Original Research Article

The Impact of Exchange Rate on Bangladesh's Export: A Cointegration Approach

Abstract: This paper investigates the monthly data of Bangladesh export value and exchange rate for the time period ~~between year~~ 2000 to ~~and year~~ 2017. It utilized the Johansen (1988) cointegration approach to identify the extent of long run and short run relationship between export value and exchange rate. The study could not establish neither any long term trend nor any short term dynamics between the variables. Respective variables are significantly related to their own one period lagged values. Distant past values do not have any implications. This study suggests that short span macroeconomic policy would be beneficial to influence the foreign exchange market and eventually the performance of export of Bangladesh.

JEL classification: C22, F14, F31

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1. Introduction

Trade balance is one of the crucial macroeconomic indicators for a small open economy. Export earnings play a vital role of defining the trade balance, hence the economic growth and development of a country in question. Foreign exchange market mechanism allows the domestic currencies to be converted in to foreign currencies and facilitate the international trade and their payments. Thus, changes in exchange rate has a greater impact on export performance of any country. When the domestic currency is depreciated, it makes domestic goods cheaper and export enhanced in the world market. Similarly, when the domestic currency is appreciated in the foreign exchange market, domestic goods become expensive and trade balance deteriorates. Bangladesh is one of the small open economies which gross domestic product (GDP) is heavily dependent on export earnings. To reap the most of the benefit from the foreign exchange market, Bangladesh adopted market-based exchange rate system on May 2003. Before that point, Bangladesh followed a fixed exchange rate regime with US dollar. Therefore, the motivation of this study is to investigate ~~what is~~ the impact of the free floating foreign exchange rate system on export performance of Bangladesh. This paper uses monthly exchange rate and export data whereas in most of the scholarly articles who focus on Bangladesh use annual data to investigate the impact of exchange rate on exports.

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2. Literature Review

The Bretton wood system of fixed exchange rate collapsed in 1973 when the prices of currencies started to fluctuate. These fluctuations brought uncertainty and risk to the traders and to the volume of international trade. Since then, many researchers conducted theoretical and empirical research to identify the impact of exchange rate changes on the trade balance. They applied different methods and obtained diversified outcomes. However, no consensus has been reached how to model and measure the impact of exchange rate change on export performance.

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This study mainly focuses on the researches that extensively used time series models. Autoregressive Conditional Heteroscedasticity (ARCH) has become the popular method of measuring volatility and Vector Auto Regressive (VAR) and Vector Error Correction Model (VECM) have become the commonly used estimation techniques. Lastrapes and Koray (1990) apply Vector Autoregression to analyze the US monthly trade data from 1973-1987. They used 12-month moving standard deviation of the real effective exchange rate (REER) to measure the volatility of exchange rate. They did not find any effect of exchange rate on export. However, they find a ~~small~~ negative effect of exchange rate on imports.

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Asseery and Peel (1991) adopted Cointegration analysis to evaluate the quarterly exports of Japan, West Germany, the USA, the UK, and Australia over the period ~~of~~ 1972-1987. They measure the volatility of exchange rate through the Auto Regressive Integrated Moving Average (ARIMA) process to the log of real exchange rate and find a positive effect of exchange rate volatility on exports for most countries.

By using the same technique, Chowdhury (1993) find the opposite result. He investigated the quarterly data of G-7 countries over the years 1973-1990 and find that volatility has a significant negative effect on exports for all countries.

Arize (1997) utilized Granger method of cointegration for the G-7 countries and concluded with same results of Chowdhury (1993). He used quarterly data from 1973-1995 where eight quarter moving standard deviation was taken to measure the volatility of exchange rate. He found significant negative effect for all countries.

By using the quarterly data from 1973-1990 for the countries Greece, Korea, Pakistan, Philippines, Singapore and South Africa, Bahmani-Oskooee and Payesteh (1993) found no significant relationship between variables. The measure the volatility of exchange rate with standard deviation of quarterly percentage changes in REER with lagged REER, Income and trend as independent variables.

Doroodian (1999) applied Auto Regressive Moving Average (ARMA) model to investigate the relationship between exchange rate volatility and export volume. He used quarterly data of India, Malaysia and South Korea for the years 1973-1996. Volatility was measured by using the Generalized Auto Regressive Conditional Heteroscedasticity (GARCH) model. He found significantly negative relationship between exchange rate volatility and export volume.

Doganlar (2002) tried to estimate the impact of exchange rate volatility on the exports of five Asian countries namely Turkey, South Korea, Malaysia, Indonesia, and Pakistan. He used Granger method of cointegrating technique to measure the volatility of quarterly data. The results indicated that the exchange rate volatility has significant negative relationship with export volume.

Aziz (2008) estimated the effect of exchange rate on trade balance of Bangladesh. He applied Engle-Granger and Johansen techniques to investigate the long run co-integration relation between 'trade balance' and REER, and then employed the Error Correction Model (ECM) to explore the short-run linkage. He found that REER has a significant positive influence on trade balance in both

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short run and long run. The Granger Causality test suggests that the REER does Granger causes the trade balance.

Hassan, and &Tufte (2010) examined both the long run and short run relationship of Bangladeshi export growth to exchange rate volatility. They used world trade volume, Bangladeshi and world export prices, and exchange rate volatility as the dependent variables. Using two restricted co-integration system of these variables they conducted an error correction mechanism. In the long run, Bangladeshi export growth is Driven by the volume of world trade, Bangladeshi export growth is negativelyand inelastically related to the volatility of Bangladeshi exchange rates. When these long-run effects are established, it revealed that none of the variables were able to explain any short-run export changes.

Alam (2010) investigated the yearly data of Bangladesh from 1977-2005 to find the link between real exchange rate and export earnings. Granger causality test has been utilized to check if real exchange rate depreciation of Taka has any contribution to export earning of Bangladesh. He found no causality run from real depreciation of Taka to export earnings of Bangladesh.

Xu et al. (2016) investigated the effect of exchange rate movements on Chinese's multiproduct firms' export behavior. They used Chinese Annual Survey of Industrial firms (CASIF) data and Chinese Customs Trade Statistics (CCTS) from 2000-2007. They found that real appreciation of exchange rate exercises negative impact on Chinese multi product firms' export price and export quantities. Their results were robust to alternative measures of exchange rates

By using the annual data of Pakistan from 1970 -to 2015, Khalil et al. (2017) conducted ARDL approach to check the impact of exchange rate on export. They came to a conclusion that exchange rate have negative but insignificant impact on exports of Pakistan. However, world's income have positive and significant effect to exports.

Thuy and Thuy (2019) explored the impact of exchange rate volatility on exports in Vietnam by using quarterly data from 2000 to 2014. They applied the ARDL bound testing approach to analyses the extent of relationship between exchange rate volatility and exportschange. As expected, the results show that exchange rate volatility negatively affects the export volume in the long run. A depreciation of the domestic currency affects exports negatively in the short run, but positively in the long run. Which is clearly consistent with the J curve effect.

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Bahmani-Oskooee and Saha (2020) assessed the impact of exchange rate volatility on India's export to and import from 14 trading partners. They found evidence of short-run asymmetric effects in almost all cases which explained the long-run asymmetric effects in majority of the sample. The findings are partner specific. It was identified that increase in real rupee–yuan volatility has significantly positive effects on India's exports to China but decrease in volatility has no effects. In the case of the US, increase in real rupee–dollar volatility has positive long-run effects on both India's export to and imports from the US but decrease in volatility has no impact on either.

~~3.~~ 3. Data and Method

The sample consists of monthly observations on the real value of Bangladeshiexports (trade) and a measure of Bangladeshi exchange rate, in terms of US dollar. The nominal exchange rate is the official exchange rate between Bangladesh Taka to US dollar. A continuous monthly sample from January 2000 to December 2017 was used in this study. The values are measured in constant US dollars. All data used in this study are obtained from the IMF's International Financial Statistics, the IMF's Central Statistics Office. The~~theoretical~~ empirical model ~~that~~ of export that we refer to this study depends on the exchange rate. The export function takes the following form:~~. Where~~

$$xp_t = \alpha_1 + \alpha_2 xc_t + u_t \quad (1)$$

Where xp_t=natural logarithm of Bangladeshi export (value in terms of constant US dollar in millions).

xc_t=natural logarithm of exchange rate between Bangladeshi taka to US dollar.

The cointegration procedure developed by Johansen (1988, 1991), and Johansen and Juselius (1990 and 1992) is employed to test the presence or absence of long-run equilibrium between the variables in Equation 1. Cointegration testing works in two steps. Firstly, the stationarity properties of the individual variables in Equation 1should be explored, and then their orders of integration should be determined by unit roots. Unit root tests suggested byDickey and Fuller (1981), and Phillips and Perron (1988) is implemented in this study. Secondly, two likelihood ratio tests, namely, the trace and themaximum eigenvalue statistics, are employed to test for thenumber of cointegrating vectors. The basic idea of cointegration is that variables in question may be outlining a long-run equilibrium relationship if they moveclose together in the long run, even though their short run behavior is otherwise.

If the series indicates a long run cointegration, the study will conduct the Vector Auto Regression (VAR) model and Vector Error Correction Model (VECM) to understand the shortrun dynamics. However, if there is no long run cointegration

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between the variables is surfaced, they study will conduct only the VAR model to find out if there is any short run fluctuation between them.

4. Result and discussion

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Table 1 reports the results of Unit root test both the Dickey Fuller Test and Phillips Perron test. Both the series are non-stationary at their levels but stationary at their first differences. Unit root tests suggest series of exchange rate and export are integrated in order one, I(1).

Table 1: Estimated Results of Unit root Test of Bangladesh Exchange Rate and Export

	Augmented Dickey Fuller Test		Phillips Perron Test	
Variables	Test Pattern	P Value	Test Pattern	P Value
lxc (log of Exchange rate)	Level	0.4267	Level	0.4801
	First Difference	0.0000	First Difference	0.0000
lxp(log of export)	Level	0.0014	Level	0.0000
	First Difference	0.0000	First Difference	0.0000

Source:The null hypothesis is that the variable has a unit root.

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Table 1 displays that both exchange rate and export are stationary at their firstdifference I(1). The cointegration results are summarized in table 2. It reports both the Maximum Eigenvalue and Trace Test statistic of Johansen (1988). Both tests suggest that there are no cointegrating vector in the sample. It implies that there is no long run relationship between exchange rate and export of Bangladesh.

Table 2 reports the Maximum Eigenvalue and Trace tests of Johansen (1988). These are complimentary versions of the same test to determine the cointegration rank, r. Both tests suggest that there is certainly no cointegrating vector in the sample. The test statistic for trace and maximum Eigenvalue are lower than that of critical value. Thus the null hypothesis of no cointegration between the variables cannot be rejected. It suggests that there is no long run relationship between export of Bangladesh and exchange rate.

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Table 2: Johansen tests for cointegration between Export and Exchange

	Trace Statistic			Max eigenvalue Statistic		
Eigenvalue	max rank	trace statistic	5% Critical value	max rank	max eigenvalue test statistic	5% critical value
	0	8.8571	15.41	0	7.9854	18.63
0.03663	1	0.8718	3.76	1	0.8718	6.65

As there is no existence of ~~does not exist any~~long run relationship between export and exchange rate, the study proceed ~~we are now interested~~ to check whether any short run dynamics prevails or not. The vector autoregressive (VAR) model is used to check if the variables are stationary at their first differences and they are not cointegrated in the long run. The basic structure of the VAR that is stationary at their first differences is given in the equations below:

$$\Delta xp_t = \gamma_{11}\Delta xp_{t-1} + \gamma_{12}\Delta xc_{t-1} + u_t^{xp} \quad (2)$$

$$\Delta xc_t = \gamma_{21}\Delta xp_{t-1} + \gamma_{22}\Delta xc_{t-1} + u_t^{xc} \quad (3)$$

The variables xp and xc in the system of equations (2) and (3) are nonstationary, but the differences are stationary. Each difference is a linear function of its own lagged differences and of lagged differences of each of the othervariables in the system. The equations are linear and least squares can be used to estimate the parameters. For selecting the length of lag, the Akaike Information Criterion (AIC), and the Schwarz Criterion (SC) are normally considered. Table 3 displayed the lag length selection based on AIC, HQIC and SBIC. Both SBIC and AIC criterion have suggested to accept lag 3.

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Table 3: Vector Autoregressive Model: Short Run Dynamics

Variables	Coef.	Std. Err.	z	P>|z|	Variables	Coef.	Std. Err.	z	P>|z|
lbdxc					lbdxp				
lbdxc					lbdxc				
L1	1.0368	0.0687	15.09	0.9021	L1	-0.4510	0.6221	0.72	0.469
L2	-0.1465	0.0985	-1.49	-0.3396	L2	-0.1805	.8921	-0.20	0.840
L3	0.0558	0.0672	0.406	-0.0758	L3	0.7843	0.6085	1.29	0.197
lbdxp					lbdxp				
L1	-0.0099	0.0070	-1.40	0.160	L1	0.5290	0.0640	8.26	0.000
L2	0.0166	0.0081	2.03	0.042	L2	0.1000	0.0742	1.35	0.178
L3	0.0026	0.0072	0.36	0.718	L3	0.3350	0.0654	5.12	0.000

Source:

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The VAR model shows ~~that variables~~ shows insignificant relationship with the other variables but shows significant levels ~~legacy~~ with their own lagged values. However, ~~the~~ only the one year lagged value of the respective variables are significant at 5% level. It indicates the distant past values do not have any impact on the current situation.

~~4.~~ 5. Conclusion

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This paper investigates the relationship between exchange rate and export of Bangladesh from the year 2000 to ~~year~~ 2017, keeping the fact in mind that Bangladesh adopted free floating exchange rate system since May 2003. It is always theorized that market mechanism of exchange rate has a crucial effect on trade balance, especially on export performance of any country. However, this study couldn't find neither any long run association nor any short run dynamics between exchange rate and export of Bangladesh. Variables are only significant with their own values with one-year lag. Bangladeshi export is heavily dependent on imported raw materials. Exchange rate has impact on export through the

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channel of import prices. Incompetence in import sector might have negative effect on export performance of Bangladesh. However, the study is not beyond limitations. The lack of information on other macroeconomic variables could be one of the reasons of such findings. If the study focuses on trade balance rather than export alone, might have possibilities of different outcome. Even the study on sector wise export performance may result in otherwise conclusion.

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