. From Granger causality test I have seen, there is a bidirectional relationship between GDP and export revenue, which means that export revenue is the source of GDP in Bangladesh. In Johansen

cointegration test there was a long-run relationship between GDP and export revenue. But in VECM there is no long-run significant relationship between the variables and the short-run relationship was checked by Wald test. It means that export should be limited. For attracting our goods and services to foreign countries, we should make the variation in goods and services and ensure the quality of goods and services. We should innovate new technology and create high skill labor force. Since Bangladesh exports a lot of garment products every year hence products quality must be outstanding. The government needs to support the garments industry by giving loan so that they can invest a lot.

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