International Journal of Economics, Commerce and Management
United Kingdom Vol. II, Issue 11, Nov 2014
http://ijecm.co.uk/ ISSN 2348 0386

RELATIONSHIP BETWEEN THE EXCHANGE RATE AND TRADE BALANCE IN BANGLADESH FROM YEAR 1973 TO 2011: AN ECONOMETRIC ANALYSIS

Chowdhury, Md. Niaz Murshed
Department of Economics, South Dakota State University, USA
md.niazmurshed.chowdhury@sdstate.edu

Khanom, Sharmina
Department of Economics and Banking
International Islamic University Chittagong, Bangladesh

Emu, Shamima
Department of Economics and Banking
International Islamic University Chittagong, Bangladesh

Uddin, Samim
Department of Economics and Banking
International Islamic University Chittagong, Bangladesh

Farhana, Poly
Deapartment of Economics, University of Chittagong, Bangladesh

Abstract

This paper attempts to identify the relationship between the exchange rate and trade balance in Bangladesh from year 1973 to 2011. This study uses Augmented Dickey Fuller (ADF) Unit Root Tests, Co-integration techniques, Engle-Granger test, and some other diagnostics test like Multicollinearity test, Normality test, Chaw test, Lagrange Multiplier serial Auto-correlation test and Rumsey's RESET model specification test and so on. The main findings of this study are: (i) relationship exists between trade balance and exchange rate. Other important variables that determine trade balance such as domestic income shows a negative relationship between trade balances, foreign income shows a long run positive relationship and another important factor foreign asset has also positive impact on trade balance dynamics (ii) the real exchange rate is an important variable to the trade balance, and devaluation will improve trade balance in the long run, thus consistent with Marshall-Lerner condition. The coefficients are found to change smoothly like exchange rate, foreign asset and growth of domestic and foreign GDP has a significant impact on trade flows. Drawing inferences from these findings, it can be suggested that increase of exchange rate and foreign asset can keep highly substantial and feasible roles to make Bangladeshi product competitive in world market.

Keywords: Exchange rate, Trade balance, Growth of Domestic, Unit root test, Granger Causality

INTRODUCTION

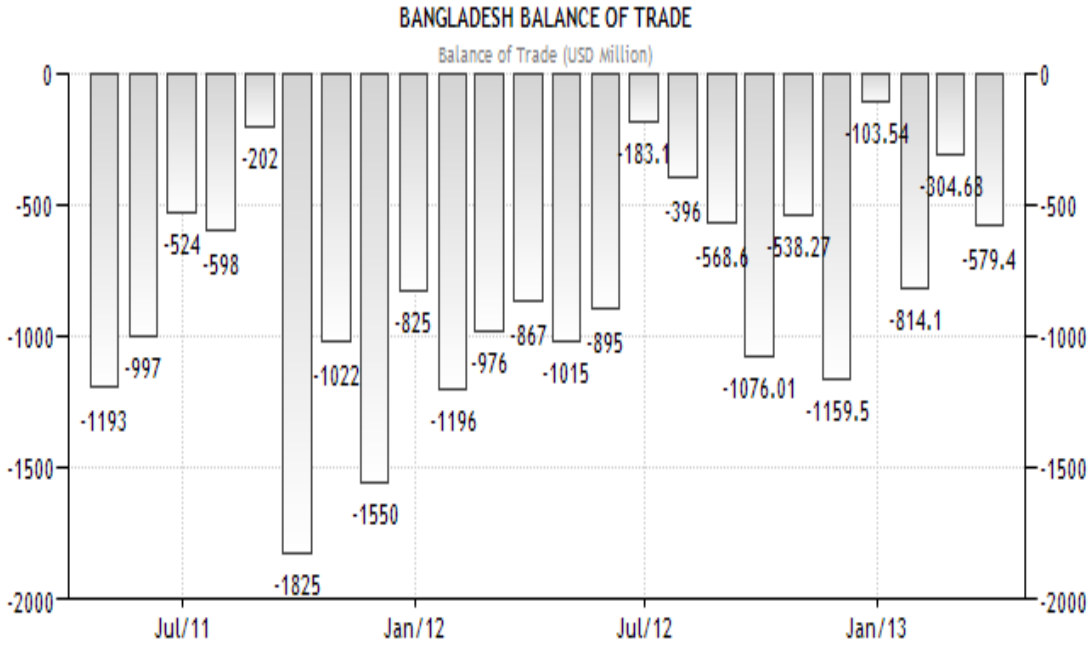
As a macroeconomic policy instrument exchange rate plays a vital role on determining the route of balance of trade. It is a great controversy whether a country like Bangladesh follow the traditional way of devaluation of its own currency to increase balance of trade through healthy view of export or not. However, where balance of trade expresses the difference between export and import of a country and it is treated as the largest component of countries balance of payment. A country has a trade surplus when its export exceeds its import and the opposite scenario is a trade deficit. Nevertheless, trade deficit does not always gives a bad sign as it may help the economy during the expansion of business cycle which limits inflation, provides goods beyond the country's ability to meet supply.

Bangladesh experienced deficit on balance of trade since a long time. Finally, the decision come that she follows floating exchange rate and the scenario has been changed. Bangladesh devaluated its currency (taka) several times to make an improvement on balance of trade. However, the improvement of trade balance due to devaluation of currency mostly depends on Marshall-Lerner condition that states that a real devaluation improves the balance of trade if export and import volume are sufficiently elastic with respect to the real exchange

rate. More specifically, by raising the relative price of imports, devaluation reduces the volume of imports in domestic currency with price elastic import demand and increases export volume (more than the fall in the price of exports) by lowering the relative price of exports in foreign currency with price elastic foreign demand for exports.

The balance of trade is the difference between the monetary value of exports and imports in an economy over a certain period. A positive balance of trade is known as a trade surplus and occurs when value of exports is higher than that of imports; a negative balance of trade is known as a trade deficit or a trade gap.

Figure 1: The recent Trade Flow of Bangladesh.



Source: Bangladesh Bank

Bangladesh recorded a trade deficit of 579.40 USD Million in March of 2013. The Bangladesh Bank reports balance of Trade in Bangladesh. Historically, from 1972 until 2013, Bangladesh Balance of Trade averaged -1161.69 USD Million reaching an all time high of -56.40 USD Million in August of 2009 and a record low of -5370.60 USD Million in June of 2008. Bangladesh exports mainly readymade garments including knit wear and hosiery (75% of exports revenue). Others include Shrimps, jute goods (including Carpet), leather goods and tea. Bangladesh main exports partners are United States (23% of total), Germany, United Kingdom, France, Japan and India. Bangladesh imports mostly petroleum product and oil, machinery and parts, soya bean and palm oil, raw cotton, iron and steel and wheat. Bangladesh main imports partners are China (17% of total), India, Indonesia, Singapore and Japan. Sometimes the central bank or

monetary policy authority of Bangladesh depreciate or appreciate to improve the domestic income by improving balance of trade like other countries. Depreciate and appreciate their exchange rate year by year.

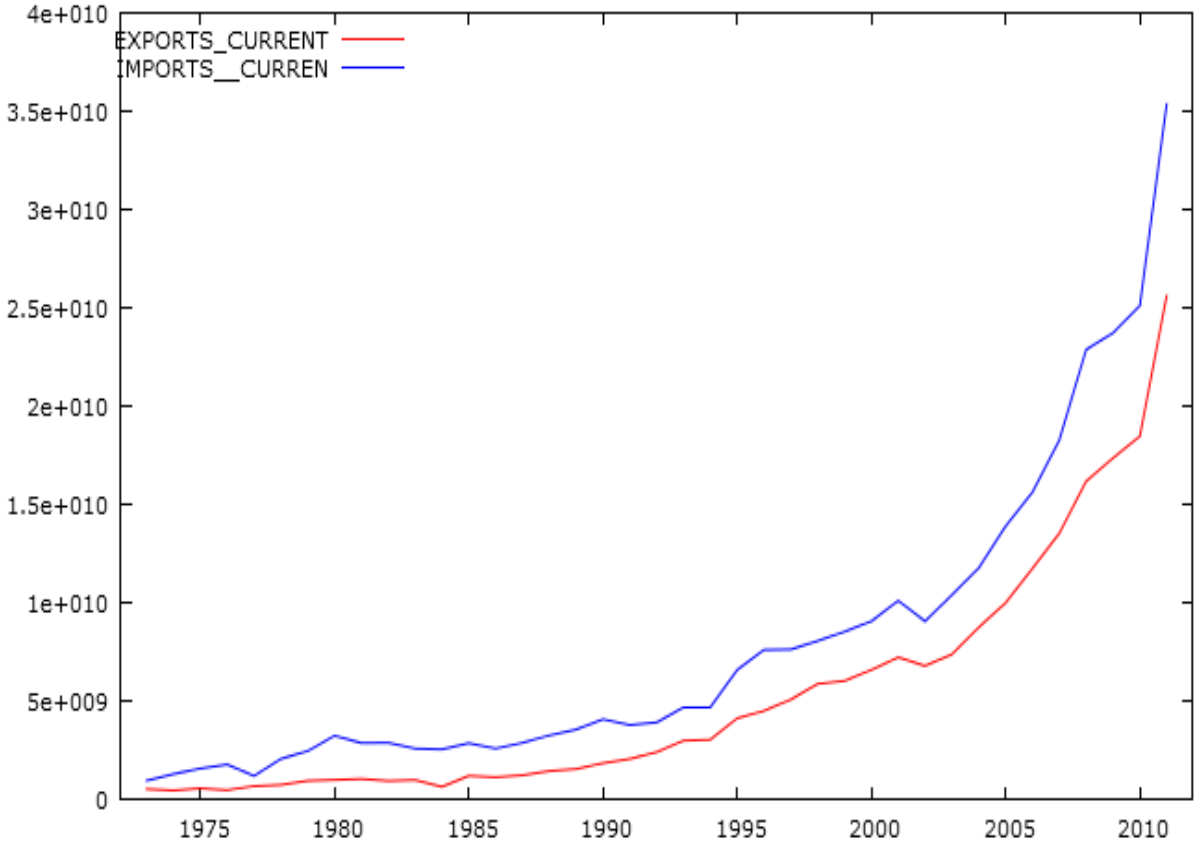
A number of factors such as exchange rate changes, monetary and fiscal policies, domestic and foreign income growth, supply shocks, and competitiveness determine the trade balance of a country. This study focuses mainly on the exchange rate changes, domestic and foreign incomes. The real exchange rate is an important determinant of exports and imports of a country since it represents the rate at which the domestic goods and services that can be exchanged with the output produced by foreign countries. A depreciation of exchange rate, for example, will spur the demand for domestic exports as foreigners find that they are able to purchase more of considered countries' goods with the same amount of their exports since their imports have become relatively cheaper. On the other hand, the consumer of considered countries will find that their imports have become more expensive and therefore they may reduce the purchase of foreign goods and increase the consumption of domestic substitute goods. This suggests that real exchange rate depreciation affects trade balance, which in turn has a direct positive impact on the exportable and importable industries in the domestic economy creating more jobs and income for the citizens.

According to the others, we have an intention in determinant of trade balance. The main purpose of our study is to find the actual effective factors of balance of trade of a country. Fiscal and monetary policy of a country is influenced by balance of trade. As a result, determinants of trade balance play vital role to policy makers. A list of examined determinates may make easy to take an appropriate policy for trade balance oriented economic development. Determinants vary according to country type, so the main objective of this study is to focus on the determinants of balance of trade and their impact. More specifically the study hubs of the following objectives:

- Study the dynamic relation of trade balance of Bangladesh.
- Study the trend of trade balance and their determinants for Bangladesh from the year 1973 to 2011.
- Design a regression model to analyze the relationship between trade balance and its determinants.
- At the same time, we try to find out the strength of various factors which influence the trade balance of Bangladesh.
- Analyze the exchange rate whether it is appreciate or depreciate and how it stimulates the bilateral trade between Bangladesh and USA.
- Some policy measures for the overall improvement of trade balance based on empirical results.

Historically Bangladesh passed a very critical period immediate after our liberation war. After the born of “People’s Republic of Bangladesh”, Bangladesh government took a highly regulated fiscal and monetary policy to reform the country. Government followed import substituting policy and over valuate exchange rate system. One of the most important reasons of government strict intervention in the economy is that, capital formation is insufficient with regards to the whole economy. Gradually Bangladesh has undergone deep and radical changes in to achieve a high and sustainable growth under the financial liberalization and reform policies since 1980’s and start to follow out-ward linking trade policy. However, the trend of export and import or on other words, the balance of trade (1973-2011) can be shown in the following figure:

Figure 2: Export (current US$) and Import (Current US$) trend (balance of trade) of Bangladesh.



Source: World Development Indicator (WDI), World Bank

The above figure shows that import always exceeds the export of Bangladesh and the practice is still going.

LITERATURE REVIEW

Numerous studies attempted to estimate short run and long run relationships between trade balance and its determinants in different countries applying different theoretical and methodological constructs. In this section, some of these studies are summarized in terms of their methodologies and findings in the basis of publishing year.

Gafar (1981) conducts a study to find the effects of devaluation on the balance of payments of Jamaica and he finds that the Marshall-Lerner condition for exchange rate stability is satisfied, implying that devaluation is an effective adjustment of trade balance. On the other hand, Ogbonna (1982) analyzes the 1973 devaluation of the Naira (Nigerian currency) in Nigeria's balance of payments and he concludes that devaluation fails to improve the balance of payments. Briguglio (1989) investigates to see whether a decrease in the external value of the Maltese Lira would improve the Maltese balance of trade. The estimates of export and import demand price elasticities indicate that the Marshall-Lerner condition is satisfied and therefore devaluation would improve trade balance. Rose (1990) also examines the empirical impact of the real exchange rates on trade balance of several developing countries using the three-stage least squares and he finds that there is little evidence to show that their trade balances are significantly affected by the real exchange rates. Rose (1991) estimates directly the responsiveness of the trade balances of five OECD countries to real exchange rates in the post Bretton Woods era using a number of techniques and he concludes that there is little to support the view that real exchange rates affects the trade balance.

Bahmani-Oskooee (1991) conducts a study on the long run relationship between the trade balance and the real effective exchange of eight LDCs, using quarterly data over 1973-1988 employing the co-integration analysis. The results suggest that the trade balance and real effective exchange rate are co-integrated and that in the long run devaluation improves the trade balance of most LDCs under study. In another study, Bahmani-Oskooee (1998) estimates the long-run trade elasticities for a group of LDCs, namely Greece, Korea, Pakistan, the Philippines, Singapore and South Africa. The study also employs cointegration technique, using quarterly data over the floating exchange rate period of 1973I-1990IV. Boyd, Caporale and Smith (June 13,2001) investigate how Real Exchange Rate effects on the Balance of Trade and in this case they used Quarterly data of 8 OECD country. They use structural co-integrating Vector Autoregressive Distributed Lag (VARDL) models for domestic and foreign output, the balance of trade and the real exchange rate to compute the effects of the real exchange rate on the balance of payments. By using three econometric model: VAR, VARDL, ARDL, finally they suggest that devaluation can play a vital role to improve the trade balance of investigated countries. A.K. Lal and T.C. Lowinger (22 March, 2002) scrutinize nominal effective exchange

rate and trade balance adjustment in five South Asian Countries: Afghanistan, Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan and Srilanka and use quarterly data from 1985Q1 to 1998Q4.Finally from the estimation they represent that in the long run estimated countries can be benefited by depreciation and can be improve their trade balance. They also find the existence of J-curve in the estimated five South Asian Countries.

Using cointegration test, Hatemi and Irandoust's (2005) study showed Sweden did not satisfy Marshall-Lerner condition. This might be due to the trade balance in Sweden is not sensitive in real exchange rate but only sensitive in changes in income.IMF (2006; approved by Mark Allen) analysis on Exchange Rate and Trade Balance Adjustment in 46 Emerging Market Economics suggests several important conclusions. This paper focuses on the average impact of a nominal exchange rate change on the trade balance. A country's trade balance significantly depends on the elasticity of export demand or the nature of the differentiated export products with a negatively sloped demand curve. Export volume and pricing-to-market elasticity tend to be quantitatively small, so most of the response of trade balance comes from the behavior of imports. The impact of an exchange rate change depends on the initial trade balance; given the price elasticity of import is greater the price elasticity of export and the country export more than its import, when the Marshall-Learner condition governing depreciation in nominal exchange rate will improve the trade balance in term of foreign currency. If the countries have a larger trade surplus than a less likely or a smaller of an exchange rate movement on trade balances.

Ng Yuen-Ling, HarWai-Mun, Tan Geoi-Mei, examined the relationship between exchange rate and trade balance in Malaysia for the period 1955 to 2006. They found on their study that the rear exchange rate and the domestic income has a positive relationship with the trade balance, but the foreign income (USA as foreign country) has a negative relation with trade balance, which is as the same theory developed in economics. Finally, they suggested adopting import-substitution policy, which may work better than the devaluation-based policy in improving domestic income and trade balance.

SHAO Ziwei (2008) examined the most important economic factors that manipulate the bilateral trade balance between Japan and the US. Ziwei's study include the net foreign asset position, and come up a decision that there is no significant long run relationship between exchange rate and trade balance, but in short run, Japan's trade balance is positively connected with exchange rate. Aziz (2008) paper examined the empirical relation between real exchange rate and trade balance of a developing country-Bangladesh. Aziz's study depicts, the real exchange rate has a significant impact on balance of trade of Bangladesh both in the short and the long run. The aim of the study by Jorge Carrera1 and Romain Restout (2008) was to determine what factors influence real exchange rates in nineteen Latin American countries over

the 1970-2006 period and through theoretical literature author found out six traditional fundamentals: the Balassa-Samuelson effect, government spending, the terms of trade, the country's openness to international trade, foreign capital inflows and the net foreign assets positions. In this study author followed the methodology proposed by Coudert and Dubert (2005) to identify the de facto regime. The study investigates that all these determinants has strong potential effect on real exchange rate whereas an increase in trade openness leads to an depreciation of the real exchange rate.

Khatoon and Md.M.Rahman (June 2009) work on the context of Bangladesh and twenty major trading partners of Bangladesh. They use the data from 1972 to 2006. They used co-integration techniques to estimate long run relationship and in short run estimation they use Vector Error correction model. Johansen Test for Co-integration shows in the long run a positive relationship of trade balance with devaluation of exchange rate and foreign income and negative relationship with domestic income. In short run there is a positive relation in between with trade balance and devaluation of currency in Bangladesh.

David and Guadalupe (2006) tried to investigate the above fact in Argentina for which they used multivariate co-integration tests for non-stationary data and vector error correction models. After investigating last forty to fifty years data investigation confirms the existence of long-run relationship among trade balance, real exchange rate and foreign and domestic incomes for Argentina during different real exchange rate management policies. Author also tried to check the Marshall-Lerner condition where they found that Ml condition is fulfilled in the periods including fix exchange rate regime policy but not in those when exchange rate has shown more flexible policies.

Osman and Sarmidi (2012) in their study mainly focused on exchange rate deviation, as the right choice of exchange rate regime can give a stable economy .In this paper author tried to investigate the long run relationship between exchange rate deviation and trade balance in the Gulf Co-operation Council (GCC) member countries. To show the deviation in exchange rate, author in this study used purchasing power parity model (PPP), through which an empirical identification was that the currency of Saudi Arabia ,Kuwait and Qatar at most of the time are overvalued the exchange rate but Bahrain and Oman are on the opposite. In this study we can see that all GCC members' countries are enjoying positive trade balance. Using two step Engel granger Co-integration technique author find the long run significant relationship between the exchange rate deviation and trade balance but not in short run.

METHODOLOGY

Any empirical model, in order to be relevant, should harbor two distinct characteristics:

- It will need to capture the equilibrium relationships among the variables; and
- It will need to capture the adjustment to equilibrium following a shock.

That is, a combination of modeling equilibrium and dynamic adjustment is important for an empirical analysis.

We have used annual time series data for the period of 1973-2011 for the five variables, Official exchange rate (LCU per US$, period average), per capita GDP in PPP dollar for domestic and foreign country (USA), Foreign Reserve asset. Data in this study has been used widely from the secondary sources. All the figures that were used in this study were collected from the following publications. Bangladesh Bank annual report, published by Bangladesh Bank. Bangladesh Economic Survey, various issues, published by the ministry of finance. Economic trends (monthly), published by the statistical department of the central bank of Bangladesh, official website of the central bank, ministry of finance and export promotion Bureau of Bangladesh. Statistical Year Book, Published by the Bangladesh Bureau of Statistics. The world economic outlook 2012, published by International Monetary Fund. Asian Development Bank (ADB) database. World Bank databank (World Development Indicator, WDI), official website of World Bank. In addition, We have also checked published books on economic issues, working papers, reports, research monographs, journals and research works that are relevant to the study.

In evaluating the effects of devaluation on the trade balance it is now a common practice to link directly the trade balance and the exchange rate. Following Dornbusch (1980: 58-59) and Rose (1990), we assume the domestic economy produces only exportable and consume both exportable and importable. The nominal trade balance, T, in terms of domestic currency is written as

$$T = P.\ X - NER\ P^*.\ M \qquad \text{---------- (1)}$$

Where X is the quantities of exports, P is the price of exportable goods, M is the amount of imports, P* is the price of imports in foreign currency, and NER is the nominal exchange rate expressed in domestic currency per unit of foreign currency.

If we denote real exchange rate (RE) instead of nominal exchange rate the export and import function stand

$$X = X\ (NER, Y^*) \qquad \text{---------- (2)}$$

Where Y* is the foreign income. The import demand is

M = M (NER, Y) ---------- (3)

Where, Y is the domestic income. Substituting equations (2) and (3) into the trade balance

Equation (1), we obtain the reduced form trade balance equation as

TB = X (NER, Y*) - M (NER, Y)

So,

TB = TB (NER, Y, Y*)---------- (4)

Econometric model of Trade Balance

The modeling the trade balance in this paper follows similar equation chosen from Shirvani and Wilbratte (1997), Baharumshah (2001), Gomez and Alvarez-Ude (2006), which emphasized in exchange rate on bilateral trade balance evidence.

To be more analytical and sophisticated understanding we will use Multivariable Ordinary Least Square Regression Model (MOLSRM) that may be like below

$\widehat{TB}_{1t} = \hat{\beta}_0 + \hat{\beta}_1 NER_t + \hat{\beta}_2 Y_t + \hat{\beta}_3 Y_3^* + \varepsilon_t$…….. (1)

$\widehat{TB}_{2t} = \hat{\beta}_0 + \hat{\beta}_1 NER_t + \hat{\beta}_2 Y_t + \hat{\beta}_3 Y_3^* + \hat{\beta}_4 Fa_t + \varepsilon_t$…….(2)

$\widehat{TB}_{3t} = \beta_0 + \hat{\beta}_1 NER_t + \hat{\beta}_2 Y_t + \hat{\beta}_3 Y_3^* + \hat{\beta}_4 Fa_t + \beta_5 \widehat{TB}_{2t}^2 + \varepsilon_t$…….(3)

Here,

TB_t = Trade balance= difference of log export and log import, NER_t = Nominal exchange rate, Y_t = Domestic income, Y_t *= Foreign income, Fa_t = foreign Assets, $\widehat{TB_t^2} = \beta_1 NER_t^2 + \beta_2 Y_t^2 + \beta_3 Y_t^{*2} + \beta_{4,} Fa_t^2$ β_i = constant coefficient ε_t =Residual Term

A regression model analysis is undertaken to determine the factors affecting trade balance. To get more fitted regression model we have run three individual model. We identify the three models as Model 1, Model 2, Model 3.

The more detailed model listed following.

Model 1:	*Measures the effect of Nominal Exchange Rate, Domestic GDP,and Foreign GDP on Trade Balance.*
Model 2:	*Measures the effect of Nominal Exchange Rate, Foreign Asset, Domestic GDP, and Foreign GDP on Trade Balance.*
Model 3 :	*Measures the effect of Nominal Exchange Rate, Foreign Asset, Domestic GDP, Foreign GDP and Fitted Trade Balance square on Trade Balance.*

In order to figure out the determinants of trade balance in Bangladesh, this empirical analysis used the Log Linear Model as method. We have Collected the sample period for investigation in 1973-2011 the empirical analysis of this study employed annual secondary data, collected from different sources, which is time series data. Most of the series are non Stationary with and without trend. So for validity of regression we have applied unit-root test to check stationary. To test the co-integration of variables, Engle Granger residual based co-integration approach is used since we got same integration order. Our empirical analysis can be divided in three stages. The first stage, we used ADF unit root test to test the stationary. In the second stage, the test for co-integration is conducted using Engle and Granger (1987) procedure that is verifies the order of integration of the variables since the various co integration tests are valid only if the variables have the same order of integration and in the final stage, we operate different diagnostics tests for the better modeling. In testing particular function, attention will be given in following criteria.

1. Parameter estimates with an algebraic sign consistent with a priory expectation.
2. Non-autocorrelation residuals are shown by *Lagrange Multiplier Test (LM Method)* statistics.
3. Confidence interval for the parameter not wide enough to conclude zero at a reasonable level.
4. For testing Heteroskedasticity we have used the *White Heteroskedasticity* test.
5. For test the Multicollinearity we have used *auxiliary regressions*.
6. To test the structural change of the model we have used the *Chow test*.

7. Percentage of variation in each function explained by the explanatory variables as indicated by the simple coefficient of determination (R^2) as well as the adjust coefficient of determination ($\overline{R}^2$).
8. To test the normality we have used *Jarque-Bera* test and Normal visualization procedure.
9. For testing specification error we have used the *Ramsey's RESET test*.

EMPIRICAL ANALYSIS

Test for stationary

The foundation of time series analysis is stationarity. Trends or other non stationary patterns in the level of a series can result in positive autocorrelation that dominate the autocorrelation diagram. Therefore, it is important to remove the non stationarity One way of removing non stationarity is through the method of differencing. Unit Root test has been conducted to find out the stationarity of the time series. For the unit root test of time series the method being used is the Augmented Dickey Fuller Test (ADF). The null is:

Ho: *the time series have unit root;*

Ha: *the time series does not have unit root;*

The decision rule here is if and only if the "P-value from ADF test > .05" then null (Ho) is accepted. Otherwise, the null hypothesis will be rejected. We apply ADF-test to trade balance, Nominal Exchange rate, domestic GDP and foreign GDP, separately. We get all the series are non-stationary (has a unit root) at their level form both in 'with trend' and 'no trend', except trade balance which is stationary at its level with trend. Then we test the stationary of the first difference and find all the series are stationary both in with trend and in with no trend. All these results are shown in the table 1.

Table 1: Tests for order of Integration

Augmented Dickey Fuller Test (ADF)				
	Test for I(0)		Test for I(1)	
Series	No trend	With trend	No trend	With trend
LnTB	-0.662954	-5.415689	-5.869870	-5.735005
NER	-0.811570	0.7376	-6.363493	-4.034977
GDP	-0.811570	-1.672295	-3.721747	-9.339060
GDPUS	1.555709	0.7509	-3.512516	-4.104299
Fa	0.8483	0.5738	-5.431964	-5.408814

Critical value of $t_{0.05} = \pm 2.967767$

Regression result

We have run three individual models keeping in mind the model specification. Especially we emphasize on the goodness of fit and connotation of explanatory variables. Here we tried to ignore insignificant variable that rarely influence the trade balance and add those variables as explanatory that significantly influence the trade balance. In addition, we take a model that is best fitted and its regressors are significant. The findings of the model and analysis is denoted following.

Model 1 Regression Estimation

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Constant	-0.482873	0.152167	-3.173319	0.0031
NER	4.467169	2.067330	2.160840	0.0376
Y	-0.001270	0.000359	-3.536580	0.0012
Y*	2.25E-13	4.14E-14	5.427558	0.0000
R-squared	0.811497	Adjusted R-squared		0.795340
F-statistic	50.22460	Durbin-Watson stat		1.132662
Prob(F-statistic)	0.000000	Independent Variable is LnTB		

In the model 1 our findings imply that the three factors nominal exchange rate domestic GDP (income) and foreign GDP have influence significantly. The nominal exchange rate and foreign GDP positively help to improve trade balance of a country. Nevertheless, trade balance negatively affected by domestic income. Our adjusted R-squared indicate that three considered variables can explain 81.15% dispersion of Trade balance variability. Introducing another explanatory variable known foreign asset we can improve our model. In this regard, we have tried to run Model-2 that may explain more significantly the variability and flows of Trade balance. The findings from E-Views are following:

Model 2 Regression Estimation

Variable	Coefficient	Std. Error	t-Statistic	Prob.	significant
Constant	-0.668918	0.130940	-5.108571	0.0000	
NER	7.123135	1.788811	3.982049	0.0003	
FA	0.069005	0.015867	4.349110	0.0001	***
Y	-0.002222	0.000365	-6.087672	0.0000	
Y*	2.92E-13	3.71E-14	7.879506	0.0000	
R-squared	0.878879	Adjusted R-squared		0.864629	*** means
F-statistic	61.67775	Durbin-Watson stat		1.368456	significant in 1%
Prob(F-statistic)	0.000000	Independent Variable is LnTB			level of signicant

The finding indicates that the intercept of the model is negative. Introducing of foreign asset series in the model specification has been improved than previous. As our model is Log- linear the explanation will varies to others. At this point, all explanatory variables are significant in 1% level of significance and all t-statistics can include the critical value. The sign of the parameter indicate that is a positive impact of nominal exchange rate, foreign asset and foreign GDP on trade balance but negative impact of domestic income. The result indicate that devaluation of the currency, growth of foreign asset and foreign income can improve the trade balance of a country but progress of a country in income turn down the trade balance by impacting on import demand. The log-linear model-2 shows that these four variables could independently explain about 87.89 percent of the trade balance movements of Bangladesh. The value of Durbin-Watson statistics insinuates that our model is free from spuriousness of model specification. F-statistic and Prob(F-statistic) points toward overall significance of the Model.

*BT = -0.67 + 7.12NER + 0.069FA - 0.0022Y + 2.92e-13Y**

In our model we got negative magnitude of intercept and coefficient of domestic income. if we devaluate taka in rate of $1 the trade balance will improve in 712% as we consider exchange rate in USA dollar it is natural. The one taka growth of foreign asset and foreign income implies 6.9% and 2.92e-11 percentage improve if trade balance of Bangladesh. Theoretically, domestic income induces the import demand of a country. Bangladesh is not exception in this regard. Increase of domestic income in one taka reduces the trade balance at 0.22% in Bangladesh. By taking this model as final we have introduce few diagnostic tests of the model-2 that are designated following.

Co integration test

Economic theory often suggests that certain pairs of economic or financial variables should be linked by a long run economic relationship.

Even if the five variables series, individually are I(1), it may be possible that a linear combination of the five variables may be stationary. If we are modelling a log-linear relationship among the variables series, even if each of them individually are non-stationary (i.e. I(1)), as long as they are co-integrated, the regression involving the five series may not be spurious. Thus, we now investigate whether the five series are co-integrated and have a long run equilibrium relationship. We can employ the Engle and Granger (1987) procedure, which is based on testing for a unit root in the residual series of the estimated equilibrium relationship by employing the Augmented Dickey-Fuller test. Therefore, the null and alternative hypotheses are:

H_0: *The residual series has a unit root.*

Rejection of the null hypothesis would mean that the exchange rate, Domestic GDP, foreign GDP, foreign asset and trade balance series are co-integrated. The results are presented in below and clearly show that all the residual series from considered model are stationary and hence the variables are co-integrated, indicating that there is long-run equilibrium relationship among exchange rate, Domestic GDP, foreign GDP, foreign asset and trade balance series are co-integrated.

Table 2:test for co-integration of all the variables series

Model Residuals	Data based value of the test statistic	Critical value at 5% level	Results
Constant and trend	-5.2383	-2.943427	Reject H_0
Conclusion	The residuals series does not have a unit root. Hence exchange rate, Domestic GDP, foreign GDP, foreign asset and trade balance series are co-integrated.		

Granger Causality Test for Series

Table 3: Granger Causality Test

Pair wise Granger Causality Tests			
Sample: 1973-2011			
Lags: 1			
Null Hypothesis:	Obs	F-Statistic	Prob.
EXC does not Granger Cause BT	38	26.0144	1.E-05
BT does not Granger Cause EXC		0.09096	0.7647
FA does not Granger Cause BT	38	0.05307	0.8191
BT does not Granger Cause FA		1.13807	0.2934
GDP does not Granger Cause BT	38	4.30344	0.0455
BT does not Granger Cause GDP		0.02984	0.8638
GDPUS does not Granger Cause BT	38	13.3575	0.0008
BT does not Granger Cause GDPUS		0.71346	0.4040

Here we have take one lagged and we can soundly reject null hypothesis of BT is not Granger caused by some explanatory variable like exchange rate, domestic GDP, Foreign GDP. Foreign asset in addition with other explanatory variables is granger caused balance of trade but not individual. There is no Granger causality of Balance of trade on considered explanatory variables.

Spuriousness Test of the Model

Yule first discovered spurious model. According to Granger and Newbold, and R-square>Durbin-Watson, d is a good rule of thumb to suspect that the estimated regression is spurious.

Table 4: Spurious Test

Model	R-Square	Durbin-Watson
Constant and trend	0.878879	1.368456
Conclusion	The model is not spurious	

Other Diagnostic test

Test For Multicollierity

We have run an auxiliary regression for exc, according to the above discussion.

$$NER_t = \hat{\beta}_3 + \hat{\beta}_4 Y_t + \hat{\beta}_5 Y_3^* + \hat{\beta}_6 Fa$$

Table 5: Multicollinearity test (Auxiliary regressions)

Model	Expected R^2	Artificial Model R^2	Decision
	0.80>	0.755803	Absence of Multicollinearity
Conclusion	Therefore, 0.755803<0.80. We see that our artificial model R^2 is less than 0.80.So; we can conclude that there is no presence of Multicollinearity.		

Test for Autocorrelation: In this regard we will use Lagrange Multiplier Test (LM Method). The general version is to estimate the equation is:

$$TB_t = \hat{\beta}_0 + \hat{\beta}_1 NER_t + \hat{\beta}_2 Y_t + \hat{\beta}_3 Y_3^* + \hat{\beta}_4 Fa + \rho \varepsilon_{t-1} + V_t$$

Here, the test for the null

$H_0 : \rho = 0$; *There is no serial autocorrelation*

Table 6: Serial Autocorrelation test (Lagrange Multiplier test)

Model	F-Calculated value	Critical value at 5% level , $F_{(1.33)}$	Results
Constant and trend	1.9295(prob=0.17)	2.545 (prob=.05)	Accept H_0
Conclusion	Therefore, F-critical > F-calculated. Evidence does not support to reject the null hypothesis, thus we can say that null hypothesis of “there is no serial autocorrelation” is accepted. That is there is no serial autocorrelation in our model.		

In presence of autocorrelation, Hetaroskedasticity and Autocorrelation Consistent (HAC) standard errors or Newey-West approach can be applied to obtain the correct standard error. HAC standerd errors are rather larger than the incorrect standard errors. This implies if autocorrelation is not taken into account, the reliability of usual least square estimates would be observed.

Test for Heteroskedasticity (White Heteroskedasticity test):

The likely variability in the variance of random error is known as hetaroskedasticity. One of the assumptions of least square estimation is the consistency of error variance but if the assumption is violated then the OLS will no longer have all desirable qualifications.

Table 7: Test for Heteroskedasticity

	Obtained χ^2 (n*R^2)	Critical value at different significant level.	Decision
Model		23.6848(5%)	No Heterskedasticity
	21.84765	21.06(10%)	No Heterskedasticity
		26.1189(2.5%)	No Heterskedasticity
		29.1412(1%)	No Heterskedasticity
Conclusion	Obtained χ^2< Critical value ofχ^2. So, our model is free from at 5%, 2.5% and 1% level of significance, but not in 10%. Finally, we can conclude that there is no Heteroskedasticity.		

Chow Breakpoint Test (Structural Change)

The null hypothesis is that there is no structural break.

$$H_0: nostructuralchange$$

$$H_A: structuralchange$$

Table 8: Chow Breakpoint test (structural stability test)

Model	F-Calculated value	Critical value at 5% level	Results
Constant and trend	2.370(prob=.06)	2.545 (prob=.05)	Accept H_0
Conclusion	Therefore, F-critical >F-calculated. Evidence does not support to reject the null hypothesis, thus we can say that null hypothesis of “No structural change” is accepted. That is our model is found structurally stable over time.		

The Jarqua-Bera statistics is given by

$$JB = n\left[\frac{S^2}{6} + (K-3)^{2/24}\right]$$

- Where N is the sample size, S is skewness, K is kurtosis. Thus large values of the skewness and/or values of kurtosis quite different from 3,will lead to a large value of the jarque-vera statistics.
- When the residuals are normally distributed the JB has a chi-square distribution with 2 degrees of freedom.
- Reject the hypothesis of normally distributed errors if a calculated value of the statistic exceeds a critical value selected from the chi-square distribution with 2 degrees of freedom.

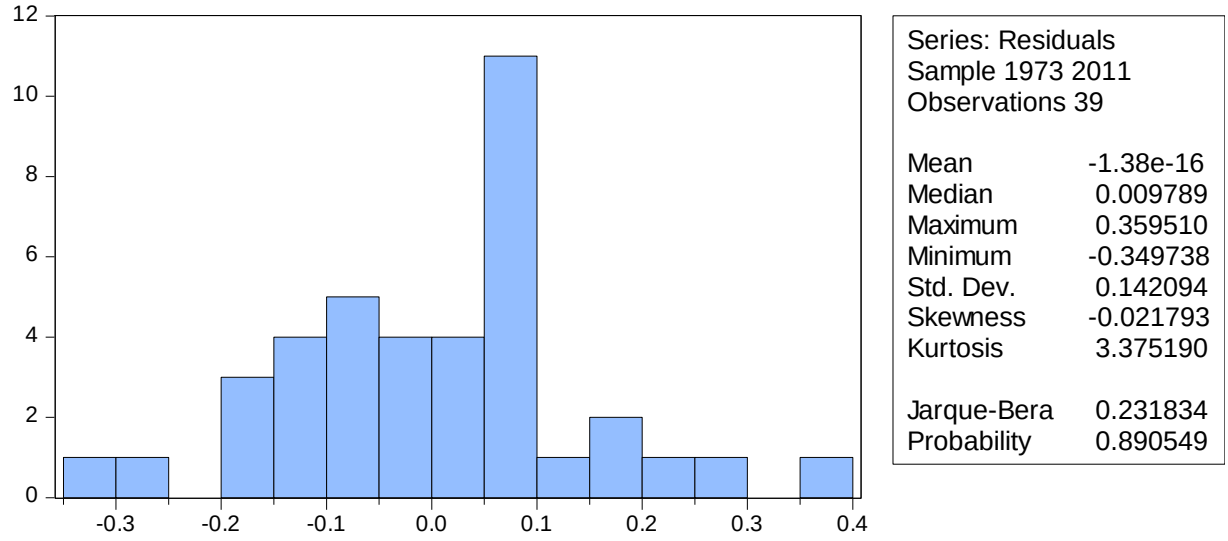
Series: Residuals	
Sample 1973 2011	
Observations 39	
Mean	-1.38e-16
Median	0.009789
Maximum	0.359510
Minimum	-0.349738
Std. Dev.	0.142094
Skewness	-0.021793
Kurtosis	3.375190
Jarque-Bera	0.231834
Probability	0.890549

By the information given above indicate that we can't reject Null Hypothesis of

" residual series are normally distributed"

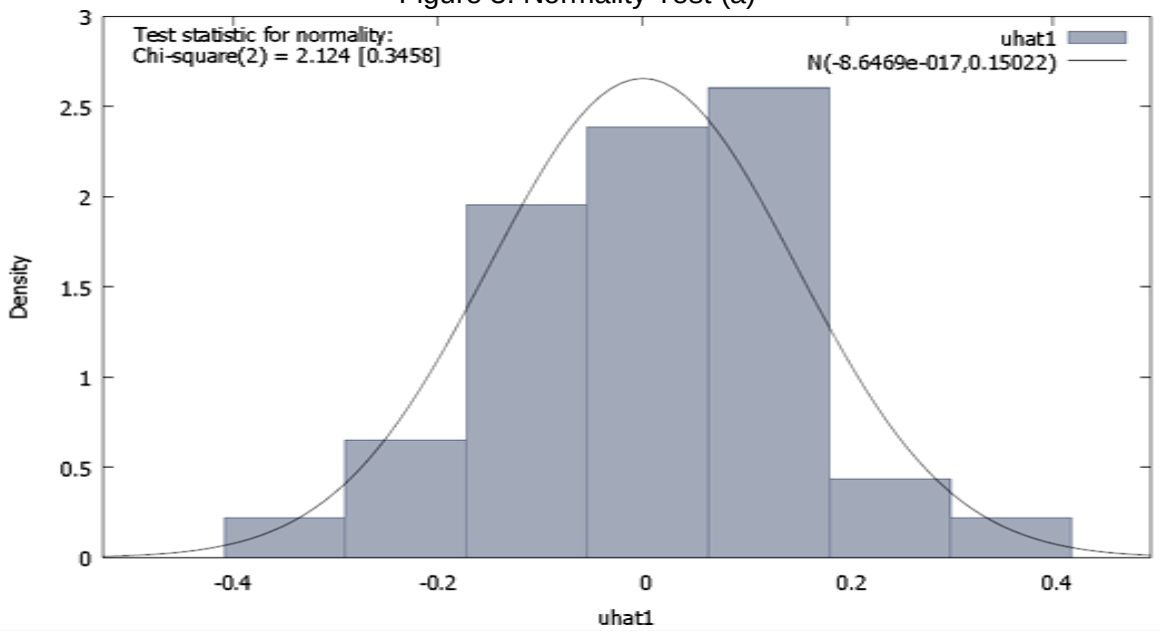
Visualization test of Normal distribution

Figure 3: Normality Test



By using E-Views we got the skewness and kurtosis of the model which are '-0.021793' and '3.375190' respectively and the JB value is 0.231834. Since this JB statistics follow the chi-square distribution and the critical value is '5.991' at 5% level of significance with 2 df. So, we cannot reject the null hypothesis that the residuals are normally distributed.

Figure 3: Normality Test (a)



By using the "Gretl" econometric software we have got the value of standard deviation is "0.15022" , Chi-square with degrees of freedom 2 is "2.124 and p-value is "0.34579" which indicates that the residual series of our model is approximately normally distributed.

Ramsey Reset Test

Table 9: Test of specification error

Model	Data based value of the test statistic	Critical value at 1% level	Results
Constant and trend	5.29234	5.33634	Accept H_0
Conclusion	Therefore, F-critical **>**F-calculated. Evidence does not support to reject the null hypothesis, and we accept null hypothesis. So, we can conclude that there is no specification error in our model.		

If we want to test in 5% level the critical value of $F_{0.05}$= 3.29454 and calculated value is F_c= 5.292345 which indicate there is specification error. In addition, we have to take a non linear regression against linear model.

We have run a new model and its finding is given below:

$$TB_t = \beta_0 + \beta_1 NER_t + \beta_2 Y_t + \beta_3 Y_t^* + \beta_4 Fa_t + \beta_5 \widehat{TB}_t^2 + \varepsilon_t$$

Table 10: Revised Model Estimation

	Coefficient	Std. error	t-ratio
Constant	-0.01210	0.175900	-5.754
NER_t	10.6998	2.11966	5.048
y_t	0.0914793	0.0168387	5.433
Y_t^*	-0.00298987	0.000441607	-6.770
Fa_t	4.10809e-013	0.000000	7.349
$\widehat{TB}_t^2$	-0.629714	0.235190	-2.677
	Test statistic: F = 7.168831, with p-value = P(F(1,33) > 7.16883) = 0.0115		

CONCLUSION AND POLICY IMPLICATION

The purpose of this paper was to find out the relationship between exchange rate and trade balance of Bangladesh during the period FY1973-2011. In this regard, the paper explained the historical trends of real exchange rate, export, import, and the trade balance, and their interrelationship.

Throughout our analysis, we sought to establish the reasons for which exchange rate fluctuations affected the trade balance of Bangladesh on a yearly basis using the log linear model and applying cointegration techniques. The cointegration technique here reflects a positive influence with exchange rate devaluation and trade balance. The Granger causality test provides support to the existence of both short run and long run bidirectional causal relationship between devaluation and trade balance. The results of the model parameter estimates are consistent with the economic and theory. An increase of exchange rate and foreign asset and growth of domestic and foreign GDP has a significant impact on trade flows. Increasing in the exchange rate will lead to depreciation of considered currency; thus, it was found to encourage export while it was found to adversely affect imports demand that implies devaluation of currency seems to be an effective policy to make Bangladeshi product competitive in world market (i.e., growth in exports).

However, as Bangladesh has to import a great deal of capital goods for its key exporting industries, devaluation of currency can merely increase the exports demand (not exports supply) at the outset. As a consequence, the increased exports demand immediately increases the effective demand of imports for capital goods. This is why trade balance deteriorates immediately after devaluation.

In addition, we scrutinize that economic reform policies and liberalization implemented between the years 1971-2011 were found to have later contributed significantly to increasing trade flows of Bangladesh, which was conditional based on forecasted estimates of trade openness policy in a previous study. Empirical results suggest that export and import activities can be improved further, if the following are utilized: (1) macroeconomic policies, which aim to keep a stable competitive real exchange rate, and (2) reasonable policies that stay away from overvaluation of the real exchange rate to decrease volatility. Therefore, policymakers should set up coherent policies that escort to a translucent exchange rate system, under which the stability of the real exchange rate will be achieved and maintained to boost the country's overall trade and economic growth strategy.

Countries located in the bottom right-hand corner can expect a larger gain in their trade balance from depreciating their exchange rate. By contrast, countries located in the top left-hand corner can expect the lowest gain in their trade balance from depreciating their exchange rate. This simple comparison shows that there is a large variety in what countries can expect from using the exchange rate as a policy tool to boost their trade balance and hence their growth.

As, we perceive that an appreciation of the domestic currency makes domestic exports dearer to foreigners but foreign imports cheaper to us. This causes the exports to fall and imports to rise. The opposite is true for depreciation. Therefore, theory suggests that currency appreciation causes a fall in the trade balance (a lessening of the current account surplus or a deepening of the deficit) and vice versa. Many others countries now prefer to increasing quality of goods and services to maintain existing share and improve to better position. In this regard, we suggest to policy makers to keep mind the policy pattern of BRICS countries before taking any policy implication related balance of trade and exchange rate. Sometime it is observed that frequent devaluation may be the cause of domestic inflation.

REFERENCES

Aziz, N. (June 2008) *"The Role of Exchange Rate in Trade Balance: Empirics from Bangladesh"*.

Lal, A.K. and T.C.Lowinger (22 March, 2002), *"Nominal Effective Exchange Rate and Trde Balance Adjustment in South Asian Countries",* Journal of Asian Economics 13 (2002), 371-383.

Briguglio, Lino(1989)"*The Impact of a Devaluation on the Malttese Trade Balance with Special Reference to the price and Income Reversal Effects."*Applied economics, Vol. 21, pp. 325 – 37.

Bahmani-Oskooee, Mohsen (1991) *"Is There a Long Run Relation Between The Trade Balance and The Real Effective Exchange Rate of LDCs?"* Economic Letters, vol. 36, pp. 403-407.

Bahmani-Oskooee, Mohsen (1998) *"Cointegration Approach to Estimate the Long Run Trade Elasticities in LDCs" International Economic Journal*, vol. 12, pp. 89-96.

Bahmani-Oskooee, Mohsen and FarhangNiroomand (1998) *"Long-run Price Elasticties and the Marshall-Lerner Condition-Revisited" Economic Letters*, vol.61, pp.101-109.

Bera, A. K. and C. M. Jarque. *"An Efficient Large-Sample Test for Normality of Observations and Regression Residuals,"* Australian National University Working Papers in Econometrics, Vol. 40 (1981), Canberra.

David Matesanz Gómez and Guadalupe FugarolasÁlvarez-Ude(1962*), "EXCHANGE RATE POLICY AND TRADE BALANCE. ACOINTEGRATION ANALYSIS OF THE ARGENTINE EXPERIENCESINCE "*

Boyd, D., M. Caporale and Ron Smith (June 13,2001), *"Real exchange rate effects on the balance of trade :Cointigration and the Marshall-Lerner Condition"*

Dickey, D. A. and W. A. Fuller. *"Distribution of the Estimators for Autoregressive Time Series with a Unit Root,"*Journal of the American Statistical Association, Vol. 74 (1979), pp. 427-431.

Engle, R. F. and C. W. J. Granger. *"Co-integration and Error Correction: Representation, Estimation and Testing," Econometrica*, Vol. 55 (1987), pp. 1-87.

Engle, R. F. and B. S. Yoo. *"Co-integrated Economic Time Series: An Overview with New Results,"* in R. F. Engle and C. W. J. Granger, eds., *Long-Run Economic Relationships*, Oxford: Oxford University Press (1991), pp. 237-266.

Gafar, John (1981) *"Devaluation and The Balance of Payments Adjustment in a Developing Economy: an Analysis Relating to Jamaica: 1954-72"* Applied Economics, vol. 13, pp. 151-165.

Godfrey, L. G. *"Testing for Higher Order Serial Correlation in Regression Equations When the Regressors Include Lagged Dependent Variables,"*Econometrica, Vol. 46 (1978), pp.1303-1310.

Hatemi, J, A., &Irandoust, M (2005).*"Bilateral Trade Elasticties: Sweden Versus Her Major Trading Partners."*Available: www.arpejournal.com/APREvolume3number2/Hatemi-J-Irandoust.pdf.

Hendry, D. F. *"Productive Failure Econometric Modelling in Macroeconomics: The Transmission Demand for Money,"* in *Economic Modeling: Current Issues and Problems in Macroeconomic Modeling in the UK and the USA, (ed.),* London: P. Ormerod (1979).

Jarque, C. M. and A. K. Bera. "Efficient Tests for Normality, Homoscedasticity and Serial Independence of Regression Residuals," *Economics Letters,* Vol. 6 (1980), pp. 255-259.

Johansen, S. *"Statistical Analysis of Co-integration Vectors,"*Journal of Economic Dynamics and Control, Vol. 12 (1988), pp. 231-254.

Jorge, Carrera and Romain, Restout (2008), *"Long Run Determinants of Real ExchangeRates in Latin America",*W.P. 08-11.

Kwiatkowski, D., P. Phillips, P. Schmidt and Y. Shin. *"Testing the Null Hypothesis of Stationarity Against the Alternative of a Unit Root,"* Journal of Econometrics, Vol. 54 (1992), pp. 159-178.

MacKinnon, J. *"Critical Values for Co-integration Tests,"In R. F. Engel and C. W. J. Granger, eds., Long Run Economic Relationships: Readings in Co-integration, Oxford: Oxford University Press (1991).*

MacKinnon, J. *"Models, Specification Error and Inference: A Discussion of Some Problems in Econometric Methodology,"* Bulletin of the Oxford Institute of Economics and Statistics, Vol. 32 (1970), pp. 301-318.

Ng, Yuen-Ling, HarWai-Mun, Tan Geoi-Mei(August,2008), *"Real Exchange Rate and Trade BalanceRelationship: An Empirical Study on Malaysia", International Journal of Business and Management,* Vol. 3, No. 8.

Ogbonna (1982), Trade Balance flow of Nigeria, Journal of Political Economy, World Bank.

Patterson, Kerry (2002). *"An Introduction to Applied Econometrics: A Time Series Approach",* New York: PALGRAVE

Rose, A.K. (1991),*"The role of exchange rates in a popular model of international trade, Does the Marshall Lerner condition hold. Journal of International Economics",* 30, 301-316.

Rose, A.K., &Yellen, J.L. (1989), *"Is there a J-curve. Journal of Monetary Economics",* 24, 53-68.

Rabeya Khatoon and Mohammad Mahbubur Rahman (June 2009), *"Assessing the Existence of the J-Curve Effect in Bangladesh"* The Bangladesh Development Studies,Vol. XXXII, No. 2.

Ramsey, J. B. *"Test for Specification Errors in Classical Linear Least Square Regression Analysis,"* Journal of the Royal Statistical Society B (1969), pp. 350-371.

Sarel, M. (May 1995), *"Nonlinear Effects of Inflation on Economic Growth,"* IMF Working Paper WP/95/56, Washington .

Shao, Ziwei (2008), *"Exchange Rate Changes And Trade Balance: An Empirical Study Of The Case Of Japan",* Singapore Management University. Institutional Knowledge at Singapore Management University, Dissertations and Theses Collection (Open Access) Dissertations and Theses.

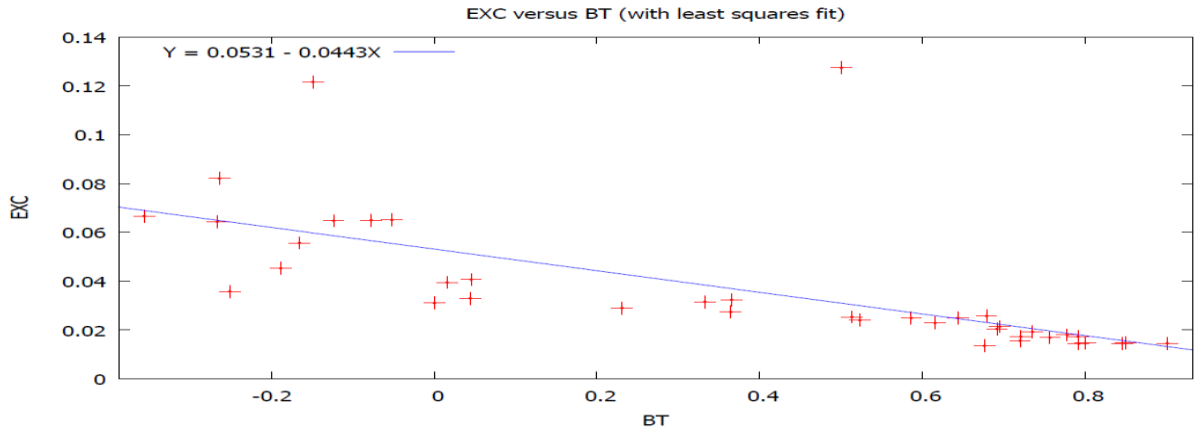
The IMF, Annual Report 2006, *Financial operations and transactions, The International Monetary Fund*, Appendix II, 144-146.

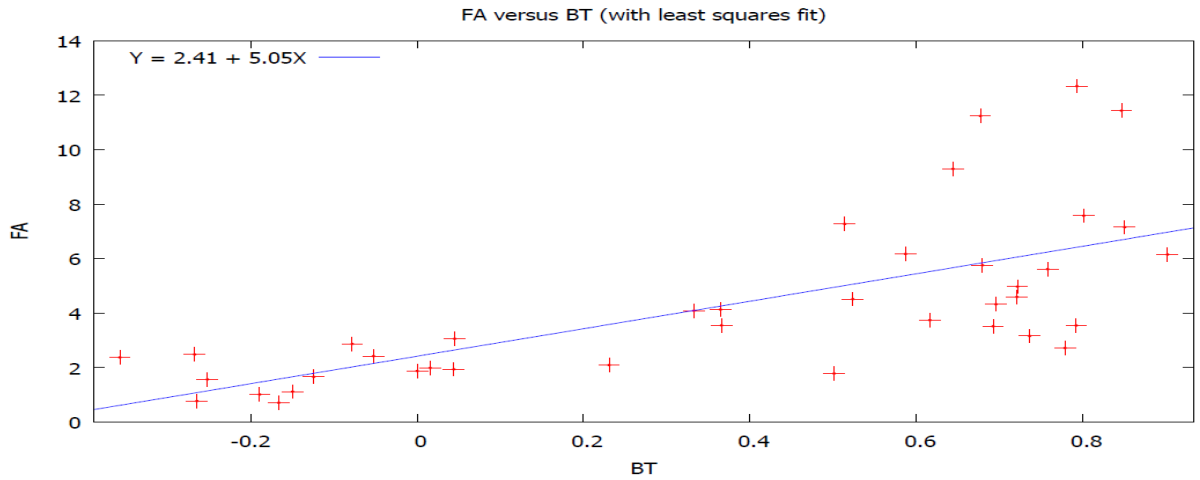
Ummi, Osman and Tamat, Sarmidi (2012), *"Deviation of Exchange Rate and Trade Balance: Evidence from the Member Countries of Gulf Cooperation council (GCC)"*©International Journal of West Asian Studies 37 EISSN: 2180-4788 Vol. 4 No. 2 (pp. 37-54) DOI:10.5895/ijwas.2012.09.

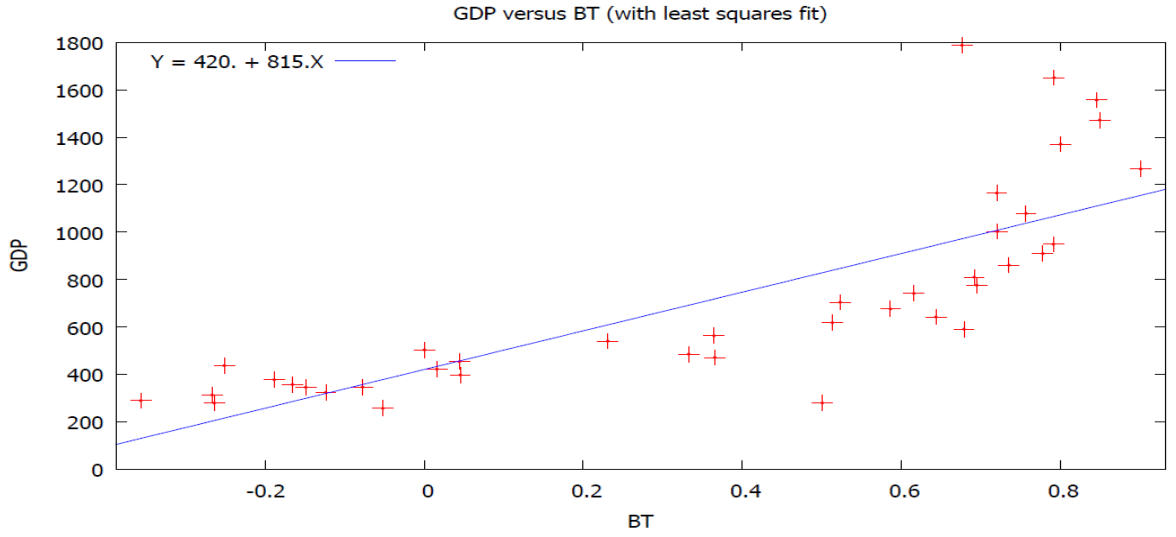
Yusoff, Dr. Mohammed B. "*Trade Balance And Real Exchange Rate In Malaysia",* Kulliyyah of Economics and Management Sciences, International Islamic University Malaysia.

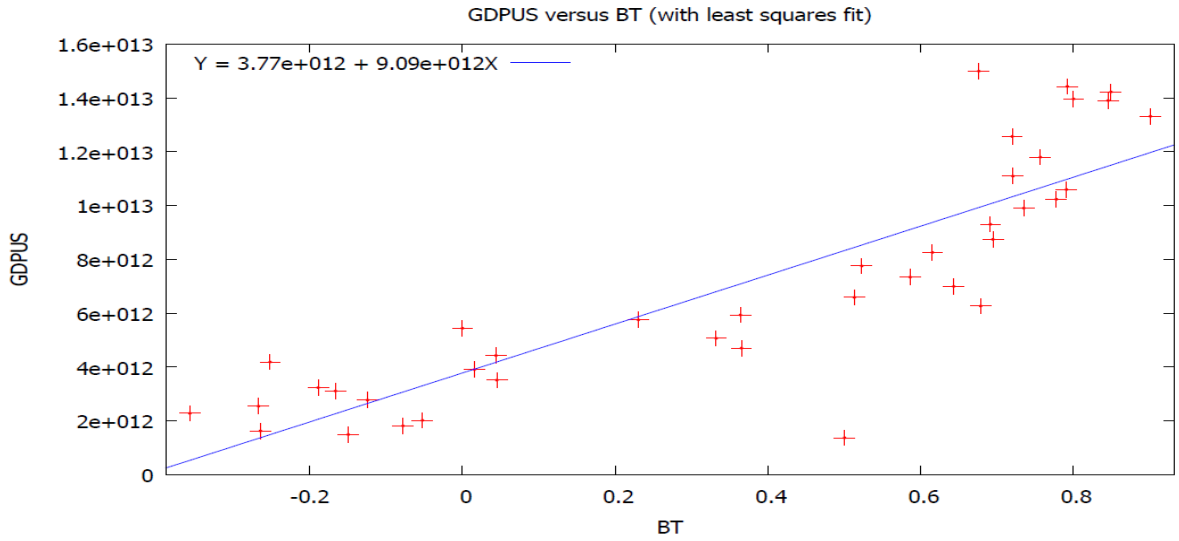
APPENDICES

1. Partial Regression Plot









2. Coefficient matrix

	C	EXC	FA	GDP	GDPUS
C	0.017145	-0.217902	-0.000679	2.57E-05	-3.39E-15
EXC	-0.217902	3.199847	0.009690	-0.000410	4.98E-14
FA	-0.000679	0.009690	0.000252	-3.47E-06	2.46E-16
GDP	2.57E-05	-0.000410	-3.47E-06	1.33E-07	-1.29E-17
GDPUS	-3.39E-15	4.98E-14	2.46E-16	-1.29E-17	1.38E-27

Correlation among the variables

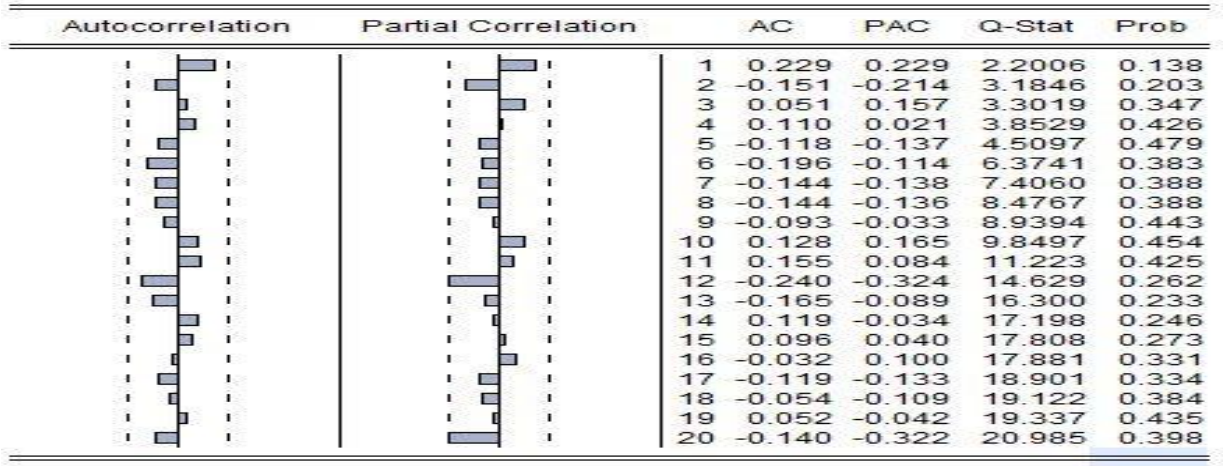
	BT	EXC	FA	GDP	GDPUS
BT	1.000000				
EXC	-0.655786	1.000000			
FA	0.692876	-0.565672	1.000000		
GDP	0.788161	-0.663106	0.822844	1.000000	
GDPUS	0.862504	-0.771328	0.763703	0.970953	1.000000

Coefficient Covariance Matrix

Included observations: 39

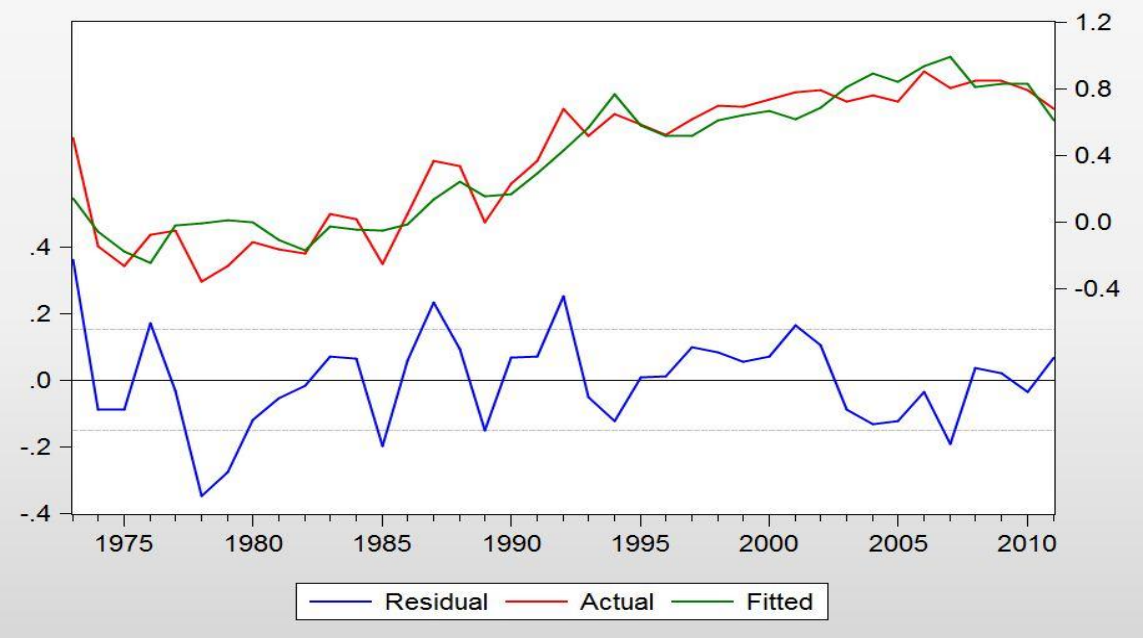
Variable	Coefficient	Standardized Coefficient	Elasticity at Means
C	-0.668918	NA	-1.821834
EXC	7.123135	0.480957	0.714348
FA	0.069005	0.503184	0.801864
GDP	-0.002222	-2.296699	-4.354667
GDPUS	2.92E-13	3.079185	5.660290

Chart and Graph of Correlogram of Residual



Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
		1	0.229	0.229	2.2006	0.138
		2	-0.151	-0.214	3.1846	0.203
		3	0.051	0.157	3.3019	0.347
		4	0.110	0.021	3.8529	0.426
		5	-0.118	-0.137	4.5097	0.479
		6	-0.196	-0.114	6.3741	0.383
		7	-0.144	-0.138	7.4060	0.388
		8	-0.144	-0.136	8.4767	0.388
		9	-0.093	-0.033	8.9394	0.443
		10	0.128	0.165	9.8497	0.454
		11	0.155	0.084	11.223	0.425
		12	-0.240	-0.324	14.629	0.262
		13	-0.165	-0.089	16.300	0.233
		14	0.119	-0.034	17.198	0.246
		15	0.096	0.040	17.808	0.273
		16	-0.032	0.100	17.881	0.331
		17	-0.119	-0.133	18.901	0.334
		18	-0.054	-0.109	19.122	0.384
		19	0.052	-0.042	19.337	0.435
		20	-0.140	-0.322	20.985	0.398

3. Residual plot and Graph of Actual & Fitted line



4. The descriptive Statistics

	TRADE_BALANCE	IMPORTS	EXPORTS	EXCHANGE_RATE	GDP_BD	GDP_USA	FA
Mean	0.970885	7.83E+09	5.21E+09	39.16438	3.83 E+10	7.11E +12	4.266592
Median	0.977029	4.08E+09	2.41E+09	38.95076	3.17 E+10	6.26E +12	3.538308
Maximum	0.987834	3.54E+10	2.56E+10	74.15240	1.12 E+11	1.50E +13	12.33447
Minimum	0.936574	9.56E+08	4.61E+08	7.849816	8.07 E+09	1.37E +12	0.700383
Std. Dev.	0.015863	7.87E+09	6.02E+09	19.94408	2.53 E+10	4.30E +12	2.977204
Skewness	-0.549334	1.762998	1.649043	0.171403	1.19 0894	0.3909 97	1.192238
Kurtosis	1.985017	5.729648	5.227816	1.848754	3.94 4379	1.8750 98	3.783881
Sum	37.86450	3.05E+11	2.03E+11	1527.411	1.49 E+12	2.77E +14	166.3971
Sum Sq. Dev.	0.009562	2.35E+21	1.38E+21	15115.12	2.43 E+22	7.03E +26	336.8222

Source: *Time siries data from WDI, World Bank.*