

## Exchange Rate and Export of Bangladesh: Does Marshall-Lerner Condition Holds?

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### Abstract

Export is expected to have a favorable impact on GDP growth, and the exchange rate is expected to have a major impact on export and thus export earnings. The relationship between exchange rate and export is a hotly debated topic in macroeconomics, and the goal of this research is to see if the Marshall-Lerner condition holds in case of Bangladesh that is if devaluation of domestic currency increase export earnings. Explanatory variables of the model in the study are the exchange rate, foreign income (WGDP), and domestic income (DGDP). Cointegration approaches; Error Correction model, Granger Causality test are used in this study to estimate the long and short-run impacts. With time series data from 1973Q3 to 2018Q2, we used the Error Correction Model and the Granger Causality Test. The findings of VECM support short-run exchange rate and export adjustments. The bidirectional causality between exchange rate and export is established using the Granger causality test.

### Keywords

Exchange rate, Export earnings, Cointegration, Vecm, Granger causality.

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## INTRODUCTION

Export is one of the foreign currencies generating sources of a country. It is supposed to effect GDP growth positively (Tyler, 1981, Xu, 1996). At the same time, the exchange rate has a significant impact on a country's overseas trade and, as a result, on its export. Depreciation/devaluation of the national currency makes domestic goods relatively inexpensive to importing countries, thus stimulating demand for those commodities and so export (Marshall-Lerner condition).

Since its independence in 1971, Bangladesh has undertaken active exchange rate strategies. Bangladeshi currency has used a variety of exchange rate regimes to improve its trade balance since independence. Bangladesh has had a floating currency rate since May 31, 2003, as part of policy reform. The exchange rate is regulated by the demand and supply of the various currencies under this arrangement. Bangladesh

Bank continues to oversee a managed floating of the taka in order to retain export competitive. However, currency rate management policies are complex, particularly in countries like Bangladesh. As the country's GDP grows, and export plays a key role in that expansion, it is necessary to be certain about the relationship that exists with export.

There are substantial evidences to support the hypothesis. The causal relation between export and exchange rate is a contested issue that has yet to yield a definitive answer.

Among available literature for certain countries, the data shows a high relationship, whereas for others, it shows a weak relationship. In several research, there is also no evidence of a link (SEKMEN and SARIBAS, 2007). For example, in support of causation, Chowdhury and Younus (2014) used monthly data from 2003M6 to 2014M6 in a working paper to investigate the impact of the real exchange rate (RER) on export, import, and trade balance. The results show a long-term and short-term link between the variables in the VECM model. S. GORDON (2017) used time series data from 1972 to 2015 to prove unidirectional causality from currency rate to export in his analysis for Nigeria. The granger causality test was used to discover the result. Fang and Miller, 2007 in their study indicate that while the effect of depreciation on export is minimal, exchange rate risk has a big negative influence on it for Singapore using a bivariate GARCH-M model. The panel cointegration technique was used by Genc and Artar (2014) to investigate the impact of currency rates on emerging country imports and exports. They used data from 1985 to 2012 to calculate an inflation-adjusted real effective foreign exchange rate (there are 616 observations for 22 emerging nations in total). The result reveals a cointegrating relationship between export and exchange rate in the short and long run. Singh (2002) finds that the 'real exchange rate' and 'domestic income' have a significant impact on the 'trade balance' obtained in Indian data using Rose's simplified technique from 1960 to 1995, but that 'foreign income' has a minimal impact.

Some model exchange rate volatility in their literature. Like Weliwita, A et al. (1999) used the Johansen-Juselius multivariate cointegration technique on data from 1978I to 1996II, on Sri Lanka's six developed trading partners and discovered that exchange rate volatility had a substantial effect on export during the sample period. Cheung and Sengupta (2012) tried to show how the REER and exchange rate volatility affect different types of exports. They looked at the effects of the REER on the share of Indian non-financial sector firms' exports from 2000 to 2010. The baseline regression model's empirical results reveal that REER appreciation has a significant negative impact on export share, and that exchange rate volatility has an impact on a firm's export decision.

In a study Rose and Yellen were unable to rebut the claim that the real exchange rate had a statistically insignificant impact on trade flows (1989). They looked at bilateral trade flows between the US and other OECD countries using quarterly data. Rose (1991) examined the empirical relationship between real effective exchange rate and trade balance in the post-Bretton Woods OECD countries. According to Rose's research, the exchange rate has a minimal impact on the trade balance.

Relation among Export exchange rate and import for Turkey is examined by Sekmen & Saribas, (2007) in their study find no causality between exchange rate and export.

In a study on the influence of currency rate on Bangladesh's trade balance, Aziz (2012) used the same model as Rose (1991) and Singh (2002). The study's model was designed on the basis of 34 annual measurements (1972-2005). The study established a long-run and short-run relationship, suggesting that the real effective exchange rate has a positive impact on export both in long and short runs. Several research, such as Guechari (2012), Aziz (2012), Younus and Chowdhury (2012), consider the effect of the real exchange rate (RER) on trade balance in the long and short run (2014). However, there are two aspects of this study that set this apart from prior studies.

First, whereas the majority of research in the literature look at the impact of foreign currency rates on the foreign trade balance, this study exclusively looks at the impact of foreign exchange on exports. Second, this paper can be differentiated from the mentioned studies by the sample size, types of data, the base year of the exchange rate (base year is 2010).

The paper is arranged as follows: An overview of export and exchange rate related policies of Bangladesh, an overview of empirical studies done before by other researchers, data and methodologies, model specification and the empirical result of the study. We have conducted the study omitting fixed exchange regime.

## DATA

This study is based on data from exports and the nominal exchange rate (BDT per USD). Though the outcomes of a cointegration test are more closely tied to the time span of the data than the frequency of the data, in the event of a short time span, frequency does play a role in achieving a significant power gain of the test (Zhou, 2001). The situation we're concerned about has the same issue with a shorter time frame. The availability of time series data on various variables is also a significant concern. These two factors are important in taking into account the variables in this investigation.

This study uses data on export and nominal exchange rate relationship (BDT per USD) to establish a causal. Export value (free on board USD) is used as the dependent variable and nominal exchange rate (BDT per USD) as the independent variable, as well as the Index of Industrial Production [IIP and GDP show strong co-movement and are widely used as an indicator of short-term GDP outlook (NBER's Business Cycle Dating Committee, Sédillot and Pain, 2003; Rünstler and Sédillot, 2003; Mitchell et al., 2005)] for Bangladesh and the United States as the proxy of GDP of Bangladesh and as the proxy of world GDP [*USD is the most accepted global currency. US is largest exporting country of our goods, 15.3% in 2018-19 (Source: Bangladesh Bank) of export earning comes from us. US economy is la largest one and value of world GDP quarterly is unavailable*]. Another benefit of employing the IIP of the United States is that the United States is Bangladesh's main trading partner. All variables data was gathered from IFS on a quarterly basis from 1973Q3 to 2018Q2. The data is presented in a natural log format.

## MODEL SPECIFICATION AND METHODOLOGY

The theoretical basis of the empirical model can be written as –

$$Exp = f(Ex, Y_D, Y_{US})$$

Exp = Export value free on board

Ex = Nominal exchange rate

$Y_D$  = Domestic income

$Y_{US}$  = World income

A log-linear time series specification of the model stated as follows:

$$Exp_t = \beta_0 + \beta_1 Ex_t + \beta_2 Y_{Dt} + \beta_3 Y_{US_t} + \varepsilon_t$$

As the study is conducted on time-series data we need to check the stationarity (Stock and Watson, 1989) of the variables to avoid spurious result. To test stationarity augmented Dickey-Fuller test, ADF, (Dickey and Fuller, 1981) and Phillips-Perron, PP, (Phillips and Perron, 1988) test is adopted. After identifying the stationarity, we run a Var model to identify the maximum number of cointegrating equation and then VECM to check the short run causality. And lastly direction of causality is checked by granger causality.

## EMPIRICAL RESULTS

### *Unit Root Test Results*

The unit root for all variables in log level was checked using the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) methods. All variables are non-stationary (at 1% level of significance) in the level form, according to ADF and PP test results, where the Null hypothesis is that variables have a unit root. We compared the data and ran our test again, and the hypothesis of non-stationary or the presence of a

unit root was rejected with a 95% confidence level. So, in both the trend present and trend missing cases, all variables are integrated in order one, I (1), and data are ready for the cointegration test.

	ADF		PP	
	Without Trend	With Trend	Without Trend	With Trend
EXP	-0.0019 (0.9564)	-3.4119 (0.0531)	0.2393 (0.9744)	-7.1017 (0.0000)**
$\Delta$ EXP	-7.7706 (0.0000)**	-7.7560 (0.0000)**	-22.4528 (0.0000)**	-22.3989 (0.0000)**
EX	-2.8676 (0.0512)	-3.1076 (0.1077)	-3.3124 (0.0157)*	-3.0682 (0.1172)
$\Delta$ EX	-7.8587 (0.0000)**	-8.1949 (0.0000)**	-9.3322 (0.0000)**	-9.5228 (0.0000)**
DGDP	2.5673 (1.0000)	-1.8423 (0.6799)	1.9709 (0.9999)	-1.6386 (0.7738)
$\Delta$ DGDP	-6.0123 (0.0000)**	-7.1554 (0.0000)**	-16.9629 (0.0000)**	-21.0627 (0.0000)**
WGDP	-1.3596 (0.6010)	-1.4941 (0.8282)	-7.1254 (0.0000)	-2.4466 (0.3544)
$\Delta$ WGDP	-6.8547 (0.0000)**	-6.9207 (0.0000)**	-8.0969 (0.0000)**	-9.6102 (0.0000)**

**Table:** Unit Root Tests

*Note:* \*Statistical tool E-views has been employed for the analysis,

\*\* denote rejection of null hypothesis of a unit root at 5 and 1% level of significance respectively.

Residual test on ECM (if the residual stationary at level there is cointegration among dependent and explanatory variables) shows cointegration among dependent and explanatory variables.

	Without Trend	With Trend
ADF	-3.5347 (0.0082)**	-4.7661 (0.0008)**
PP	-5.4864 (0.0000)**	-5.5032 (0.0000)**

**Table:** Residual test on ECM

The ideal lag 3 is found using SC lag selection criteria. After that, we do the Johansen cointegration test. In order to obtain long-run relationships among the series, cointegration methods (Johansen, 1988, and Johansen and Juselius, 1990) are extensively utilized. Non-stationary series (obtained from the unit root test technique) are tested to see if there is any long-run equilibrium among the series. The best lag duration for all variables is three lags, based on the Schwarz Bayesian Criterion (SBC) and the minimal lag need for stability. Trace statistics and Maximal Eigen Value statistics are produced using the assumptions of a linear deterministic trend in data, intercept and trend in the cointegration equation, and no intercept in VAR.

According to SC lag selection criteria optimal lag 3 is detected. Then we run Johansen cointegration test. Cointegration method (Johansen, 1988, and Johansen and Juselius, 1990) is widely used in order to obtain long-run relationship among the series. According to the test, non-stationary series (obtained from unit root test process) are tested to establish long-run equilibrium among the series if there is any. Based on the Schwarz Bayesian Criterion (SBC) and the minimum lag requirement for stability, three lags is selected for all variables as the optimal lag length. With the assumption of a linear deterministic trend in data and intercept and trend in cointegration equation and no intercept in VAR, Trace statistics and Maximal Eigen Value statistics are calculated. The test result is presented as follows:

		Trace Statistics			Eigenvalue		
H <sub>0</sub>	H <sub>1</sub>	Statistics	Critical value	Probability	Statistics	Critical value	Probability
r=0	r=1	78.1501	47.8561	0.0000	44.8111	27.8561	0.0001
r≤1	r=2	33.6989	29.7971	0.0169	25.7710	21.1316	0.0103
r≤2	r=3	7.9279	15.4947	0.4731	6.0119	14.2646	0.6117

**Table:** Result of Johansen Cointegration Test

In the table 1, the null hypothesis of  $r = 0$ ,  $r \leq 1$ ,  $r \leq 2$  is tested against the alternative  $r = 1$ ,  $r = 2$ , and  $r = 3$  that is alternative is tested against zero, at least one and at least 2 cointegrating vectors. Null is rejected at the 5% level of significance for the tests  $r = 0$  and  $r \leq 1$  based on both the trace statistic and the maximum eigenvalue. The null hypothesis is then tested against the alternative of  $r = 3$ , which implies that there could be three cointegrating vectors. Because the null hypothesis cannot be rejected using either the trace statistic or the maximum eigenvalue statistic (the p value in both cases is more than 5%), the conclusion is that there are exactly two cointegrating vectors. Thus, the result of the trace statistic and the maximum eigenvalue statistic, existence of at least two cointegrating vectors is established.

To represent the short-term adjustment dynamics, the next step is to estimate the Vector Error Correction Model. Table 2 shows the final result. The ECM is made up of four equations, each of which has an adjustment coefficient. Export (X), which has a negative adjustment coefficient (-0.1632), is also significant in the Equation 1 (statistic is -3.1). When the error correction term, which represents the speed of adjustment towards equilibrium, is negative, it suggests that there is adjustment in the short run. As a result, the findings suggest that there is a short-run adjustment, indicating that the model is convergent to the long-run relationship.

	$\Delta EXP$	$\Delta EX$	$\Delta DGDP$	$\Delta WGDP$
ECT	-0.1632	0.0174	0.0614	-0.0174
SD	0.0467	0.0117	0.0034	0.0057
t-statistics	-3.4975	1.4814	1.8098	-3.0411

**Table:** Result of VECM

### ***Result of Variance Decomposition***

The proportion of the movements in the dependent variables that are due to their own shocks vs shocks to the other variables in the model can be determined using variance decomposition. A shock to one variable, such as export, will have a direct impact on that variable (export), but it will also be communicated to all other variables in the system (in this case, GDP and exchange rates) due to the dynamic structure of the Vector Autoregression (VAR). (C. Brooks, pp.342)

Table 1 (annex) shows the variance decomposition forecasts for the next ten years. The export variance decomposition analysis demonstrates that only the shock to export innovation explains the entire change in exports. Apart from its own shock, Bangladesh's IPI, which is a proxy for GDP of Bangladesh, accounts for around 1.17 percent of export shock after the first year period. The shock to export, as well as the exchange rate and DGDP, explain exchange rate innovation in the next year. During the ten-year period under review, the IPI of the United States, which is used as a proxy for global GDP, has had the least impact on export. The exchange rate accounts for 5.52 percent of export innovation in the tenth period, whereas DGDP contributes for 24.66 percent.

Export has a significant effect in explaining the change in DGDP, according to the DGDP variance decomposition study. From the first to the tenth period of consideration, export has an impact, but it is not greater than 2.9 percent (in tenth period). DGDP and WGDP have a negligible effect on the exchange rate and never cross 1% during the ten-year period under study.

### ***Granger Causality Test***

The test statistic confirms that the null hypothesis of exchange rate does not Granger cause export is rejected at a 5% level of significance. Furthermore, at a 5% level of significance, reverse causality is established, implying that there is a bidirectional correlation between Exchange rate and Export. Unidirectional casualty from export to domestic GDP (IPIBD), Exchange rate to foreign income (IPIUS), and Export discovered (Export Ganger causes the Domestic GDP and World GDP (IPIUS) and World GDP(IPIUS) to Export).

	$\Delta EXP$	$\Delta EX$	$\Delta DGDP$	$\Delta WGDP$
$\Delta EXP$	-	4.04042(0.0459)*	4.32454(0.0390)*	0.00197(0.9646)
$\Delta EX$	5.09584 (0.0252)*	-	2.42346(0.1213)	10.9685(0.0011)**
$\Delta DGDP$	2.95412(0.0875)	2.21794(0.1382)	-	0.00046(0.9830)
$\Delta WGDP$	4.72831(0.0310)*	0.13517(0.7136)	2.73639	-

**Table:** Pairwise Granger Causality Tests

**Note:** \*Statistical tool E-views has been employed for analysis.

\*\* denote rejection of null hypothesis of a unit root at 5 and 1% level of significance respectively.

## CONCLUSION

The impact of the exchange rate on export revenues is a critical topic since it affects a country's export competitiveness, macroeconomic stability, and economic growth. In this regard, the purpose of this work was to determine if currency appreciation has resulted in a loss of export competitiveness in the short and long run. We try to analyze the effect of the exchange rate on Bangladesh's exports using quarterly data from 1973Q3 to 2018Q2 using the Johansen cointegration technique as well as the VECM approach. The paper's estimated results show that the exchange rate has a strong negative effect on real export earnings in Bangladesh both in the long and short run. Over time, real devaluation/depreciation of the currency rate has been linked to an increase in real export revenues.

As a consequence, currency depreciation/devaluation appears to be positive to Bangladeshi exports as a whole (Marshall-Lerner condition holds). Economists, on the other hand, discourage continual depreciation since a highly volatile exchange rate makes macroeconomic factors like inflation, interest rates, and the narrow and wide money supply unstable. Because Bangladesh's exchange rate policy is based on a free-floating exchange rate system, a stronger official market is required to prevent speculators from bringing the currency market to a complete halt. It must also ensure a lower degree of exchange rate to inflation pass-through. Otherwise, Bangladesh's undervalued exchange rate strategy could be harmful to the country.

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## Appendix

Variance Decomposition of LN EXP:					
Period	S.E.	LN EXP	LN EX	LN IPI BD	LN IPI US
1	0.134792	100.0000	0.000000	0.000000	0.000000
2	0.173459	98.56959	0.230811	1.179172	0.020432
3	0.197470	95.70095	0.703681	3.533416	0.061953
4	0.215551	91.94233	1.337578	6.603014	0.117078
5	0.230755	87.78559	2.056230	9.979329	0.178850
6	0.244351	83.58632	2.802060	13.36955	0.242077
7	0.256908	79.56224	3.537880	16.59643	0.303448
8	0.268703	75.82552	4.242804	19.57053	0.361145
9	0.279881	72.41920	4.907044	22.25940	0.414352
10	0.290530	69.34590	5.527595	24.66365	0.462863

  

Variance Decomposition of LN EX:					
Period	S.E.	LN EXP	LN EX	LN IPI BD	LN IPI US
1	0.034622	0.908327	99.09167	0.000000	0.000000
2	0.047893	0.488290	99.47791	0.024014	0.009785
3	0.057576	0.406859	99.51404	0.049846	0.029252
4	0.065415	0.539955	99.33981	0.064671	0.055569
5	0.072088	0.807300	99.03873	0.067353	0.086621
6	0.077938	1.157803	98.65934	0.062019	0.120838
7	0.083167	1.559206	98.22918	0.054571	0.157040
8	0.087908	1.991189	97.76353	0.050955	0.194328
9	0.092252	2.440934	97.27066	0.056400	0.232007
10	0.096267	2.900309	96.75501	0.075156	0.269530

  

Variance Decomposition of LN IPI BD:					
Period	S.E.	LN EXP	LN EX	LN IPI BD	LN IPI US
1	0.092445	7.525045	0.006322	92.46863	0.000000
2	0.127969	9.447443	0.003736	90.54805	0.000772
3	0.153901	11.15158	0.004996	88.84016	0.003264
4	0.174883	12.61936	0.006419	87.36614	0.008082
5	0.192709	13.86295	0.006829	86.11461	0.015619
6	0.208294	14.90708	0.006321	85.06053	0.026071
7	0.222177	15.77983	0.005558	84.17514	0.039480
8	0.234708	16.50820	0.005391	83.43064	0.055769
9	0.246131	17.11631	0.006677	82.80223	0.074781
10	0.256624	17.62485	0.010189	82.26866	0.096302

  

Variance Decomposition of LN IPI US:					
Period	S.E.	LN EXP	LN EX	LN IPI BD	LN IPI US
1	0.016182	0.448597	1.158164	0.092040	98.30120
2	0.022679	0.392879	2.234365	0.684455	96.68830
3	0.027624	0.916259	3.431438	1.389879	94.26242
4	0.031747	1.616838	4.677074	2.061249	91.64484
5	0.035309	2.304599	5.938408	2.645487	89.11151
6	0.038442	2.901769	7.202040	3.133011	86.76318
7	0.041225	3.385246	8.463231	3.531815	84.61971
8	0.043718	3.756682	9.720629	3.855459	82.66723
9	0.045964	4.027762	10.97387	4.117954	80.88042
10	0.048000	4.213240	12.22256	4.331829	79.23237

Cholesky Ordering: LN EXP LN EX LN IPI BD LN IPI US

**Table 1:** Result of variance decomposition

Cointegrating Eq:		CointEq1			
LN_EXP(-1)		1.000000			
LN_EX(-1)		-1.331243 (0.18495) [-7.19794]			
LN_IPI_BD(-1)		-0.958777 (0.09786) [-9.79719]			
LN_IPI_US(-1)		0.456654 (0.45123) [1.01132]			
C		-0.138769			
Error Correction:		D(LN_EXP)	D(LN_EX)	D(LN_IPI_BD)	D(LN_IPI_US)
CointEq1		-0.163234 (0.04667) [-3.49751]	0.017420 (0.01176) [1.48142]	0.061383 (0.03392) [1.80977]	-0.017385 (0.00572) [-3.04106]
D(LN_EXP(-1))		-0.271004 (0.07341) [-3.69166]	-0.002383 (0.01850) [-0.12885]	-0.131442 (0.05335) [-2.46379]	-0.001912 (0.00899) [-0.21264]
D(LN_EX(-1))		-1.026572 (0.26771) [-3.83469]	0.376652 (0.06745) [5.58423]	0.025704 (0.19455) [0.13212]	-0.004006 (0.03279) [-0.12217]
D(LN_IPI_BD(-1))		0.207881 (0.10729) [1.93756]	0.021753 (0.02703) [0.80473]	-0.014829 (0.07797) [-0.19018]	0.016786 (0.01314) [1.2726]
D(LN_IPI_US(-1))		-0.133662 (0.58279) [-0.22935]	-0.712049 (0.14684) [-4.84928]	0.115161 (0.00772) [0.27190]	0.298881 (0.00139) [4.18688]
C		0.046170 (0.01062) [4.34661]	0.011187 (0.00268) [4.17990]	0.015661 (0.00772) [2.02874]	0.003061 (0.00139) [2.35236]
R-squared		0.220532	0.249787	0.047726	0.185376
Adj. R-squared		0.197873	0.227978	0.020044	0.161695
Sum sq. resid		2.734514	0.173586	1.444212	0.041027
S.E. equation		0.126089	0.031768	0.091633	0.015444

Table 2: Result of VECM

Group: UNTITLED Workfile: WORK FILE(EXCHANGE RATE, EXPORT)::Unti...  
 view Proc Object Print Name Freeze Sample Sheet Stats Spec

Pairwise Granger Causality Tests  
 Date: 09/20/21 Time: 21:58  
 Sample: 1 180  
 Lags: 1

Null Hypothesis:	Obs	F-Statistic	Prob.
LN_EX does not Granger Cause LN_EXP	179	5.09584	0.0252
LN_EXP does not Granger Cause LN_EX		4.04042	0.0459
LN_IPI_BD does not Granger Cause LN_EXP	179	2.95412	0.0874
LN_EXP does not Granger Cause LN_IPI_BD		4.32454	0.0390
LN_IPI_US does not Granger Cause LN_EXP	179	4.72831	0.0310
LN_EXP does not Granger Cause LN_IPI_US		0.00197	0.9646
LN_IPI_BD does not Granger Cause LN_EX	179	2.21794	0.1382
LN_EX does not Granger Cause LN_IPI_BD		2.42346	0.1213
LN_IPI_US does not Granger Cause LN_EX	179	0.13517	0.7136
LN_EX does not Granger Cause LN_IPI_US		10.9685	0.0011
LN_IPI_US does not Granger Cause LN_IPI_BD	179	2.73639	0.0999
LN_IPI_BD does not Granger Cause LN_IPI_US		0.00046	0.9830

Table 3: Granger Causality Test