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

Takrima Sayeda[1*]

[1]*Department of Tourism and Hospitality Management, University of Dhaka, Bangladesh.*

Author's contribution

The sole author designed, analysed, interpreted and prepared the manuscript.

Original Research Article

ABSTRACT

The purpose of the paper is to see if there is any relationship exist between free floating exchange rate and export performance of Bangladesh. It inspects the monthly data of exchange rate and export value for the time period between year 2000 and 2017. It utilized the Johansen [1] cointegration approach to identify the extent of long run and short run relationship between them. 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 immediate past values. Distant past values do not have any implications. This study suggests that short run macroeconomic policy would be beneficial to influence the foreign exchange market and eventually the performance of export of Bangladesh.

1. INTRODUCTION

There is a strong association between exchange rate, export performance and economic growth. A proper management of exchange rate within the part of macroeconomic policies gear the superior performance of exports, which eventually improve the gross domestic product

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Corresponding author: E-mail: takrimasayeda@du.ac.bd;

(GDP) in one country. An undervalued exchange rate means the country's products become relatively cheaper than their trading partners and the demand for country's export may increase. A depreciation in exchange rate makes imports expensive, hence the trade balance improves through higher exports and lower imports. Historically it is proven that emerging and rapidly growing economies managed their exchange rate remain undervalued. These countries made sure that their currencies do not become overvalued and hence they can make their exports more competitive in the world market. The prominent example is China, which has been deliberately undervaluing their currency for last 30 years to exercise their eminence in export performance. Started as a low income third world country after its independence in 1971, Bangladesh has been graduated to lower middle income country in 2015. In this transition path, Bangladesh has gone through several major policy changes. In the late seventies, Bangladesh adopted market economy policy formulated by International Monetary Fund (IMF) and World Bank. Bangladesh started to shift to a more outward oriented economy. Export sector was given breakthrough policies like reduced ceiling on private borrowing, duty draw back system and bonded warehouse facilities to promote export industry [2]. Exchange rate management policies also underwent several major changes. Historically, Bangladesh had been maintaining different pegged exchange rate regimes, pegged to different intervening currencies until 2003 [3]. Keeping pace with ever changing world economy, Bangladesh also has been changing its export and exchange policies. Bangladesh adopted free floating exchange rate system from 31st May 2003 to reap the benefit of market equilibrium of exchange market. The regime change was suggested by the IMF for the developing countries mainly for two reasons: firstly, since 1980s gross capital flows to developing countries had risen substantially which makes pegged rates more difficult to maintain; secondly, countries with single currency pegged were facing wide fluctuations among major currencies as they were highly integrated with the rest of the world [4]. Due to these dual policies change in exchange rate and export sector, export earning of Bangladesh has increased and exchange rate also depreciated. According to World Integrated Trade Solution (WITS) of World Bank [5], Bangladesh export of goods and services as a percentage of GDP is 14.80%. However, it is not clear how much impact is done by the exchange rate on exports

earning, or is there any causal relationship exist between them. Likewise the world context, the literature based on Bangladesh also demonstrate conflicting views [6]. Thus, the motivation of this paper is to examine the relationship of free floating foreign exchange rate system and export performance of Bangladesh, if there is any. This study is distinguished from the previous research as it uses complete time period of free floating exchange rate since its inception in 2003. Moreover, unlike the previous studies, this study uses monthly data rather than annual data to focus on exchange rate fluctuations.

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.

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), Vector Error Correction Model (VECM) and Autoregressive Distributed Lag (ARDL) models have become the commonly used estimation techniques.

Lastrapes and Koray [7] 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 negative effect of exchange rate on imports.

Asseery and Peel [8] adopted Cointegration analysis to evaluate the quarterly exports of Japan, West Germany, the USA, the UK, and Australia over the period 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 [9] 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 [10] utilized Granger method of cointegration for the G-7 countries and concluded with same results of Chowdhury [9]. 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 [11] 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 [12] 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 [13] 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 [14] estimated the effect of exchange rate on trade balance of Bangladesh. He applied Engle-Granger and Johansen techniques to investigate the long run cointegration 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 short run and long run. The Granger Causality test suggests that the REER does Granger causes the trade balance.

Hassan and Tufte [15] 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 negatively and 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 [16] 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. [17] 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 1970-2015, Khalil et al. [18] 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 has positive and significant effect to exports.

Thuy and Thuy [19] 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 export. 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.

Buabeng et al. [20] examine the effect of exchange rate fluctuations on the performance of manufacturing firms in Ghana. They implement bounds testing approach to cointegration in the framework of autoregressive distributed lags (ARDL) model on yearly data for the period 1990 to 2018 to measure the relationship between exchange rate fluctuations and manufacturing firm performance. The results indicate that increase in Ghana's exchange rate decreases the manufacturing firm's performance.

Abbas et al. [21] investigated the impact of exchange rate policy of China on its trading partners. The empirical result of Global Vector Autoregressive model indicates that China's exchange rate policy of keeping RMB undervalued has mixed effects on its trading partners. As per trade theory, China's RMB devaluation accelerate Chinese exports and reduce imports. As one of the trading partners of China, Bangladesh is also affected by the Chinese currency devaluation. It indicates that Bangladesh's export decreases with the devaluation of Chinese RMB as it is unable to compete with China in the international market.

Bahmani-Oskooee and Saha [22] 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.

Sugiharti et al. [23] examine the impact of exchange rate volatility on Indonesia's primary export commodities to its top five exporting countries. The study uses generalized auto regressive conditional heteroscedasticity (GARCH) to measure exchange rate volatility and then implement ARDL and NARDL model to capture the impact on export to the exporting countries. Both the models suggest that exchange rate volatility has negative impact on Indonesian exports.

3. DATA AND METHODS

The sample consists of monthly observations on the real value of Bangladeshi exports (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 (IFS), the IMF's Central Statistics Office.

The empirical model of export that we refer to this study depends on the exchange rate. The export function takes the following form:

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

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 [1,24], and Johansen and Juselius [25,26] 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 1 should be explored, and then their orders of integration should be determined by unit roots. Unit root tests suggested by Dickey and Fuller [27], and Phillips and Perron [28] is implemented in this study. The Augmented Dickey Fuller (ADF) test is specified as follows:

$$\Delta y_t = \alpha_1 + \alpha_{2t} + \gamma y_{t-1} + \sum_{s=1}^{m} a_s \Delta y_{t-s} + v_t \quad (2)$$

where yt is a random walk with drift around a stochastic trend, Δ is the first difference operator, v_t is the white noise error term, m is the number of lagged difference terms to include, so that the error term in equation (2) is serially uncorrelated, and $\gamma = \rho - 1$. Therefore, the null and alternative hypotheses are H_0: $\gamma = 0$ and H_a: $\gamma < 0$ respectively.

The Phillips-Perron unit root test is used in time series analysis to test the null hypothesis that a time series is integrated of order 1, I (1). It builds on the Dickey-Fuller test of the null hypothesis $\rho = 1$,

$$\Delta y_t = (\rho - 1)y_{t-1} + u_t \qquad (3)$$

Secondly, two likelihood ratio tests, namely, the trace and the maximum eigenvalue statistics, are employed to test for the number of cointegrating vectors. The basic idea of cointegration is that variables in question may be outlining a long-run equilibrium relationship if they move close 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 short run dynamics. However, if there is no long run cointegration 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. RESULTS AND DISCUSSION

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 displays that both exchange rate and export are stationary at their first difference I (1). The cointegration results are summarized in Table 2. It reports both the Maximum Eigenvalue and Trace Test statistic of Johansen [1]. 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 [1]. 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.

As there is no existence of any long run relationship between export and exchange rate, the study proceeds 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:

$$\Delta xp_t = \gamma_{11}\Delta xp_{t-1} + \gamma_{12}\Delta xc_{t-1} + u_t^{xp} \qquad (4)$$

$$\Delta xc_t = \gamma_{21}\Delta xp_{t-1} + \gamma_{22}\Delta xc_{t-1} + u_t^{xc} \qquad (5)$$

The variables xp and xc are nonstationary, but the differences as portrayed in the system of equations as equation (4) and (5) are stationary. Each difference is a linear function of its own lagged differences and of lagged differences of each of the other variables 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 criteria, based on the selection criteria, lag 3 was selected.

Table 4 displayed the results of vector autoregressive (VAR) model for short run dynamics. The VAR model shows insignificant relationship with the other variables but shows significant levels with their own lagged values. However, 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.

Table 1. Unit root test results: ADF and PP

Variable	ADF				PP			
	Level		1st Difference		Level		1st Difference	
	Constant	Constant with trend	Constant	Constant with trend	Constant	Constant with trend	Constant	Constant with trend
lnxc	-.0093	-.9961	-.9751**	-.9812**	.9906	.9640	.0884	.0859
lnxp	-.0136	-.3051**	-1.337**	-1.3380**	.9863	.6948**	-.3379**	-.3380**

*Source: Author's calculation based on IFS (2020) data. Note: ** represent 5% significant level*

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

Source: Author's calculation based on IFS (2020) data

Table 3. Lag length selection criteria

Lag	LL	LR	df	p	FPE	AIC	HQIC	SBIC
0	159.483				0.000776	-1.48569	-1.47289	-1.45403
1	858.573	1398.2	4	0.000	1.1e-06	-8.04314	-8.00474	-7.94814
2	871.861	26.576	4	0.000	1.0e-06	-8.13076	-8.06677	-7.97243
3	886.06	28.399*	4	0.000	9.2e-07*	-8.22698*	-8.13739*	-8.00532
4	887.544	2.968	4	0.563	9.4e-07	-8.20325	-8.08806	-7.91826

*Source: Author's calculation based on IFS (2020) data. Note: * indicates 5% significant level*

Table 1. Vector autoregressive model: Short run dynamics

Variables		Coef.	Std. Err.	z	P>|z|	Variables		Coef.	Std. Err.	z	P>|z|
lbdxc						lbxp					
	lbdxc						lbdxc				
	L1	1.0368	0.0687	15.09	0.00**		L1	-0.4510	0.6221	0.72	0.469
	L2	-0.146	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	-0.009	0.0070	-1.40	0.160		L1	0.5290	0.0640	8.26	0.00**
	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: Author's calculation based on IFS (2020). Note: ** indicates 5% significant level*

5. CONCLUSION

This paper investigates the relationship between exchange rate and export of Bangladesh from the year 2000 to 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. It should be noted that Bangladeshi export is heavily dependent on imported raw materials. Devaluation of exchange rate has impact on exports through the channel of high import prices. Incompetence in import sector might have negative effect on export performance of Bangladesh. However, the study is not beyond its limitations. Unavailability of the data on other macroeconomic variables could be one of the reasons of such findings. If the study focuses on trade balance rather than export alone, there is a possibility of different outcome. Even the study on sector wise export performance may result in otherwise conclusion.

COMPETING INTERESTS

Author has declared that no competing interests exist.

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Peer-review history:
The peer review history for this paper can be accessed here:
http://www.sdiarticle4.com/review-history/60928