

Global Financial Crisis in the Late 2000s and  
Exports, Imports and Economic Growth in  
Bangladesh:  
A Granger Causality Analysis

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**Abstract**

*The financial crisis of the late 2000s, originated in the USA, affected the economy of many countries in the world. The paper assesses the impact of the crisis on the foreign trade and economic growth in Bangladesh applying the cointegration and vector error correction modelling approach. We apply the techniques to evaluate the relationship among export, import and economic growth for the pre-crisis period 1972-2001. Results show that export, import and economic growth are cointegrated in the long-run, although there is short-run instability in them for both periods. Results also imply that export-and import-led growth hypothesis and growth- and export-led import hypothesis are valid for the period covering the financial crisis of the late 2000s; and GDP- and import-led export hypothesis and GDP-and export-led import hypothesis are valid for the pre-crisis period.*

**Keywords:** *Global Financial Crisis, Foreign Trade and Economic Growth, Cointegration and Vector Error Correction, Granger Causality, Bangladesh*

**1. Introduction**

Since the Great Depression of the 1930s, the late-2000s financial crisis (often called the global recession, global financial crisis or the credit crunch) is considered to be the worst financial crisis by many economists. This resulted in the collapse of large financial institutions and downturns in stock markets around the world. It has been argued that the financial system melted down in America

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for adopting relaxed rules of providing loans to jobless people with no income for buying houses. These are called “sub-prime housing loans” or now known as “toxic loans or assets” amounting to about \$2.1 trillion dollars.

The packages of the securities on property were sold to banks and financial institutions worldwide. When borrowers failed to make payment for the loan, the banks and financial institutions could not recoup the loan-money because either the price was too low or because there was no buyer of the property. The owners of the houses had left and the banks could not sell the property. The towns in which houses are located in the US are reportedly called “ghost- towns”.

Banks and financial institutions that bought security-paper have lost money. The money market works well if lending and borrowing money by banks and financial institutions remain normal. During the crisis, money markets ceased to function as investors and banks who ordinarily arrange for a set time period are nervous about the risk that their counter-party will go bust because of liability of “toxic assets” while the swap is being put into place and so have shied away from such deals. Thus the global money market was closed, a severe credit-crunch was felt, and financial crisis occurred across the world. If it were allowed to continue further, it would have led to depression.

A complex interplay of valuation and liquidity problems in the United States banking system in 2008 triggered the financial crisis. The bursting of the U.S. housing bubble caused the values of securities tied to U.S. real estate pricing to plummet, and damaged financial institutions globally. Therefore, bank solvency, declines in credit availability, and damaged investor confidence had an impact on global stock markets, where securities suffered large losses during 2008 and early 2009. Economies worldwide slowed during this period through various economic channels, as credit tightened and international trade declined. Governments and central banks responded with unprecedented fiscal stimulus, monetary policy expansion and institutional bailouts. Although there have been aftershocks, the financial crisis visibly ended between late-2008 and mid-2009.

The economy of Bangladesh is likely to be affected through trade channel as it is integrated with the world economy in terms of foreign trade. If the recession persists, export growth may slow down and sluggish import growth may affect balance of payments. Exact magnitude of change and the impact on the economy depends on how long the recession sustains and the interplay of negative and positive factors emanated from the recent change in global economy. Bangladesh’s export earnings have risen rapidly since the early 1990s. Exports have grown from around 7 percent of GDP in 1991 to around 18 percent in 2006.

The GDP growth rate has been consistently over 6 percent over the last few years despite a number of weather related shocks emanating from cyclones and floods. The export sector is vulnerable to the global financial crisis as it heavily depends on the EU and US markets, which have been badly hit. Almost 90% of our export is targeted to US, EU and other developed countries, and hence depressed demand will have negative implication for prospect of our export growth. Floating exchange rate regime makes the economy exposed to exchange rate risk with the global crisis.

Bangladesh's imports as a share of GDP have been rising steadily over the past three decades. A large portion - about 27 percent of GDP - was spent on import payments in 2007-08. Around 76 percent of export earnings originate in the RMG sector, of which 54 percent goes into imports of inputs needed for the RMG industry. Given the importance of imports for Bangladesh's economic growth and development, it is important to assess the likely impact of the world recession on the volume of imports, and the terms of trade. Import based revenues also comprise of a significant part of the national budget and could be a cause of concern.

The aim of this paper is to assess the impact of financial crisis of the late 2000s on the short- and long-run relationship among exports, imports and economic growth in Bangladesh applying cointegration and vector error correction modeling approach, which subsequently assesses Granger causality. We use the data of exports, imports and GDP for the period 1972 – 2010. Economic growth is proxied by real gross domestic product. We apply the approach to the dataset for the whole period 1972-2010, which includes the financial crisis, and apply to the dataset, 1972-2007, which has not been affected by the financial crisis, and hence assess the impact of the financial crisis of the late 2000s.

## **2. Exports, Imports and Economic Growth in Bangladesh**

We present the trend of the export, import and GDP in Table 1 and Figure 1. The increase in GDP, export and import has been consistent. This could be due to deft economic management that helped absorb the pressure of the global food and oil price crisis of the 2008 without jeopardizing macroeconomic stability. But the increase in export and import in 2008 and 2009 was a little slower than previous years.

## **3. Econometric Framework**

An econometric model can be formulated to test the long-run relationship and Granger causality among the variables. Most of the macroeconomic time series are characterized by random walk so that their first differences are stationary

Table 1 : Export, Import and GDP of Bangladesh (Million US dollars)

Year	Export	Import	GDP	Year	Export	Import	GDP
1972	356.84	863.54	23,788.67	1992	2,405.65	3,915.20	57,942.34
1973	527.54	956.37	24,555.45	1993	2,990.71	4,677.91	61,393.08
1974	461.13	1,289.35	25,598.70	1994	3,039.70	4,681.80	65,463.04
1975	561.53	1,571.17	26,554.12	1995	4,122.01	6,580.60	69,670.90
1976	478.56	1,778.29	27,127.47	1996	4,507.55	7,601.78	73,983.83
1977	678.20	1,192.64	27,836.14	1997	5,075.48	7,625.08	78,231.36
1978	739.13	2,058.85	29,489.97	1998	5,876.85	8,058.88	82,795.99
1979	952.18	2,462.25	30,474.74	1999	6,028.72	8,525.94	86,827.52
1980	995.27	3,239.43	32,010.41	2000	6,588.07	9,060.86	91,988.98
1981	1,041.53	2,865.52	33,474.68	2001	7,227.58	10,102.56	96,840.50
1982	942.10	2,883.05	34,842.02	2002	6,791.24	9,060.89	101,116.40
1983	985.13	2,586.47	36,558.01	2003	7,378.91	10,401.05	106,431.07
1984	645.18	2,548.51	38,247.71	2004	8,747.04	11,772.23	113,104.84
1985	1,199.58	2,860.04	40,308.33	2005	9,994.81	13,891.43	119,840.77
1986	1,132.31	2,585.75	42,415.46	2006	11,744.91	15,626.73	127,785.42
1987	1,228.33	2,879.48	44,480.76	2007	13,530.31	18,268.58	135,999.27
1988	1,442.79	3,255.87	47,124.93	2008	16,181.04	22,873.05	144,418.21
1989	1,541.72	3,557.83	49,610.30	2009	17,360.48	23,727.17	152,709.49
1990	1,844.50	4,076.61	51,800.80	2010	18,546.46	24,944.62	161,619.75
1991	2,062.58	3,785.24	54,523.45				

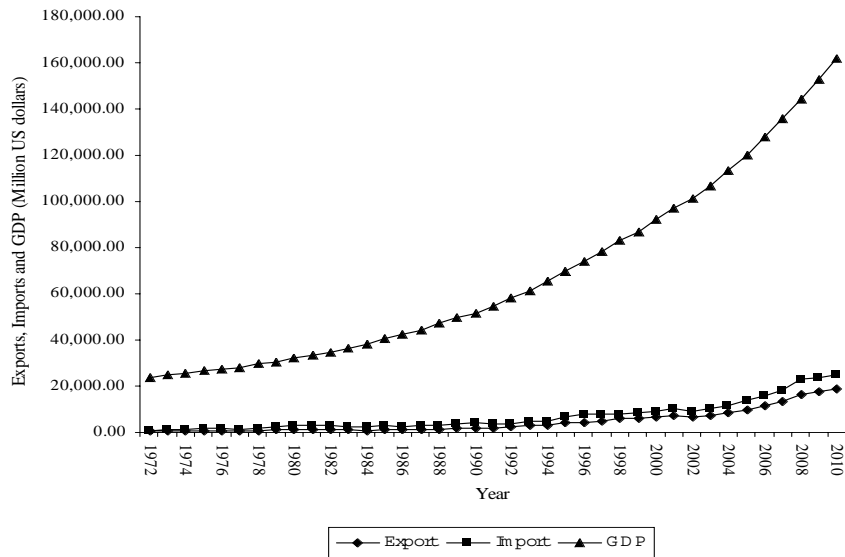


Figure 1: Exports, Imports and GDP in Bangladesh (Million US dollar)

(Engle and Granger, 1987; Nelson and Plosser, 1982). If statistical tests, like cointegration, establish co-movement in these time series, the residuals from the regression can be used as error correction terms in the dynamic first-difference equation (Ahmed and Harnhirun, 1995). Therefore, for two integrated  $I(1)$  and cointegrated time series there must exist Granger causality in at least one direction in the  $I(0)$  variables (Engle and Granger, 1987) and hence a VAR model can be prepared with an error correction term for cointegrated  $I(1)$  time series to capture the short-run dynamics and to decrease the chance of observing 'spurious regression' in terms of the levels of data or their first differences. After checking the stationary and cointegration properties of the variables we shall test the Granger causality with vector error-correction model (VECM) among export, import and economic growth (in terms of GDP growth) of Bangladesh. Therefore, our analysis consists of the unit root, cointegration and VECM. These are briefly described as follows.

### 3.1. Unit Root Test

The first step of our methodology is to test the order of integration, i.e., the stationarity, of the levels of export (Ex), import (M) and GDP. Augmented Dickey-Fuller' (ADF) test is widely used in practical applications to test stationarity allowing the chance of autocorrelation (Dickey and Fuller, 1981).

$$\Delta Y_t = \alpha + \beta t + \delta Y_{t-1} + \theta_i \sum_{i=1}^n \Delta Y_{t-i} + \varepsilon_t$$

Augmented Dickey-Fuller test requires the following regression as:

where  $\varepsilon_t$  are assumed to be identically, independently distributed random variable. This ADF test statistic checks the null hypothesis that the time series has a unit root, i.e.,  $\rho = 1$ , under the alternative hypothesis of stationary time series.

### 3.2. Multivariate Cointegration Approach

The second step is to test for cointegration applying Johansen's maximum likelihood estimation approach (Johansen, 1988 and 1991; Johansen and Juselius,

$$\Delta y_t = \beta_{0y} + \beta_{1y} t - \Pi_y x_{t-1} + \sum_{i=1}^{p-1} \Gamma_{iy} \Delta x_{t-i} + \Phi_y w_t + \varepsilon_t$$

1990, 1992 and 1994). Johansen's test for multivariate

cointegration approach is based on the following econometric model of the VAR process:

$\Gamma_{y1}, \Gamma_{12}, \dots, \Gamma_{(p-1)y}$  are  $m_y \times m$  coefficient matrices capturing the short-run dynamic effects and  $\theta$  is the  $m_y \times q$  matrix of coefficients on the  $I(0)$  exogenous variables. Engle-Granger test, augmented Engle-Granger test (Engle and Granger, 1987) and Cointegrating Regression Durbin-Watson (CRDW) test (Sargan and Bhargava, 1983) can also be applied for testing the order of integration of the cointegrating regression error term. If cointegration is established, then Granger causality, either unidirectional or bidirectional, must exist in at least the  $I(0)$  variables. In other words, cointegration indicates causal effects (Engle and Granger, 1987).

### 3.3. Vector Error Correction Mechanism

The third step involves testing whether there exists multivariate causality among export, import and GDP. Granger Representation Theorem states, if time series are all  $I(1)$  and are cointegrated, then a dynamic multivariate VECM would prevail and vice versa. Therefore, assuming the integration of order  $I(1)$  and cointegration among export, import and GDP, the following VECM, according to Engle and Granger (1987), is formulated to carry out a standard Granger causality test:

$$\Delta GDP_t = \alpha_{10} + \sum_{i=1}^p \alpha_{11,i} \Delta GDP_{t-i} + \sum_{j=1}^p \alpha_{12,j} Ex_{t-j} + \sum_{i=1}^p \alpha_{13,i} M_{t-i} + \gamma ECT_{t-1} + \xi_t \quad (1)$$

$$\Delta Ex_t = \beta_{20} + \sum_{i=1}^p \beta_{21,i} GDP_{t-i} + \sum_{j=1}^p \beta_{22,j} \Delta Ex_{t-j} + \sum_{i=1}^p \beta_{23,i} M_{t-i} + \tau ECT_{t-1} + \zeta_t \quad (2)$$

$$\Delta M_t = \gamma_{30} + \sum_{i=1}^p \gamma_{31,i} GDP_{t-i} + \sum_{j=1}^p \gamma_{32,j} Ex_{t-j} + \sum_{i=1}^p \gamma_{33,i} \Delta M_{t-i} + \delta ECT_{t-1} + \varepsilon_t \quad (4)$$

where  $GDP$ ,  $Ex$  and  $M$  are real GDP, export and import, respectively;  $\Delta$  indicates the difference operator,  $\zeta_t$ ,  $\xi_t$  and  $\varepsilon_t$  imply non-zero, serially independent random error terms and  $ECT_{t-1}$  is the error-correction term obtained from the long-run cointegrating regression. The short-run dynamics which are inevitable to achieve the long-run equilibrium can be provided by the causal relationship between the variables (Granger, 1988). For example, considering equation (1), exports and imports are said to Granger cause economic growth not only if the  $\rho_i$ 's are jointly significant but also if  $\gamma$  is significant. The ECM approach also permits to distinguish between 'short-run' and 'long-run' Granger causality. In the short-term, when variables are cointegrated, divergences from the long-run equilibrium will feed back on the variations in the dependent variable in order to force the movement towards the long-run equilibrium; if the dependent variable is driven directly by this long-run equilibrium error, then it is responding to this feedback and if not, it is responding only to short-term shocks to the stochastic

term, when variables are cointegrated, divergences from the long-run equilibrium will feed back on the variations in the dependent variable in order to force the movement towards the long-run equilibrium; if the dependent variable is driven directly by this long-run equilibrium error, then it is responding to this feedback and if not, it is responding only to short-term shocks to the stochastic environments (Kabir and Tufte, 1998).. This paper adopts Schwarz information criterion to determine the optimal lag of the explanatory variables.

The data used in this study are annual time-series data for 1972-2010 and are collected from the World Development Indicators 2011 (online version)

#### 4. Empirical Results

We now discuss results of unit root test, cointegration and VECM in the light of the econometric methodology. Results of the VECM indicate the status of the Granger causality relationship among economic growth, export and import We shall also explain the results of pairwise Granger causality.

##### 4.1 Unit Root Tests

The augmented Dickey-Fuller test (ADF) is used to examine existence of unit roots. The tests are done both with constant and time trend. Schwarz information criteria method is used to choose the optimal lag length. Results of unit root tests are given in Table 2.

Results show that, for both the periods, GDP, export and import have nonstationarity properties in levels as the test statistics are smaller than their corresponding values. Results also indicate that export and import become stationary at the first difference as the test statistics are greater than their

Table 2: Augmented Dickey-Fuller Unit Root Test

Variable	Test Statistic	
	1972-2010	1972-2007
GDP	3.005874	2.861891
Export	2.597560	2.735769
Import	1.467020	1.993359
$\Delta^2$ GDP	-7.837809	-7.686451
$\Delta$ Export	-4.297713	-4.002519
$\Delta$ Import	-4.945739	-4.537353

Note: denotes second difference operator. Critical values at 1, 5 and 10 percent levels are -4.219126, -3.533083, -3.198312, respectively, for both intercept and trend. These critical values are taken from MacKinnon (1991). Lag length is 9 based on Schwarz information criteria.

corresponding critical values but GDP becomes stationary at the second difference. Therefore, export and import are integrated of order one and the series of GDP is integrated of order two for both periods. This means that there is short-run instability in export, import and economic growth in Bangladesh.

#### 4.2 Cointegration Tests

Results of cointegration test between GDP export and imports for the period 1972-2010 and 1972-2007 are presented in Table 3. Results of both the eigenvalue and trace tests are reported. Results show that both the maximum eigenvalue and trace statistics are greater than the corresponding critical values at 5% percent significance. Therefore the null hypothesis of no cointegration is rejected. Results ensure the variables - GDP, exports and imports- are cointegrated and confirm a single cointegrating vector as well as support stable genuine long-run relationship among exports, imports and economic growth for the period 1972-2010, which include the financial crisis of the late 2000, and for the period 1972-2007, which precedes the financial crisis. Therefore, we can conclude that the financial crisis did not affect the long-run relationships between the foreign trade and economic growth in Bangladesh.

#### 4.3 Granger Causality Tests

The short-run causality can be examined by looking at the significance of the coefficient of the relevant lagged independent variable while long-run causality can be checked by observing the significance of the coefficients of the ECTs (Oh and Lee, 2004; Awokuse, 2006). The significance of the coefficient of the lagged independent variable is checked by the estimated statistics. Table 4 presents

Table 3: Cointegration Test

Variables	Maximum eigenvalue			Trace test	
	Cointegration rank	Test statistics	5% Critical values	Test statistics	5% Critical values
<b>1972-2010</b>					
<i>GDP - X - M</i>	r = 0	29.45440	21.13162	39.97874	29.79707
	r ≤ 1	10.51221	14.26460	10.52434	15.49471
	r ≤ 2	0.012127	3.841466	0.012127	3.841466
<b>1972-2007</b>					
<i>GDP - X - M</i>	r = 0	30.79060	21.13162	41.23304	29.79707
	r ≤ 1	10.22338	14.26460	10.44244	15.49471
	r ≤ 2	0.219060	3.841466	0.219060	3.841466

Note: The tests are done linear deterministic trend.



results of Granger causality based on VECM. The coefficient of GDP in both the export and import equations is significant for both the periods. This implies that there is short-run causality between GDP and export, and GDP and import running from GDP to export and GDP to import, respectively. But for the other equation, there is no such short-run causal relationship for either equation.

Results also exhibit that the coefficients of ECTs in both GDP and import equations are significant. This indicates that there is multivariate causality among GDP, export and import in the long-run for the period 1972-2010. This implies that exports and imports Granger causes GDP, and GDP and import Granger causes exports in the long-run.

On the other hand, the ECTs in both the export and import equation are significant at 10% levels for the pre-financial crisis. This shows multivariate Granger

Table 4: Results of Granger Causality based on Vector Error Correction

Dependent Variable	D(GDP)	D(Export)	D(Import)	ECTs
<b>1972-2010</b>				
D(GDP)		0.949665 (0.6220)	1.621658 (0.4445)	-0.6034 [-2.08048]
D(Export)	5.445705 (0.0657)		1.450978 (0.4841)	0.170769 [ 0.66752]
D(Import)	11.55710 (0.0031)	1.378339 (0.5020)		1.171566 [ 2.56309]
<b>1972-2007</b>				
D(GDP)		1.018993 (0.6008)	0.933493 (0.6270)	-0.095051 [-0.38036]
D(Export)	5.501671 (0.0639)		0.853877 (0.6525)	-0.66363 [-1.95511]
D(Import)	11.13337 (0.0038)	1.732363 (0.4206)		0.736933 [ 1.80313]

causality running GDP and import to export, and GDP and exports to import. Results show that export equation does not provide a significant for the whole and GDP equation does not estimate a significant ECT coefficient for the pre-crisis period. In sum, we can conclude that in the economy of Bangladesh, export-and import-led growth hypothesis and growth- and export-led import hypothesis are working for the period covering the financial crisis of the late 2000s; and GDP-and import-led export hypothesis and GDP-and export-led import hypothesis are working for the pre-crisis period.

Our results differ from Tang (2006) who found no long-run causality between GDP, export and import, but found short-run causality running from GDP to

import. Tang had also found that there was no cointegration among GDP, export and import and hence had concluded absence of long-run stability.

### 5. Pairwise Granger Causality

We also assess pairwise Granger causality between GDP and export, export and GDP, import and export, GDP and import for both the periods and results are reported in Table 5. Results of Pairwise Granger causality test show that Granger causality runs two ways from GDP to exports and exports to GDP for both the periods. Exports Granger cause import for the period 1972-2010, but this causal relationship does not exist for the period 1972-2007. For both periods, this is Granger causality between GDP and import running from GDP to import. Therefore it appears that, in most of the cases, relationships are similar for the period which covers the financial crisis and which excludes the crisis.

### 6. Conclusions

The financial crisis of the late 2000s that originated in the USA have had impacts

Table 5: Result of Pairwise Granger Causality Test

Null Hypothesis:	1972-2010		1972-2007	
	F-Statistic	Prob.	F-Statistic	Prob.
GDP does not Granger Cause EXPORT	3.17451	0.0299	2.41481	0.0781
EXPORT does not Granger Cause GDP	2.49875	0.0672	2.29048	0.0905
IMPORT does not Granger Cause EXPORT	0.93414	0.4596	0.19290	0.9396
EXPORT does not Granger Cause IMPORT	2.38162	0.0775	1.58848	0.2111
IMPORT does not Granger Cause GDP	0.59064	0.6724	0.35258	0.8395
GDP does not Granger Cause IMPORT	2.63460	0.0570	2.01982	0.1251

on the economy of many countries in the world through various channels. The paper assesses the impact of the crisis on the short- and long-run multivariate Granger causal relationship among export, import and economic growth in Bangladesh applying the cointegration and vector error correction modelling approach; we apply the techniques to the dataset for the period 1972-2010, which includes the financial crisis, and for the period 1972-2007, which precedes the crisis and hence assess the impact of financial crisis on the relationship. Results show that although there is instability in the variables in the short-run there is

long-run cointegration relationship among them for both periods. Results also indicate that export-and import-led growth hypothesis and growth- and export-led import hypothesis are working for the period covering the financial crisis of the late 2000s; and GDP- and import-led export hypothesis and GDP-and export-led import hypothesis are working for the pre-crisis period.

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