

## **The Link between Real Exchange Rate and Export Earning: A Cointegration and Granger Causality Analysis on Bangladesh.**

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*This paper mainly aims to see whether there is any contribution of real exchange rate depreciation of Taka to export earning of Bangladesh. All the macroeconomic series used here are non-stationary, integrated at order one but not cointegrated. This is why the Granger Causality has been tested by vector autoregressive (VAR) model using the first difference forms of the series as suggested by Granger (1980, 1986, 2000) and Ben-Zion et.al. (1996). The finding shows no causality runs from real depreciation of Taka to export earning of Bangladesh. This finding substantiates among others the necessity of sub-sector-wise analysis of depreciation-export relation, comparing the effectiveness of various incentive policies for various sub-sector of export, increasing the share of local commodities in exportable etc. to mention a few. However, the negative impact of depreciation on some macroeconomic variables especially inflation in a poor country like Bangladesh should also be considered very seriously before going for devaluation or any policies that help depreciation.*

**Key Terms:** Unit root test, Cointegration, Error Correction Model, Vector Autoregression, Johansen Cointegration Test, Real Exchange Rate (RER), Nominal Exchange Rate (NER), Nominal Export Earning (NEXP), Real Export Earning (REXP).

### **1.0 Introduction**

Real Exchange Rate index is a good indicator of competitiveness of a country's exportable as it shows the price of the country's goods and services relative to the price of goods and services of other countries. A fall along the RER index means the country's products become relatively cheaper in comparison to the products of other countries and hence the demand for the country's export may increase. A depreciation in exchange rate also affects exporters' return positively making export more profitable which in-turn may encourage firms to increase volume of export. Given that the demand for export is price elastic, increase in export volume may lead to increase in export earning

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. Again many analyses show that depreciation may coincide with greater exchange rates volatility and uncertainty and such uncertainty may have adverse effects on export. Literature based on the impact of depreciation on export earning is not conclusive in results. Some show positive impact of depreciation on export earning while the others show virtually no impact of depreciation on export earning.

Bangladesh is a low-income third world country. Its achievement on economic ground since its independence on 16<sup>th</sup> December of 1971 has not been sufficient to satisfy a large portion of its huge population with even basic needs. Very few indicators are optimistic enough to foresight a shiny future with modest average income and fulfillment of basic needs. Though achievements are not significant enough, Bangladesh economy has gone through several major policy changes. Starting with economic policies dominated by socialist ideologies, it first jumped into market economy in late seventies when policies were reformulated in line with IMF-World Bank suggestions. Concurrently, export sector was also given a break-through with policies like reducing/demolishing ceiling on private borrowing and investments, export-led industrialization etc. Exchange rate management policy also experienced progressive changes. Since early eighties Bangladesh economy has marched towards free market economy with ever-increasing momentum gained from different policies taken time-to-time. Policies regarding exports and exchange rates have also been changed over time keeping pace with the ever-opening economic policies. Since independence, export earning of Bangladesh has increased and Bangladeshi Taka has also depreciated (or devalued) significantly. But how much contribution this depreciation has to the export growth of Bangladesh is not clear. Like literature on world context, literature based on Bangladesh context also shows contradicting results (Hossain, 2000).

Bangladesh has recently introduced free-floating exchange rate system (From 31<sup>st</sup> May, 2003). Intuitively, depreciation is expected to be more free and frequent under free-floating exchange rate regime than under any other regimes. Again, both the pattern and destination of our export have been changed significantly since near past. Infact, the global trade pattern has also been changed in this free-trade era. The empirical studies show that the relation between exchange rates and export varies due to economy, time period and extent being concerned, methodology applied etc. All these require a fresh insight into the depreciation-export relation in Bangladesh.

## 2.0 Literature Review

The existing literature on whether exchange rate depreciation favors export or not is clearly divided in results-economists with structuralist persuasion oppose the devaluation for its many bad consequences on economy while the IMF, World Bank economists are out to defend devaluation. The results also vary due to the economy concerned, technique used, extent considered etc. Arslan(1993), in his attempt to find

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out the causes of the Turkish miraculous export growth between 1980-87, which eventually helped Turkish growth recover rapidly from the debt crisis of late seventies, found exchange rate depreciations' robust role in export growth. Nabli and Marie-Ange(2002), showed that exchange rate overvaluation caused huge loss in the export of MENA(Middle Eastern and North African) countries by decreasing their export competitiveness. They stated -

*“For the MENA region as a whole, exchange rate policy explains losses in competitiveness and in manufactured exports. RER overvaluation has reduced on average the ratio of manufactured exports to GDP by 18 percent a year. Manufactured exports which averaged 4.4 percent of GDP from 1970 to 1999 could have reached 5.2 percent of GDP if no overvaluation had taken place. These losses were more concentrated in the 1970s and 1980s than in 1990s due to the higher overvaluation of the currencies during those two sub-periods.”*

Such optimism in favor of depreciation was also shared by Bayoumi(1999) and Thapa(2005). Bayoumi(1999), working on 21 industrial economies, estimated exchange rate elasticity of export beginning from 0.31 to 0.79 for a period of four years that showed a positive impact of depreciation on export. Thapa(2005) analyzing the data of Nepal found that depreciation of real exchange rate enhances international competitiveness of domestic good and boosts net export of Nepal. However many researchers did not find such (positive) impact of exchange rate depreciation on export. Telak & Yeok's(1998) findings may have more relevance for the small economies whose exports are highly dependent on imported raw materials and intermediate inputs. Analyzing the case of Singapore they showed that in the presence of high import content, exports are not adversely affected by a currency appreciation because the lower import price due to appreciation reduce the cost of export production.

Same result was found in Singapore by Fang.W. & Miller.S.M. (2004) but they put the things albeit differently; they showed that in Singapore depreciation doesn't significantly improve export but exchange rate risk (generated by fluctuation) significantly impedes export. They suggested that Singaporean policy makers better promote export growth by stabilizing the exchange rate rather than generating its depreciation. Similar emphasis on stability of exchange rate was given by Fang, Lai & Miller(2005) while they analyzed the relation between exchange rate depreciation and export in 8 Asian countries namely Indonesia, Japan, Korea, Malaysia, Philippines, Singapore, Taiwan and Thailand. They, though found depreciation's weak contribution to export growth, pointed out that such growth might be offset by exchange rate fluctuation that usually coincide with free-falling of domestic currency.

Devkota(undated) pointed out that an economy like Nepal whose export is dominated by imported raw materials and intermediate goods, depreciation might increase but cannot decrease the trade deficit. Literature based on Bangladesh context also differs in results but dominated by the pessimistic views that depreciation has little effect on export earning or on correcting trade balance. The conclusion of a study by CPD (Centre for Policy Dialogue)(1996) on Bangladesh context is as follows-

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*“What has been the impact of this real depreciation of taka on the growth of Bangladesh’s exports? We find it difficult to establish any positive relationship between change in the real exchange rate and the growth of exports by matching annual changes in these variables. Further, preliminary results from the application of Granger causality tests fails to identify any causality running from real exchange rate to exports. From these results we are led to argue that real exchange rate depreciation might not have played a significant role in boosting exports in Bangladesh.”*

Such a pessimistic view is supported by the low price elasticities found by many Bangladeshi researchers over the ages as reported in Hossain(2000). However, Hossain(2000) questioned their findings including the one by CPD in the ground that they had not taken time series properties of data into consideration and had not covered sufficient number of observation particularly after the beginning of trade liberalization in the 1980s etc. But he himself found Bangladesh’s export price inelastic. However he still defended devaluation-

*“---these estimates of price elasticities are however based on historical data that includes the 1970s when Bangladesh’s exports were dominated by a few low-price elastic primary goods. The exports tirade of Bangladesh is now dominated by non-traditional exports. As these exports have high price elasticities , devaluation may be effective in raising export earnings from them.”*

He in his attempt to disprove the view of many economists of the country that bad consequences of devaluation are more than its good consequences concluded that-  
*“The estimated values for the price elasticities of demand for export and import satisfy the Marshall-Lerner condition when trade is not initially balanced. This suggests that currency devaluation may be effective in improving the trade balance position of Bangladesh.”*

However, the literature based on Bangladesh has more or less three shortcomings-

- (a) Most of them have used price ratio(to test the export-price elasticity) instead of exchange rate as explanatory variable.
- (b) Most of them have not taken into account the time series properties of the variables.
- (c) Most of them have considered data up to mid nineties, but Bangladesh’s trade has significantly been changed since then.

All these shortcomings have been tried to over come in this literature and have been tried to see whether there is any relation between exchange rate depreciation and export earning in Bangladesh.

### 3.0 Description of the Variables

NER: Nominal Exchange Rate of Taka against US dollar.

RER: Real Exchange Rates of Taka against US dollar.

There are various definitions of real exchange rate. Real exchange rates have been derived for Bangladesh by multiplying nominal exchange rates of taka per unit of US dollar by the ratio of foreign price level to domestic price level. This definition of RER is

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widely used by the researchers because of its easy computability with readily available data. CPI has been used as domestic price while producers' price index of USA has been used as the proxy of foreign price.

$$RER = NER \times PPI^{USA} / CPI^{BAN}$$

Here  $PPI^{USA}$  is a rough proxy for world price of tradable while  $CPI^{BAN}$  is a rough proxy of domestic price of non-tradable. Thus this index can well be used to measure the international competitiveness of Bangladesh's tradable.

NEXP: Yearly nominal export earning of Bangladesh in million US dollar.

REXP: Real Export earning of Bangladesh found as dividing nominal export earning by GDP deflator.

### 5.0 Data Source

Yearly data between 1977-2005 have been retrieved from IFS, The IMF's International Financial Statistics Site.

### 6.0 Granger Causality Test

To confirm that the Granger causality results will not generate any spurious inferences, the unit root and cointegration tests are performed before conducting the causality test to measure the existence and direction of causality (Enders, 1995; Phillips, 1986, 1987). To test stationarity, unit root test has been performed using Augmented Dicky-Fuller taking appropriate assumptions on lags, trend and intercept. The matters that have been considered in choosing the lags are number of observations and power of test. The results of unit root test of the variables are as follows-

#### ADF Unit Root Test (Uniform LAG-1)

Null hypothesis: The variables are non-stationary.

Variables	ADF test-statistics	Variables	ADF test-statistics
RER	.77	DRER	-3.46**
EXP	0.07	DEXP	-3.68**
REXP	1.71	DREXP	-1.90*

\*\* & \* indicate rejection of null hypothesis of non-stationarity at 5% & 10% level of significance.

From the above table it is seen that the variables are non-stationary at level but stationary at first differences, i.e. they are  $I(1)$ . However integrated at order 1 does not necessarily mean that the series are cointegrated. For granger causality test it is important to know whether the variables are cointegrated or not as Engle and Granger (1987) pointed out that when a set of variables is cointegrated, a vector autoregression in first differences will be misspecified. The first differencing of all the nonstationary variables puts too many unit roots and any potentially important long-term relationship

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between the variables will be unclear. Thus, inferences based on vector autoregression in first differences may lead to incorrect conclusions (Granger, 1981, 1988 and Sims, *et al*, 1990). In such case, there exists an alternative representation, an error correction representation of such variables, which takes account of a short- and long-run equilibrium relationship shared by those variables. (Engle and Granger 1987, Wong, *et.al*, 2005). However if the variables are not cointegrated, one can adopt the VAR model to test for the Granger causality (Granger *et al* 2000). To test whether the variables are cointegrated or not, Johansen test of cointegration has been performed with appropriate assumptions on trends and lags.

### Cointegration between NEXP & RER

no.of cointegrated eq <sup>ns</sup>	Trace Statistics	5% critical value	Max-Eigen Statistic	5% critical value
r=0	18.70	25.32	10.92	18.96
r≤1	7.78	12.25	7.78	12.25

### Cointegration between REXP & RER

no.of cointegrated eq <sup>ns</sup>	Trace Statistics	5% critical value	Max-Eigen Statistic	5% critical value
r=0	20.93	25.32	12.07	18.96
r≤1	8.86	12.25	8.86	12.25

Both the tables show that we can't reject the hypothesis of 'no cointegrated equations' at 5% level of significance. So we can conclude that RER is not cointegrated with NEXP or REXP, in other words there is no long run relationship between RER and NEXP or REXP.

Granger proposed the Granger causality in 1969 to test whether one economic variable can help forecast another economic variable (Granger, 1969). Granger causality test is used to examine whether the past value of a variable series X, will help to predict the value of another variable series at present, Y, taking into account the past value of the Y (Granger, 1988). Specifically, Granger causality from X to Y is established when the coefficients of the lagged difference of X are found to be jointly statistically significant and therefore help explain and predict Y, over and above what the lagged differences of Y can predict (Yaqiong Li, Lihong Huang). Since the variables are non-stationary, integrated at order 1, but not cointegrated, the appropriate model for testing the Granger Causality will be a VAR model using first difference forms of the variables in the following form as suggested by Granger (1980, 1986, 2000) & Ben-Zion *et.al.* (1996.)

$$\Delta Y_t = \alpha_1 + \sum_{j=1}^n \beta_j \Delta Y_{t-j} + \sum_{j=1}^n \gamma_j \Delta X_{t-j} + \varepsilon_t$$

Where Y is REXP or NEXP and X is RER.

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The null hypothesis is  $\gamma_j = 0$  for all  $j$  versus the alternative hypothesis that  $\gamma_j \neq 0$  for at least some  $j$ . If the coefficient  $\gamma_j$  are statistically significant then  $X$  causes  $Y$ .

The results of Granger causality are very sensitive to the selection of lag length. If the chosen lag length is less than the true lag length, the omission of relevant lags can cause bias. If the chosen lag length is more, the irrelevant lags in the equation cause the estimates to be inefficient. (Bhattacharya & Mukherjee). To deal with this problem, Hsiao (1981) has developed a systematic autoregressive method for choosing optimal lag length for each variable in an equation. This method combines Granger causality and Akaike's Final Prediction Error (FPE), defined as the (asymptotic) mean square prediction error (Hsiao, 1981). However, here lags varying from 1 to 5 have been used with the assumption that lags more than 5 years may have little economic meaning or implication.

The results of causality tests are as follows.

Null Hypothesis: DRER does not granger cause DNEXP.

Lag	F-statistic	P-value
1	2.56	0.12
2	1.32	0.29
3	1.77	0.19
4	1.19	0.35
5	0.85	0.54

Null Hypothesis: DRER does not granger cause DREXP.

Lag	F-statistic	P-value
1	2.71	0.11
2	.93	.41
3	.84	.49
4	.67	.62
5	.68	.65

Both the tables show that we can't reject the null hypothesis at conventional level of significance at any lag. From here we can conclude that RER does not granger cause either NEXP or REXP.

## 7.0 Conclusion & Policy Implication

Devaluation or not devaluation, floating or not floating has been a matter of tag-of-war for long time between the fund-banks and the intellectuals with conservative disposition in third-world countries. One of the merits the advocates of depreciation of local currency commonly put forward is its contribution to increase export earning. In fact in

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the era of devaluation the authority in Bangladesh, like in many third world countries, used to place export as one of the foremost reasons of devaluing local currency against US\$. In this analysis, the result shows that no causality runs from depreciation of real exchange rate of Taka to export earning of Bangladesh. This result goes in line with the findings of CPD and many other Bangladeshi researchers over the years (as mentioned in Hussain,2000)who found Bangladesh's export price inelastic and depreciation of Taka does not have much impact on export. So, for Bangladesh's export to be price elastic, policies that help increase the share of domestic goods in exportable by the expansion of production base and that help diversification of the pattern of the export items should be prioritized. However, the impact of exchange rate depreciation might not be same for all sub-sectors of export. This is why the relation of exchange rate with various sub-sectors of export should be analyzed and considered separately. In addition, careful investigation of various incentive options is required to select an effective and pragmatic policy to support export. One policy may not fit all. Moreover, the bad impacts of depreciation on other sectors of economy should also be considered seriously before taking any policy that help depreciation.

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