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# Exchange Rate and Trade Balance Relationship in India: An Application of Marshall Lerner Condition

Rupal Chowdhary\*, Shubhangi Jore\*\*, Vibha Sahu\*\*\*, Raksha Thakur\*\*\*\*

## *Abstract*

*At present, most Developing Countries have been facing persistent trade deficits in the regime of exchange rate liberalization that most of countries are practicing. The value of domestic currency in terms of foreign currency in the liberalized foreign exchange market is determined through market forces. International Economics is based on the assumption that a real devaluation of a nation's currency against foreign currency improves the trade balance and its current account. A decline in a nation's currency value in terms of foreign currency is likely to make export commodities relatively cheaper in the world market thus, increasing the volume of exports. Imports of the currency depreciating country turns costlier and hence, the volume of imports should reduce in response to devaluation. However, the Marshall Lerner condition states that devaluation of currency improves the balance of trade only if the sum of the price elasticities of demand for exports and for imports is greater than one. The objective of the study is to identify the relationship between Trade Balance and the exchange rate. Here, Trade Balance is defined as the ratio of exports to imports. In order to test results, the Augmented Dickey-Fuller (ADF), Phillips-Perron (PP) stationary tests are used to check for the presence of a unit root for the individual variable and first differences among variables. The results indicated that Marshall Lerner condition is applicable in Indian context for the period of 1996 to 2011.*

**Keywords:** *Marshall-Lerner Condition, Exchange Rate, Trade Balance*

## Introduction

In a liberalized foreign exchange market, depreciation of a nation's currency causes export commodities to be cheaper and hence it should lead to an increase in the volume of exports. At the same time, the imported goods become more expensive and the volume of imports is expected to decrease. An increase in exports coinciding with a reduction in imports should logically lead to an improvement in the country's trade balance. However, the effects of devaluation on the trade balance have generated a long debate among economists. According to one group of economists believing in the elasticity approach, the trade balance can improve due to devaluation if certain price elasticity condition is met namely to what extent,

trade flows are responsive to relative price changes. These conditions are best known as the Marshall-Lerner condition. The Marshall Lerner condition states that devaluation of currency improves the balance of trade if the sum of the price elasticity of demand for

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exports and the price elasticity demand for imports is greater than one. The attainment of the Marshall Lerner condition rests on the assumption that when the prices of export goods in terms of foreign currency fall due to devaluation of domestic currency, the volume of exports should increase. Devaluation increases the prices of import products in terms of domestic currency and this should lead to a decline in quantity demanded. Presently, in spite of considerable devaluations of domestic currencies, in many Developing Countries, the trade balance did not improve and a decrease in the value of the currency was observed resulting in an increased trade deficit.

Depreciation of currency is a matter of utmost concern for many economies. At present in India, depreciation of rupee against US dollar is an enduring and crucial problem which can be a threat to our economic stability. There is a need to have an insight and have an understanding about the concept of depreciation of the exchange rate, the trade balance and their relationships in Indian context.

## Literature Review

Relationships between the exchange rate and the trade balance have been a subject of intense theoretical and empirical debate in economic literature. These studies reported mixed results on the impact of devaluation of the real exchange rates on trade balances. Some studies attempt to identify whether devaluation of domestic currency has a long-run favourable effect on the trade balance even if this effect on trade balance is not so favourable in a short run. This concept in other words can be seen as a J-curve effect. It postulates an initial deterioration of the trade balance followed by a subsequent improvement in response to the real exchange rate depreciation. It could significantly delay overall balance of payments adjustment to changes in the exchange rate leading to a J-curve shaped response of the trade balance.

Early contributors to the elasticity approach are Marshall (1923), Lerner (1944), and Robinson (1947). The focus of this approach has been whether devaluation will improve the trade balance and what conditions are necessary for this to lead to an improvement in the trade balance. However, the theory has provided conflicting theoretical reasoning and

implications of the use of devaluation as a tool to improve the trade balance.

According to Reinhart (1995), it is normal that a nominal devaluation or depreciation can only reduce the trade imbalances when it translates into devaluation in real terms and relative prices affect the trade flows in a significant and predictable manner. Kandil and Mirazaie (2005) argued that economic activity of any country may get stimulated due to depreciation of the domestic currency through an initial increase in the prices of foreign goods relative to home goods. The increase in global competitiveness of domestic industries may divert spending from the former to the latter. According to Dornbusch (1988), the effectiveness of depreciation in improving the balance of payments depends on redirecting demand in the right direction and by correct amount. It also depends on the capacity of the domestic economy to meet the additional demand through increased supply.

Certain country specific empirical literature discusses the possibilities of validation of Marshall Lerner condition for devaluation. Anastassiou and Vamvoukas (2012) assess the impact of the real exchange rate changes on Irish external trade performance. The results show that in the case of Ireland the ML condition is validated. Tze-Haw Chan & Chee-Wooi Hooy (2012) has examined the long run dynamics of exchange rate and bilateral export-import flows between China and Malaysia, from January 1990 to January 2008. The study is based on the Autoregressive Distributed Lag bound testing procedure, the fully modified OLS, dynamic OLS and rolling estimations as well as the generalized impulse response (IRF) and variance decomposition (VDC) analyses. The findings of the study revealed that the Marshall-Lerner condition holds in the long run but the export-import demands do not adhere to the J-curve pattern.

Halicioglu (2007) empirically has studied the dynamics of Turkish bilateral trade between Turkey and her nine trading partners, in addition to aggregate trade balance data. The empirical results suggest non-existence of the J-curve effect at disaggregate and aggregate levels. However, Marshall-Lerner condition holds for the aggregate data along with some of the trading partners. A study done by Loto (2011) shows

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that devaluation/depreciation does not improve the trade balance; since the sum of demand elasticities for imports and exports is less than unity, the Marshall-Lerner condition does not hold. This paper concluded that devaluation/depreciation cannot improve the trade balance in the Nigerian economy. Devaluation can only benefit countries that are originally export based before the devaluation of a currency. Economies that are import dependent can hardly benefit from the devaluation/depreciation of its currency. Nigeria is a typical example of a 90 percent dependent on imported raw materials into the production process. For an economy that is structured like that of Nigeria, devaluation will surely complicate the problem, rather than solving it.

Eita (2013) investigated if elasticities of trade are large enough in order to justify a change in the exchange rate as an appropriate policy to improve the trade balance. The results have found that world income has a positive effect on exports while the real exchange rate appreciation discourages exports. Imports respond positively to both domestic income and the real exchange rate appreciation.

Studies in the Indian context have shown mixed and inconclusive results. According to Bahmani-Oskooee (1985, 1989), Bahmani-Oskooee and Malixi (1992), the trade balance of India deteriorates with devaluation in both short and long-run. While a different result has been reported by Himarios (1989) that there was no evidence of J-curve and found that devaluation improves the trade balance in India. Buluswar et al., Kulkarni (1996), on the contrary, found that there is deterioration in the trade balance in the initial period while it increased in the long-run.

Despite the volume of research into how exchange rate changes affect the trade balance, there is still considerable disagreement concerning the effectiveness of currency devaluation as a tool for increasing a country's trade balance. The empirical results from these studies (including for India) are inconclusive. So it appears worthwhile to re-examine the relationship between the balance of trade and the exchange rate.

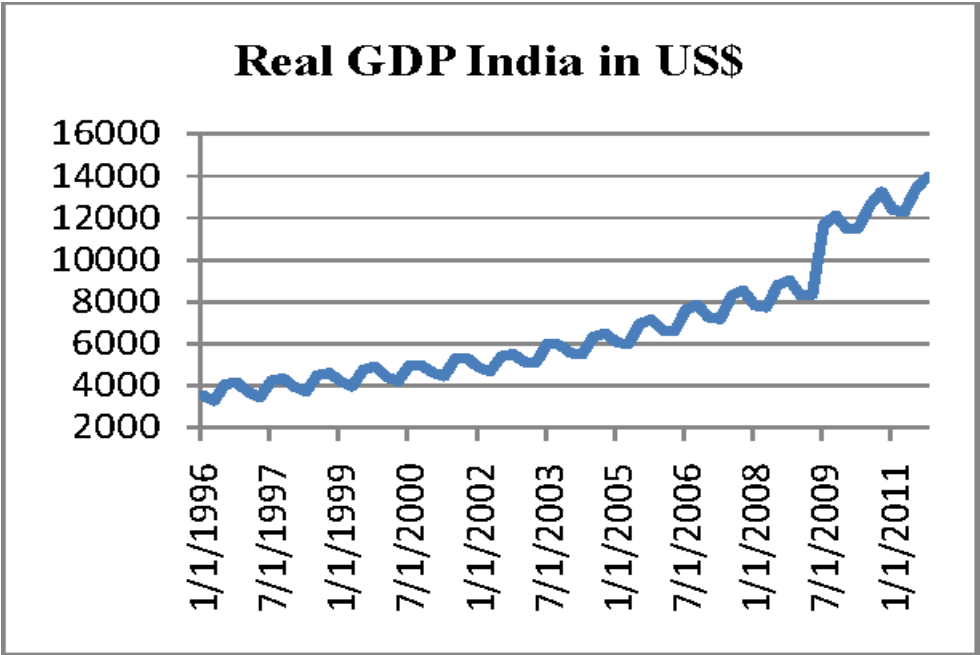
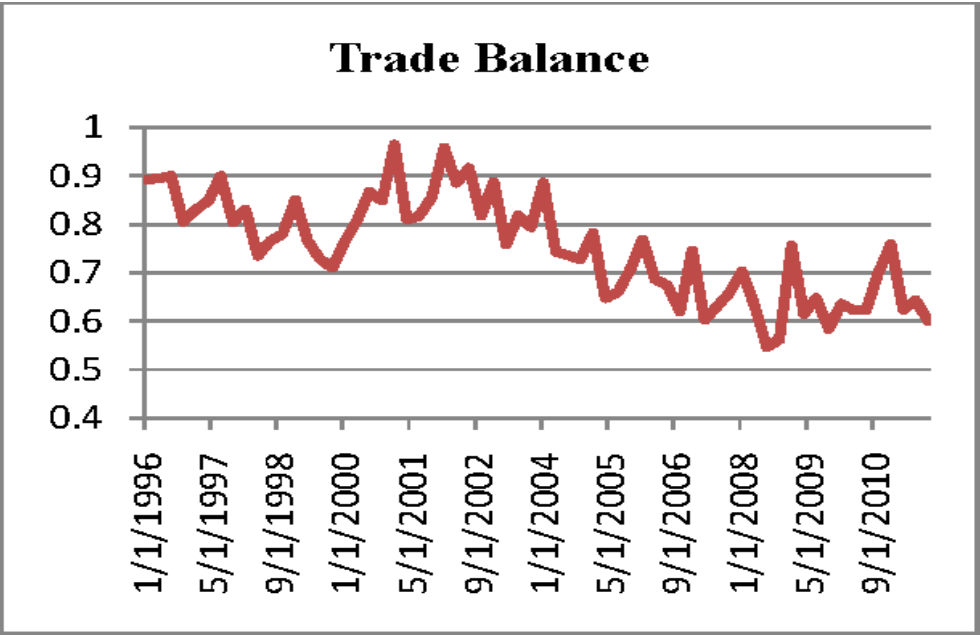
## Research Methodology

**Data Set:** The data set consists of quarterly data and covers the period from 1996q1 to 2011q1. The data were obtained from the RBI Handbook of Statistics on Indian Economy and US Real GDP was obtained from Bureau of Economic Analysis. Trade Balance is the trade ratio defined as the ratio of exports to imports. By defining Trade Balance as a ratio of exports to imports, the trade balance measure is made unit free. RE is the real effective exchange rate, Y is the real GDP of India and  $Y^*$  is the real GDP of US.

Trade Balance has been stated in terms of Equation 1 in the following section. Actually, if the devaluation of home currency causes trade balance improvements, it is evident that ML condition is satisfied. Alternatively, if the effect of devaluation of trade Balance is positive and significant, then the demand elasticities of exports and imports are high and ML condition is satisfied.

## Tool for data analysis

Before pursuing formal tests, the graphical analysis gives an initial clue about the nature of time series data. The time series corresponding to the trade balance, the real effective exchange rate, real GDP India and real GDP US (both in \$ billion) were plotted on graph and stationarity was tested using graphical analysis. Figure 1 shows trend in these variables except the real effective exchange rate over time. From the figure, it can be noted that real GDP for both India and US are showing an upward trend and the trade balance is moving downward with time, suggesting that the mean of these variables has been changing. Further, data were also checked for its stationary behaviour using autocorrelation function (ACF) and correlogram. The autocorrelation coefficients at various lags are found to be very high and positive. Figure 2 is showing the correlogram in levels and in first difference shows that all the variables under study, except the real effective exchange rate are not hovering around zero. This suggests that the trade balance, real GDP India and US are not stationary in levels and becomes stationary in first difference. Further Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests are used to confirm the stationarity of the series.



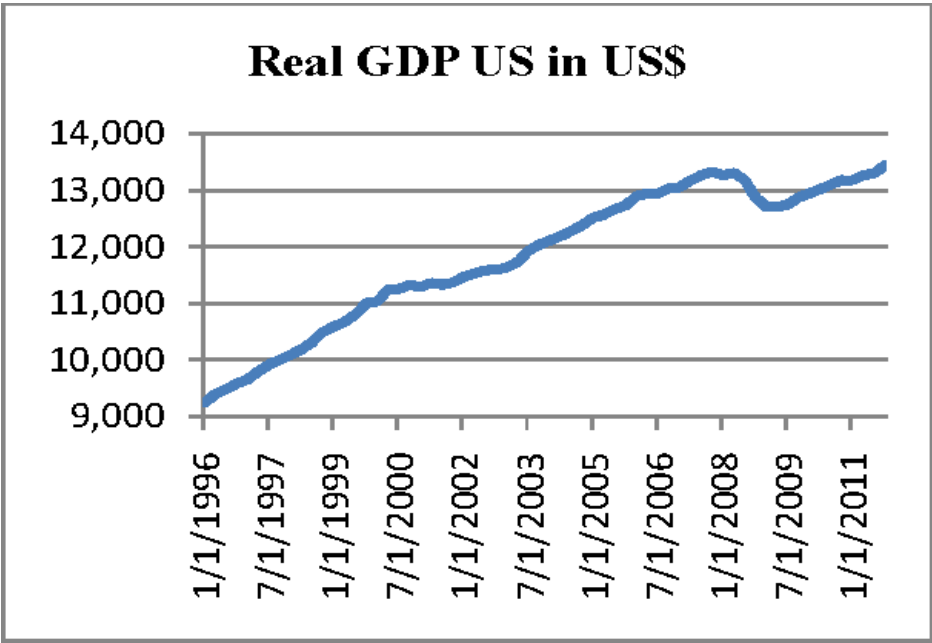
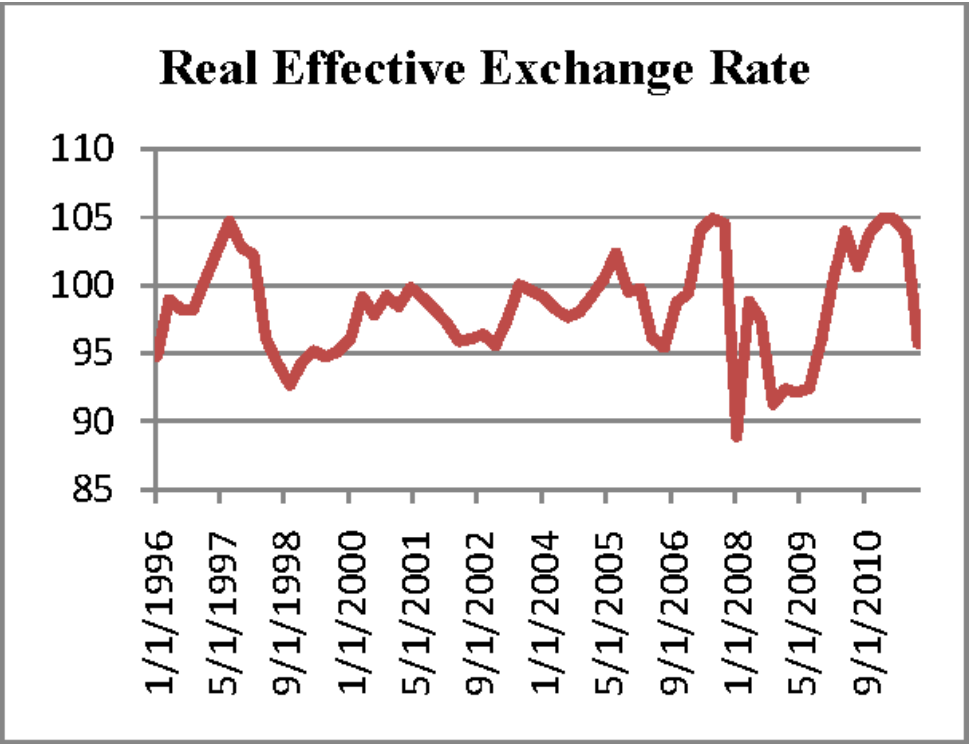


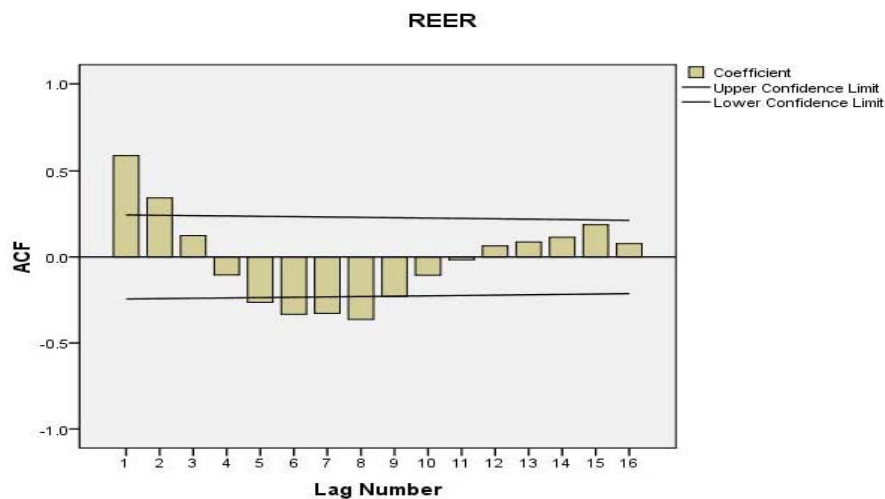
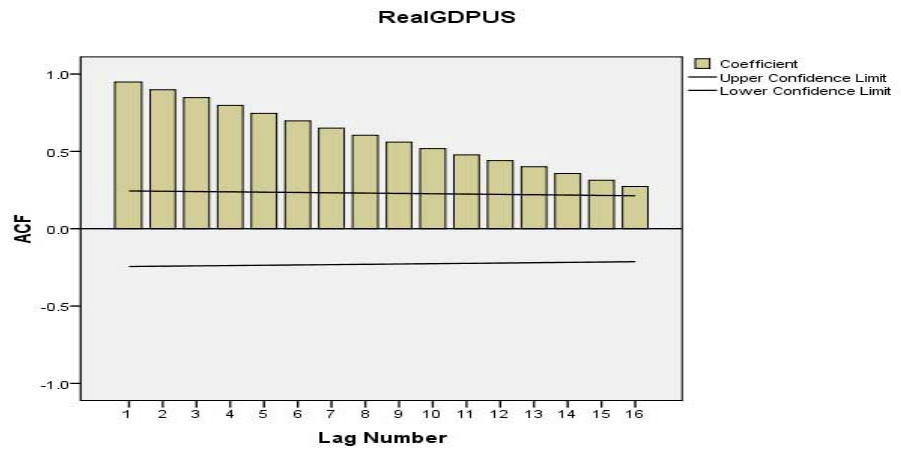
Figure 1: Graphical Analysis- Periodograms of original data

Following Rose and Yellen (1989), Gupta-Kapoor and Ramakishnan (1999) among others, the bilateral balance equation is specified as below:

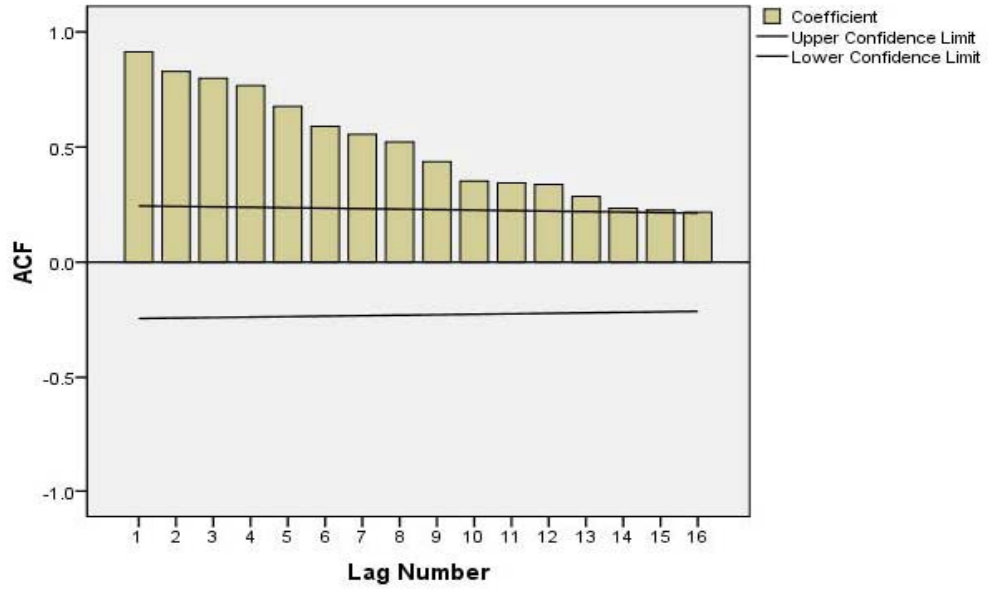
$$TB_t = \hat{a}_0 + \hat{a}_1 RE_t + \hat{a}_2 Y_t + \hat{a}_3 Y_t^* + \varepsilon_t \quad (1)$$

Where TB is the trade balance, RE is the real effective exchange rate; Y and Y\* are domestic and foreign real outputs;  $\varepsilon$  is the disturbance term; and t denotes time. Equation 1 illustrates the long-run relation among the variables TB, RE, Y and Y\* which reflect the Indian bilateral trade balance. The sign of  $\hat{a}_1$  is expected to be positive, because an increase in RE

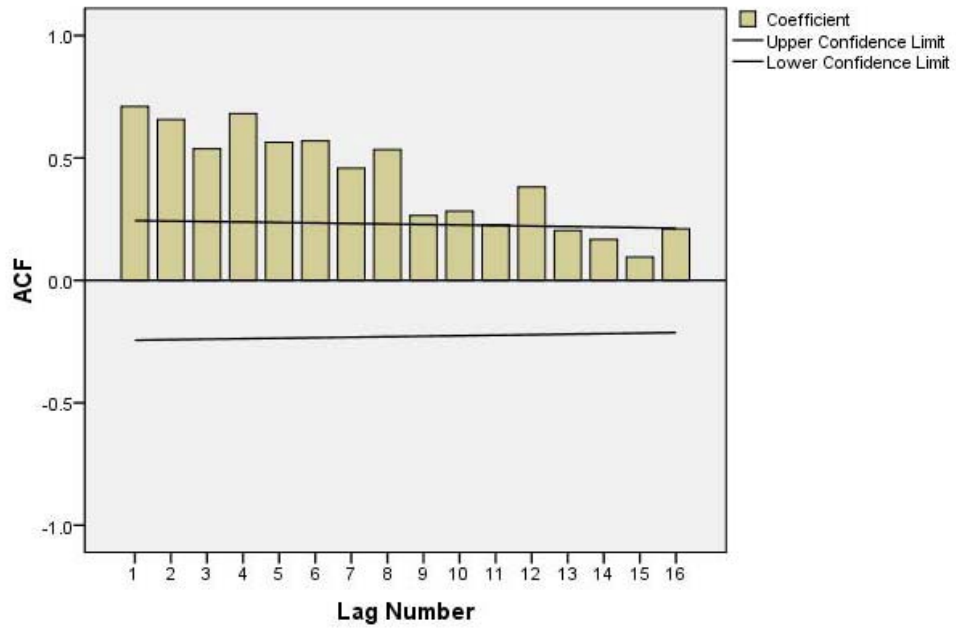
will raise exports and decrease imports. It may be noted that a decline in RE denotes a real depreciation and a rise in RE indicates a real appreciation of the domestic currency. It is expected that a real depreciation of the home currency will improve the trade balance. According to economic theory the estimates of  $\hat{a}_2$  and  $\hat{a}_3$  will raise the demand for imports, so that the trade balance will deteriorate, thus yielding a negative coefficient for  $\hat{a}_2$ . Similarly, a rise in Y\* will increase Indian exports, so that the estimate of  $\hat{a}_3$  is anticipated to have a positive sign.

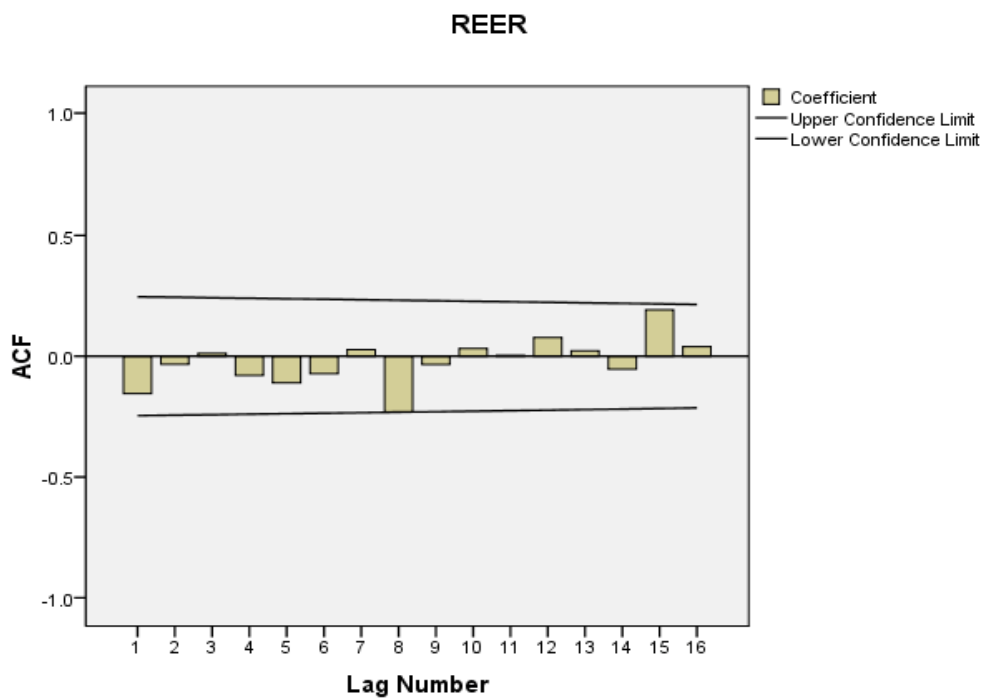
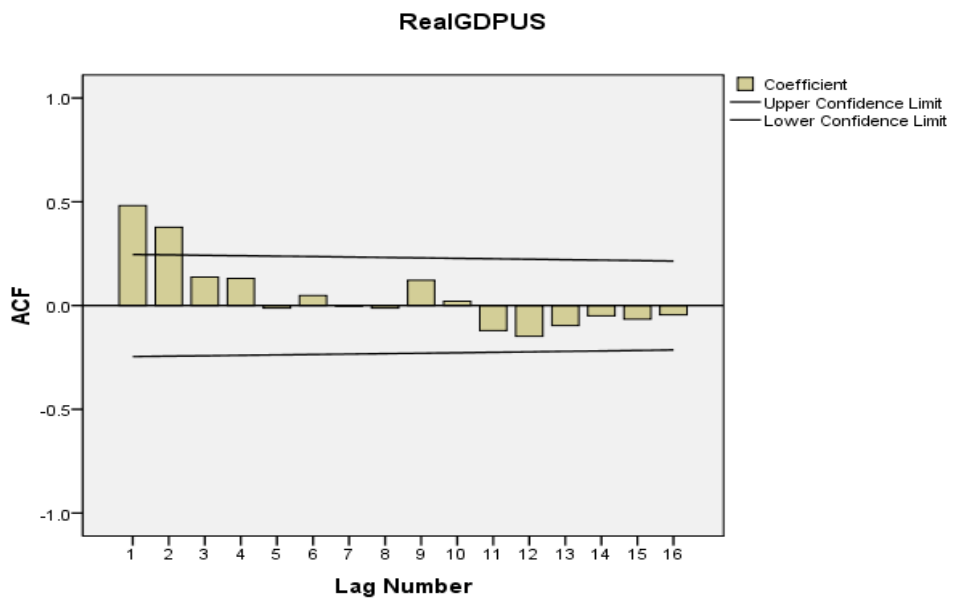


**RealGDPIndia**



**TradeBalance**







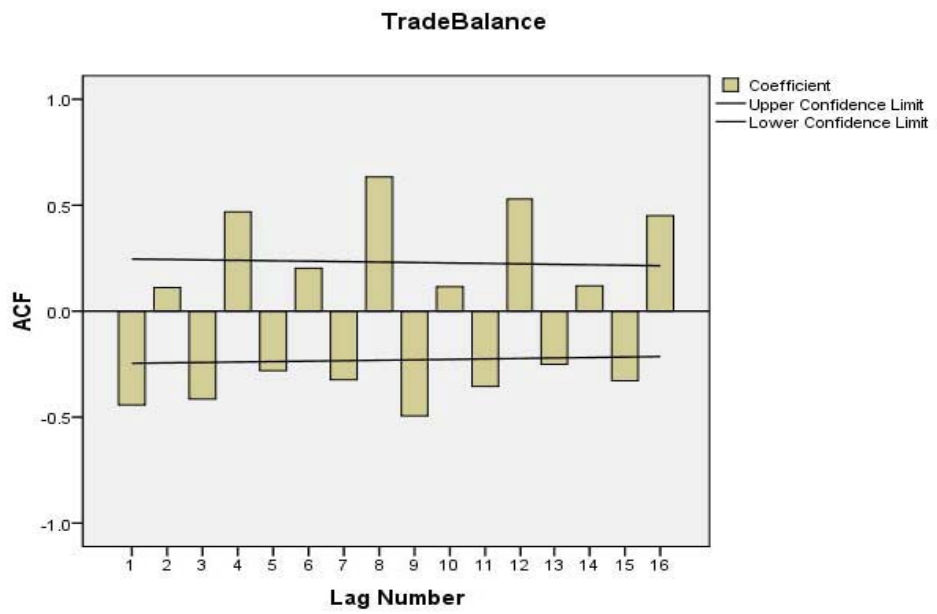
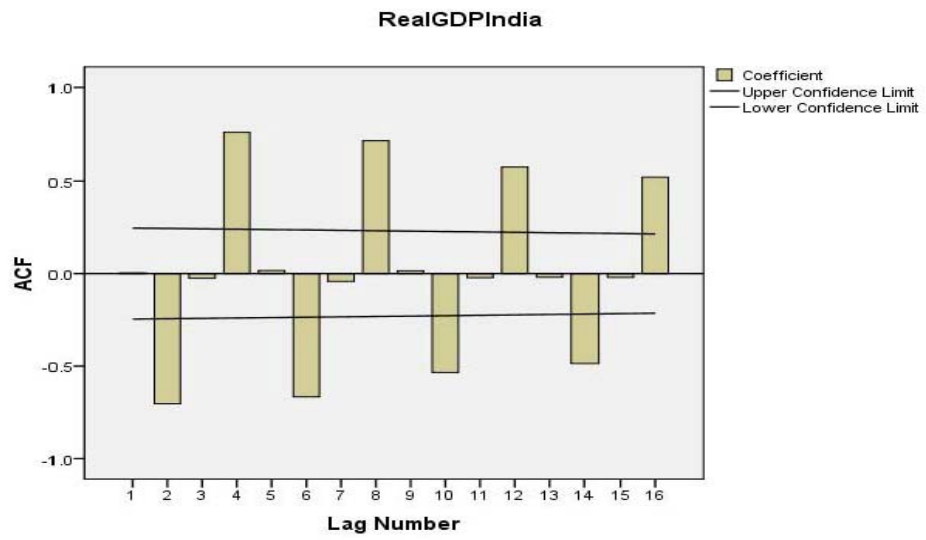


Figure 2: Correlogram of Real GDP US, Real GDP India, Real Effective Exchange Rate and Trade Balance in levels and Difference.

The first step in the empirical analysis is to examine the stationary properties of the time series before proceeding with Regression Analysis. For this, the Augmented Dickey-Fuller (ADF), Phillips-Perron (PP)

stationary tests are used to check for the presence of a unit root for the individual variables and their first differences. The unit root test results are presented in Table 1.

**Table 1**

**Unit Root Tests, 1996-2012**

Variable	ADF	Sig	PP	Sig
△TB	1.29	0.52	18.42	0.0001
△RE	44.56	0.000	44.71	0.000
△Y	4.38	0.118	40.99	0.000
△Y*	15.60	0.000	15.60	0.000

*Source: Authors Calculation*

All the variables are stationary in first order so the regression equation (1) is run for first difference and results are reported in Table 2. Bringing data from table 2 to equation (1), we get the model of India's bilateral balance equation (2) as follows

$$TB_t = 0.994516 + 0.002604 TB_{t-1} - 1.54E-05 Y_t - 3.33E-05 Y_{t+1} + \epsilon$$

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Judging from the statistical test results, the model is reliable. The model indicates that estimated coefficient of the real exchange rate is 0.002604, distinctly different from zero, and the absolute value is more than one. In other words, the real exchange rate positively and significantly affects the trade balance. The interpretation for the impact of the real exchange rate on the bilateral trade balance is that a

depreciation of domestic currency (or a rise in the real exchange rate) causes the trade balance to improve, thus proving the Marshall Lerner condition. Further, the coefficient of domestic real output is -1.54E-05 which is significant and hence, has significant effect on the trade balance of the country. It means an increase in domestic Real GDP will cause imports to rise and thus worsen the bilateral trade balance and vice versa. The third coefficient of foreign real output is -3.33E-05, distinctly different from zero, and the absolute value is less than one. Hence, there is a negative and significant effect of foreign real output on the trade balance of India. The result shows that the negative sign on the foreign income (United States) implies that a rise in foreign income leads to a decrease in the domestic trade balance. This may be because the rise in foreign real income is due to an increase in the foreign production of import-substitute goods. Thus, their imports might decline as income increases.

Table 2

Estimated values of equation 1

Dependent Variable: TRADE\_BALANCE\_EXPORT\_IMP

Method: Least Squares

Date: 07/12/13 Time: 14:34

Sample: 1 64

Included observations : 64

Variable	Coefficient	Std. Error	t-Statistic	Prob.
US_REAL_GDP_IN_US_\$	-3.33E-05	1.16E-05	-2.861146	0.0058
REAL_GDP_INDIA	-1.54E-05	5.08E-06	-3.034323	0.0036
REER	0.002604	0.002446	1.064568	0.2913
C	0.994516	0.268505	3.703906	0.0005
R-squared	0.579973	Mean dependent var	0.752483	
Adjusted R-squared	0.558972	S.D. dependent var	0.105487	
S.E. of regression	0.070054	Akaike info criterion	-2.418651	
Sum squared resid	0.294450	Schwarz criterion	-2.283721	
Log likelihood	81.39683	F-statistic	27.61601	
Durbin-Watson stat	1.240067	Prob(F-statistic)	0.000000	

Source: Authors calculations

It is also observed that REER is insignificant while other variables are significant at 5 % level of significance. It is clear from the table 2, that Marshall Lerner condition is applicable in the Indian context for the period of 1996 to 2011. This indicates that devaluation does have a positive impact on the trade balance. The results are in line with the study by Caporale et al (2012) which showed that the Marshall-Lerner condition holds good for Kenya. On the contrary, Rose and Yellen (1989), Backus *et al.* (1994), Wilson (2001), and Mahmud *et al.*(2004), have provided results which refute the Marshall Lerner condition.

**Conclusion**

The objective of the study was to identify the relationship between the trade balance and the exchange rate while standardizing for other important variables which reflect overall activity and affect the

Balance of Trade. The ML condition was investigated within the framework of multivariate systems which, in turn, were used to observed whether the relationship between the real effective exchange rate and the trade balance was sustainable when other important variables such as domestic and foreign real GDP were introduced in the analysis. On the basis of regression analysis, the study led to the conclusion that Marshall Lerner condition was satisfied for India. The findings of this study support the existence of relationship between the balance of Trade, the real exchange rate and relative income indicating that the Marshall-Lerner condition holds in India. This finding has important policy implications for the country. The results indicate that the exchange rate is an important tool for attempting to address issues related to current account deficits in India and can therefore contribute to achieving an external balance.

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