

# Dynamic Linkage Between Real Broad Effective Exchange Rate and Banking Industry Index Performance: A Study on India

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**Abstract** The nexus between real broad effective exchange rate and Indian banking industry index performance is explored in the study. The banking industry index has been considered in this article taking variable as S&P Bank Ex index. The long run relationship between real broad effective exchange rate and S&P Bank Ex index is explicated here by taking Auto Regressive Distributed Lag Model. The analysis explores that there is significant long run cointegration among the two variables. The long run impact of exchange rate, though, is not significant. But, the short run causality from exchange rate is significant. The short run impact of real effective exchange rate is positive explaining that strength in Indian currency against universal currency, Dollar in real terms brings strength in stock market S&P Bank Ex index. Finally, Granger Causality between the two variables finds that there is unidirectional causality from S&P Bank Ex index to Real Broad Effective Exchange Rate in short run. The article concludes that not only real exchange rate but also S&P Bank Ex index gives impact on each other in short run. As both the variables are useful in intraday transaction, the short run impacts are more visible and significant than in long run.

**Keywords** — Real Broad Effective Exchange Rate, S&P Bank Ex, ARDL Model, Cointegration, Error Correction Term, Granger Causality.

## I. INTRODUCTION

Stock market considers to be one of the most important contributors to the economic development of countries. The investment in stock market depends not only on countries' own investors, but also on the foreigners. The investment made by foreign investors are generally in form of long term and short term in nature. Thus, they are literally investing their corpus in either form of Foreign Direct Investment or Foreign Portfolio Investment. The amount of foreign investment depends on the strength of the economy. Also, the foreign investment is influenced through the respective exchange rates of the countries. As foreigners bring foreign currency and convert these to local currency, there remains a relationship between stock market investment and the movement in the exchange rates.

World economies are related with the respective countries' stock market. Coming to our analysis, our study is confined towards Indian equity market. Being categorized as one of the Newly Industrialized Economies (NIEs), India is an important destination of investment within the foreigners. The financial market of India can be well explained by Indian Financial sector. As recent years have observed with high growth in financial sectors, it is obvious that Indian stock market has performed well in private and public-sector banking. The share of financial services increased with the higher weightage of banks' performance.

In this context, our article analyses the relationship of Indian stock market and nominal exchange rate. The stock market index has been taken as S&P BankEx Index and nominal exchange rate as Rs/\$ exchange rate values. Data taken for this analysis are monthly and ranging from 2002 to 2018. The sections are divided as follows: Section two will consist of theoretical and empirical review of literature. Section three will describe the data sources, description of the variables. Section four will cover the methodology and analysis of the results. Section five concludes the paper.

## II REVIEW OF LITERATURE

Purbaya, Yudhi Sadewa (2000) in his analysis "The effect of exchange rate on foreign direct investment" explained devaluation of currency attracts FDI if the country is focusing on export primarily and vice versa.

Magda Kandil, Ida Mirzaie (2005) entitled "The Effects of Exchange Rate fluctuation on Output and Prices: Evidence From Developing Countries" clarified two parts of exchange rate as Anticipated exchange rate fluctuation and unanticipated exchange rate fluctuation. The analysis explored that exchange rate fluctuation does not impact on output growth and price level.

Tomoe More and J Pentecost (2006) analyzed in the article "The Sources of Real Exchange Rate Fluctuations in India" the impacts of real (permanent) and nominal (temporary) shocks on the nominal and real exchange rates of the Indian

Rupee against the US dollar since 1993.

Alok Kumar Mishraa, et al. (2007), in the article “Volatility Spillover between Stock and Foreign Exchange Markets: Indian Evidence”, discussed about the bidirectional volatility regarding Indian stock market and foreign exchange market

Debjiban Mukherjee (2007), in his study “Comparative Analysis of Indian Stock Market with International Markets” analyzed Indian stock markets are integrated with global market. The analysis explained the position of Indian stock market with global capital markets.

Magda Kandil (2008) in his study “Exchange Rate Fluctuations and the Macro-Economy: Channels of Interaction in Developing and Developed Countries” explored the growth of consumption, investment, imports, exports, overall trade balance for developing and developed countries on account of the effect of currency fluctuation.

Deepti Gulati and Monika Kakhani(nov 2012) ,in their study, “Relationship Between Stock Market and Foreign Exchange Market in India: An Empirical Study”, analyzed two way relationship between stock market and exchange rate. By using Granger Causality Test, it was found that neither SENSEX nor NIFTY has a two-way relationship with foreign exchange (Rs/\$).

Susil Palakkod (2012) in his article “Integration of Capital, Commodity and Currency Markets: A Study on Volatility Spillover” explained the volatility spillover integration between different markets. The integration and interrelationship among the capital market, currency market and commodity market in India was analyzed here.

Vandana Kotai (2013) explored in her article “An Empirical Study on Currency volatility in Foreign Exchange Market” the impacts of a group of economic releases on five exchange rates: INR/USD, JPY/USD, EURO/USD, GBP/USD, and CNY/USD. The paper explicates volatility in these five markets and finds out the most volatile currency in its discussion.

Sharad Nath Bhattacharya, J. K. Dasa(2014) in their analysis “Macroeconomic Factors and Stock Market Returns: A Study in Indian Context” explored thirteen macroeconomic factors which explain the growth of Indian economy. This study extracted thirteen variables into three factors by using Factor Analysis. The first factor (F1) combines IIP, M3, FII inflow, export, foreign exchange reserve, WPI, gold and crude prices. The second factor (F2) combines call money rates, long term interest rates and Treasury bill rates. The third factor (F3) combines the global index and exchange rates (Rupee vs US dollar). Then these three factors are analyzed with regression analysis taking SENSEX, NIFTY, CNX500, and BSE500 as dependent variables and the three factors as independent. The study concludes with a negative relationship between exchange rate and stock market overall.

In these above studies, focus was given broadly on exchange rate, Indian macroeconomic variables, commodity market, the whole stock market performance index and Foreign Direct Investment in India. The gap of the existing literatures is that there is no area specific analysis on the stock market. Our study, in contrast, concentrates on a specific area of stock market which is the performance of banking sector. Indian Banking industry performance is proxied by S&P Banking Ex index taken from Bombay Stock Exchange official website. The analysis tries to find out a relationship of S&P Bank Ex and Real Broad Effective Exchange Rate (Rs/\$) with respect to Indian economy. The objective of this study is, hence, as follows:

- a. To know the long run association of S&P BankEx and Real Broad Effective Exchange Rate (Rs/\$) 2002-2018.
- b. To know the short run impact of Real Broad Effective exchange rate on S&P BankEx
- c. To know the granger causality between Real Broad Effective exchange rate and S&P BankEx.

### III DATA SOURCES, DESCRIPTION OF THE VARIABLES

The paper considers following time series data – namely, Real Broad Effective Exchange Rate (Rs/\$) and S&P Bank Ex as Indian stock market financial and banking industry data. The study is spanning over the period 2002-2018. Monthly data of Exchange rate is gathered from Federal Reserve Bank of St. Louis. S&P Bank Ex data has been taken from Bombay Stock Exchange official website.

As per Federal Reserve Bank of St. Louis, the Real Broad Effective Exchange Rate is calculated as weighted averages of bilateral exchange rates adjusted for relative consumer prices. S&P Bank Ex data is covered as top performing banks in India. The performance of Banking industry is judged based on top ten holdings in the banking sector. The two time series data further have been further converted to logarithmic format to avoid the unit measurement.

The trends of the variables taken for the study has been shown below for better understanding of the results of econometric methodology. Both these two variables have been plotted together in Figure 1 to get a clear picture of their respective movements.

Figure 1 : Plot of Logarithmic of Exchange Rate and S&P Bank Ex

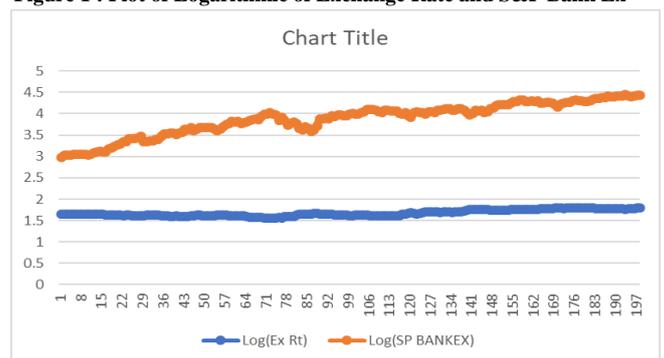


Figure 1 shows the movement of exchange rate is stable. Whereas, the movement of BSE index in financial market is upward trending from period 2002-2018. This gives us a chance to study the relationship further using ARDL Model and Granger causality to analyze the long run cointegration and short run causality between the two variables.

#### IV METHODOLOGY AND ANALYSIS OF THE RESULTS

Taking these data together, we also ran the econometric analysis. In the first stage, to analyze an empirical long run relationship and short run nexus among the variables Real Broad Effective Exchange rate(Variable named as RBEER) and S&P Bank Ex(Variable named as S&P BX), we execute Auto Regressive Distributed Lag (ARDL) model. In the second stage, short-term causality effect is tested. We have used Eviews 9.5 software to conduct the experiment.

##### A. Unit Root Tests

ARDL model is established on the concept that all the underlying variables should be either integrated to order zero [I (0)] or order one [I (1)], but none will be of I (2) because of its spurious outputs in the analysis. Thus, variables need to be checked with stationarity problems at I (0) or I (1) level. For this purpose, we have performed Augmented Dicky Fuller (ADF) Test, and Phillips Perron for checking stationarity and detrending of each variable prescribed by Elliot et al. (1992). This study has used restricted intercept and no trend as chosen by Eviews 9.5 automatic method of ARDL.

The results of Augmented Dicky Fuller (ADF) Test, and Phillips Perron are given in Table (1) and Table (2).

**Table 1: ADF, PP and DF-GLS unit root tests on log levels of variables**

Variables	ADF t-Stat	Critical value at 5%	PP t-Stat	Critical value at 5%
ln(RBEER)	(2.151429)	(2.876123)	(2.337092)	(2.876123)
ln(S&P BX)	(1.910224)	(2.876047)	-1.892689	-2.876047

Source: Author’s formation from application of Eviews version 9.5

Note: \*\* indicates variables are significant at 5% level

**Table 2. ADF, PP and DF-GLS unit root tests on 1st difference of log levels of variables**

Variables	ADF t-Stat	Critical value at 5%	PP t-Stat	Critical value at 5%
ln(RBEER)	<b>(12.44401)**</b>	(2.876200)	<b>(12.42669)**</b>	(2.876200)
ln(S&P BX)	<b>(12.91412)**</b>	(2.876123)	<b>(12.91412)**</b>	(2.876123)

Source: Author’s formation from application of Eviews version 9.5

Note: \*\* indicates variables are significant at 5% level

##### B. ARDL Bound Test for Cointegration Results

The basis of applying ARDL model, here, is that ARDL holds three advantages over the other traditional cointegration techniques. First, the underlying variables need not to be integrated of the same order. Variables can

be of order zero, one or fractionally integrated. The second is ARDL is more effective for small sample data size. The third advantage is through ARDL, we can get an unbiased long run relation among the variables taken into consideration. (Harris, R., & Sollis, R, 2003).

The co-integration equation applied in this study is as follows:

$$\Delta \ln Y_t = \alpha + \sum_{i=1}^n \beta_i \Delta \ln Y_{t-i} + \sum_{j=0}^n \gamma_j \Delta \ln X_{t-j} + \gamma_1 \ln(Y_{t-1}) + \gamma_2 \ln(X_{t-1}) + e_t \text{----- Equation (1)}$$

Where all the variables employed here are ln(.) or Logarithmic operator. Δ is first difference and et is error term. The specifications of the variables are:

Yt = S&P Bank Ex

Xt = Real Broad Effective Exchange Rate

The first step in ARDL model is to measure the above Equation (1) by Ordinary Least Square (OLS). Through this procedure, we can find out the long run relationship between FDI, exchange rate and trade openness over the period. The estimation of the above Equation (1) tests for the joint significance of coefficients of the lagged variables by conducting F test. The Null (H0) hypothesis for long run estimation of the variables states that  $\gamma_1 = \gamma_2 = 0$ , i.e. no cointegration or long run relationship among the variables against the Alternative hypothesis (H1) as  $\gamma_1 \neq \gamma_2 \neq 0$ , i.e. proving existence of cointegration. Two sets of critical values at given significance levels can be learned from Pesaran Table (Pesaran et al.,2001). The first set of values, i.e., upper bound values, at any given significance level is evaluated on the assumption that all the variables under consideration are of order one and the second set of values, i.e., lower bound, are of the order zero. If the value of calculated F-statistics exceeds the upper bound values, it ascertains the rejection of Null Hypothesis of no cointegration and explains a long run cointegrating relationship among the variables. If the F-statistics is lower than lower bound it indicates acceptance of Null hypothesis. If calculated F-statistics falls in between the upper and lower bound values, the result is inconclusive.

The calculated F statistic values are noted in Table (3). The result shows us a long run cointegration among them:

**Table 3: Results from ARDL Bound Test**

Variables	F Statistic	Decision
ln(S&P BX), ln(RBEER)	<b>4.084805*</b>	Cointegration

Source: Author’s formation from application of Eviews version 9.5

\*indicates significant at 10% level

Critical Values at 10 % level: [3.02I(0), 3.51 I(1)]

a. Lower and Upper-bound critical values are taken from Pesaran et al. (2001).

b. Table CI(ii) Case II: Restricted intercept and no trend

c.  $k = 1$  (Number of independent variables or regressors in this study)

Once the cointegration is established, the long run equation and model is expressed as below:

$$\ln Y_t = \Omega + \sum_{i=1}^n \beta_{1i} \ln Y_{t-i} + \sum_{j=0}^n \gamma_{1j} \ln X_{t-j} + \mu t$$

----- Equation (2)

The estimated Long run coefficients of the above equation for four countries are given below in Table (4).

**Table 4: Estimated Long run coefficients of ARDL Bound Test**

Variables	Coefficient	t-statistic	Probability
C	22.90977	0.631691	0.5283
ln(RBEER)	(9.275212)	(0.511297)	0.6097

Source: Author's formation from application of Eviews version 9.5

The long run coefficient of the model statistically insignificant. It implies that increase in Real broad effective exchange rate decreases S&P Bank Ex index. Alternatively, it can be explained that revaluation in exchange rate results worse position in Indian financial market.

According to Odhiambo (2009) and Narayan and Smyth (2008), the short run parameters are calculated by estimating Error Correction Model associated with the long run estimates, which is determined by F statistic and the lagged Error Correction Term (ECT). The short run and long run relationship (represented through ECT), together, are expressed in equation (3). The short run coefficients of the equation and ECT are reported in Table (5). The coefficient of Error Correction Term (ECT) displays long run causal relationship. The error correction term is an equation where null hypothesis of no cointegration is rejected.

The Error Correction Term along with short run causality equation is noted below as:

$$\Delta \ln Y_t = \Pi + \sum_{i=1}^n \beta_i \Delta \ln Y_{t-i} + \sum_{j=0}^n \gamma_j \Delta \ln X_{t-j} + \theta ECT_{t-1} + \Psi t$$

----- Equation (3)

The coefficients in the above equation  $\beta_i$ ,  $\gamma_j$ , explain the short run relationship among the variables and the coefficient of  $ECT_{t-1}$ ,  $\theta$ , explains the long run causality among the variables for the period mentioned in the study. It is also noted as speed of adjustment from short run disequilibrium to long run stable equilibrium with due course of time. The details of the short run and  $ECT_{t-1}$  coefficients are reported below in Table (5).

**Table (5): Error Correction Representation for the Selected ARDL**

Variables	Coefficients	t-Statistic	Probability
$\Delta \ln(RBEER)$	<b>1.708085***</b>	4.470874	0.0000
$ECT(-1)$	<b>(0.010938)***</b>	(3.518816)	0.0005

Source: Author's formation from application of Eviews version 9.5

Note: \*\*\*Indicates significance at 1% level

R-squared: 0.116781

JB-statistic: 29.59(0.00)

Breusch-Godfrey Serial Correlation LM Test: F- 0.957921 (P value-0.3855)

Heteroskedasticity Test: Breusch-Pagan-Godfrey: F- 2.248810 (P value-0.0840)

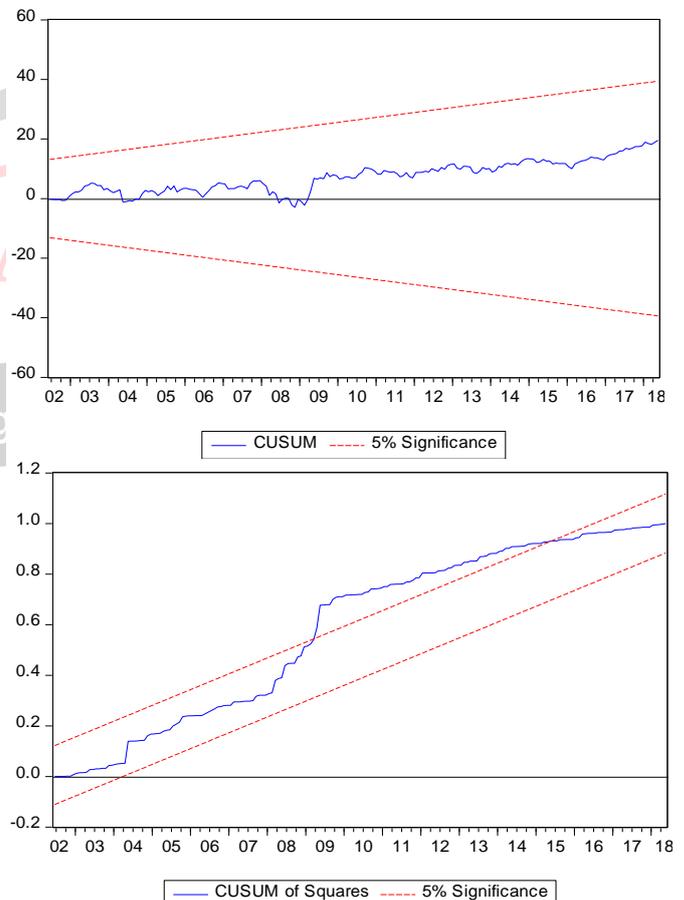
Ramsey Reset Test: F- 0.130682 (P value-0.7181)

The short run impacts of the variables are as follows:

In short run, if Real Broad Effective Exchange Rate increases, it increases index of S&P Bank Ex. It gives the explanation that when foreign investors invest in Indian market, the supply of foreign currency increases. It implies the real appreciation of Indian currency against one unit of foreign currency, Dollar. This finally boosts the investment market in India, i.e., Indian Banking industry performance specifically in our study. The Error Correction Term is negative and significant. But, there is 1% chance to bring equilibrium in long run from short run disturbances.

The stability in the model is expressed through CUSUM and CUSUMQ graph. In Figure 2, the plots of CUSUM and CUSUMQ are given as follows:

**Figure (2): Plots of CUSUM and CUSUMQ**



Also, the short run Granger Causality test explains the both way causality between the two variables, exchange rate and S&P Bank Ex.

Result of Granger Causality Test is shown below in Table 6:

Table (6): Pairwise Granger Causality Tests

Null Hypothesis	F-Statistic	Prob.
ln(S&P BX) does not Granger Cause ln(RBEER)	5.10373 ***	0.0069
ln(RBEER)does not Granger Cause ln(S&P BX)	1.66115	0.1927

Source: Author’s formation from application of Eviews version 9.5

Note: \*\*\*Indicates significance at 1% level

The explanation of the above table (6) is that, in short run, there exists unidirectional causality from ln(S&P BX) to ln(RBEER) . The financial market granger causes exchange rate significantly in short run scenario.

### V. CONCLUSION

The continuous growth of Indian banking industry shows strength of Indian financial market in recent times. Our analysis explores this market strength brings appreciation in Indian currency against Dollar. The continuous growth of Indian bank ex performance index attracts foreign investments in country. As dollar is universal currency, while foreign investment is attracted in India, there would be a huge supply of dollar for the sake of new investment. With a hike in supply of foreign currency, there would be appreciation in Indian currency with respect to Dollar. Also, in short run, the study finds that Indian Banking industry granger causes real broad effective exchange rate. As stock market and currency market are everyday transaction oriented, the short run effects are clearly visible than long run. In short run, hence, it is suggested that, foreign investments need to be encouraged to reflect strength in exchange rate in India. Once the strength in exchange rate is established and its stability remains unchanged in long run, we can have a significant impact on Indian economy in terms of further economic development in future.

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