An Empirical Study of the Impact of Currency Exchange Rate Volatility on Indian Stock Market fluctuations.

I. INTRODUCTION

It is well known fact that, the foreign exchange market is the barometer of effects of changes in demand and supply of foreign currencies of a particular country, these bi directional movements in demand and supply of foreign currencies will have its own bearings on the fluctuations of foreign exchange rate. There is consensus about the fact that fluctuations in exchange rate will influence macroeconomic indicators like GDP, Interest rates, Inflation rates and so on. It also influences the economic viability of companies by impacting their share prices to move from their current state. India has well developed stock market which provides real time financial information about the stock prices of selected companies in respective stock exchanges. They also provide high liquidity to investors by providing a solid platform for trading of securities on 24*7 basis.

A stock market index, also known as stock index, is a statistical measure that reflects changes taking place in the stock market. It is created by combining a few similar stocks among the securities listed on the stock exchange and the selection criteria may be the size of a company, its market value or type of industry.

The present study is an attempt to analyze the relationship between stock market volatility and exchange rates movement in India. This analysis on stock markets has come to the fore as it is the most sensitive component of the economy. This paper attempts to examine how changes in currency exchange rates and stock prices are related to each other over the period from January 2010 to June 2021. Because this period has seen tremendous changes in the fundamentals of the economy.

II. REVIEW OF LITERATURE

In this study we analysed various research works relevant for this study from both domestic and international perspective. The summary of them is presented below;

INDIAN STUDIES

Following are some of the Indian studies reviewed in relation to exchange rate volatility and stock market performance.

Kamini Bhutania and Dr. Rajni (2021) have conducted an empirical study entitled "Nexus between Indian Stock Indices and Foreign Exchange Rate during Covid-19 Pandemic: An Empirical Study". In this paper they made an attempt to examine whether the nexus exist between the Indian stock indices and foreign exchange rate during COVID- 19 period. They took the data of Nifty, Sensex and Exchange Rate on daily basis from 1st January 2020, to 10th June, 2021 during which there is too much volatility in stock indices and exchange rate. Through this study they summarized that the significant and negative association between the stock indices and exchange rate in regression analysis but the variation in the indices due to exchange rate is very low. **Smita Mahapatra, and Saumitra N. Bhaduri (2018)** Studied the impact of currency fluctuation on Indian stock market by analyzing the pricing of exchange rate risk during the period 2005 to 2016, particularly before and after financial crises. From their study they found that higher the foreign exchange exposure of industry, measured by trade balance (net inflows), higher is their sensitivity to exchange rate risk (β).

Aruna Polisetty. And Jikku Susan Kurian. (2016) have attempted to reveal the Influence of Exchange Rate on BSE Sensex & NSE Nifty. In this study they collected and analysed the data related to BSE Sensex and NSE Nifty from 2005 to 2014. And they used Rupee-Dollar exchange rate to measure volatility. Result of this study found the absence of strong relationship between the variables under study. It is observed that Indian stocks are highly sentiment driven. There are some qualitative factors which

influence stock prices like speculation, hubris activities and investor confidence level. **D. Bhuvaneshwari and K. Ramya (2015)** have analysed the Co integration and Causality between Stock Prices and Exchange Rate. Here they considered data related to stock prices of some randomly selected companies and exchange rate of Rupee-Dollar for the period of 10 years starting from January 2006 to December 2015. Results of the study show that, the study variables were non-stationary and became stationary series at first difference. Karl Pearson's correlation test resulted with statistically significant and positive relationship between all the study variables. Johansen co integration test exhibited the absence of long-run relationship between stock prices and exchange rate. **Ashish Samarpit Noel and Vidhu Grace Noel (2012)** analysed the impact of foreign exchange rate on stock market fluctuations. Through this study they found higher degree positive correlation between exchange rate dynamics and stock price fluctuations in selected banks, they further suggested that Companies tend to smooth dividends to make them less volatile than stock prices. **Kumar Srivastav and Ankita Srivastava (2010)** in this remarkable study they analysed casual relationship between exchange rate movements and stock market volatility of selected NSE listed companies by using Rupee-Dollar exchange rate. They found that Nifty returns as well as Exchange Rates were non-normally distributed, further they concluded that Correlation between Nifty returns and Exchange Rates was found to be negative.

INTERNATIONAL STUDIES

Following are some of the international studies reviewed in relation to exchange rate volatility and stock market performance.

Korhan, Gokmenoglu, and Siamand Hesami, (2021) have conducted a research entitled "Exchange rates and stock markets in emerging economies: new evidence using the Quantile-on-Quantile approach". Through this study they proposed that the estimation outcome demonstrates that the examined countries' stock market performances are not affected by the exchange rate changes unless certain market

conditions are established. The empirical result concludes that the exchange rate dynamics has a decisive role in determining the market returns based on the bearish or bullish conditions. **Fatbardha Morina and Eglantina Hysa (2020)** This study made an attempt to examine the effect of real effective exchange rate volatility on economic growth in the Central and Eastern European countries. This study uses annual data for fourteen CEE countries for the period 2002–2018 to examine the nature and extends the impact of such movements on growth. The empirical findings reveal that the volatility of the exchange rate has a significant negative effect on real economic growth. **Robert Gitau Muigai and Irene Cherono (2019)** examined the effect of fluctuations in exchange rates on share prices of the listed companies in Kenya. The study used a longitudinal research design and a relevant data of all the sixty one listed companies were taken. The outcome of the study concluded that exchange rates volatility had a major adverse effect on the share prices of selected companies from Nairobi Securities Exchange (NSE). **Charles Adjasi, and Daniel Agyapong (2008).** These researchers studied the relationship between Stock Markets and Foreign Exchange market, then analysed whether movements in exchange rates have an effect on stock market in Ghana. It was observed that there is inverse relationship between exchange rate volatility and stock market returns. It concludes that a depreciation in the local currency leads to an increase in stock market returns in the long run. Where as in the short run it lessens stock market returns. It was also suggested that an increase (or decrease) in trade deficit and expectation in future rise in trade deficit will decrease (or increase) stock market volatility. Further, the consumer price index (CPI) has a strong relationship with stock market volatility.

III. OBJECTIVES

1. To analyse the volatility pattern of stock market and currency exchange rate.
2. To understand the casual relationship between the currency exchange rate volatility and stock market performance in India.

IV. HYPOTHESES

The following null hypotheses are framed and they need to be tested by using appropriate statistical test to study aforesaid objectives.

H_1: There exists no relationship between exchange rate volatility and stock market volatility.

H_2: S&P BSE Index does not granger cause Real Broad Effective Exchange Rate

H_3: Real Broad Effective Exchange Rate does not granger cause S&P BSE Index

V. RESEARCH METHODOLOGY

Research is considered as the fact finding process. Methodology is an approach to solve the research problem tactfully and systematically. This study follows the following methodology.

5.1 Research design

Casual research is a study intended to understand the cause-and-effect relationship that exist between any two closely related variables. In this study we are interested in examining the impact of exchange rate volatility on stock market volatility assuming currency exchange rate as independent variable and stock market volatility as dependent variable.

5.2 Data collection

5.2.1 Type of data and its source

In this study we used secondary data related to currency exchange rate and stock market index. *Monthly average* real broad effective exchange rate (RBEER) of 60 developing and developed countries is collected from the official website of Bank for International Settlement

(BIS) Basel. And data related to stock market indices are collected from the official website of Bombay Stock Exchange (BSE).

5.2.2 Selected index for the study.

In this study judgemental sampling is used to select the appropriate stock market index to understand stock market volatility. The selected index is BSE SENSEX. The rationale behind selecting this index is that, selected index covers the stocks of 30 Companies of different sectors which are listed and actively traded in BSE. Hence this selected index will reflect the true stock market performance on an average.

5.3 Statistical tools used

The accuracy and reliability of research output equally dependent on the type of tools that we employ for the analysis of the data and quality and quantity of the data used in the study. This study demands application of sophisticated appropriate statistical and econometric tools to reveal the hidden relationship between selected variables. Hence the following tools are used for systematic and scientific analysis of the data. Descriptive statistical tools, ADF and PP Unit Root, Pearson Correlation Test Granger Casualty Test and so on.

VI. ANALYSIS AND INTERPRETATION OF DATA

The selected variables are analysed systematically by using appropriate statistical and econometric tools such as descriptive analysis, normality tests, Stationarity test and casualty test.

6.1 Descriptive analysis

The summary of descriptive analysis of study variables i.e. Real Broad Effective Exchange Rate and S&P BSE Index are given in table 1 below. The table clearly depicts that there is high difference between the maximum and minimum value of S&P BSE Index, it tells about the extent of extreme scatterness of the values of S&P BSE Index. Of the two variables Real Broad Effective Exchange Rate is said to be relatively consistent when it is compared with the S&P BSE Index.

Table: 1 Descriptive analysis of variables

Descriptive measures	RBEER	S&P BSE SENSEX
N	140	140
Missing	0	0
Mean	97.8	28273
Std. error mean	0.398	814
Median	99.0	27006
Mode	101	15455
Sum	13687	3.96e+6
Standard deviation	4.71	9630
Coefficient of variation	4.815	34.060
Variance	22.2	9.27e+7
Range	20.5	42097
Minimum	84.1	15455

Maximum	105	57552
Skewness	-0.908	0.727
Kurtosis	0.227	-0.0604

Source; Authors Calculation and Compilation

6.2 Normality test

It is a property of a distribution that allows precise distributional characterizations and sharp inferences. It also provides a basis for comparison with alternative methods. Normality test for selected variables are conducted by using few appropriate econometric tools like Jarque-Bera Test, Shapiro-Wilk test, Skewness and Kurtosis. The summary statistic of above tests are given in table-2 below

Table: 2 Summary of Normality Test

Normality Measures	standard	**RBEER**	**S&P BSE SENSEX**	**Result**
Jarque-Bera Test	5	18.99815	12.1430	NOT NORMAL
Shapiro-Wilk W	0	0.927	0.927	NOT NORMAL
Skewness	0	-0.908	0.727	SKEWED
Kurtosis	3	0.227	-0.0604	PLATYKURTIK

Source; Authors Calculation and Compilation

All these data analytic tools indicate that neither Real Broad Effective Exchange Rate nor S&P BSE Index is perfectly normally distributed. As per the thumb rule of skewness a distribution is said to be normally distribute if it has value of skewness equals to zero. But in the present study it can be said that Real Broad Effective Exchange Rate is positively skewed and S&P BSE Index is negatively skewed. The

value of kurtosis indicates that both variables are platykurtic in their shape of distribution. It is also very clear from the following Q-Q Normality plot that both the distributions are not normally distributed. Hence, it is concluded that variables are not normally distributed.

RBEER

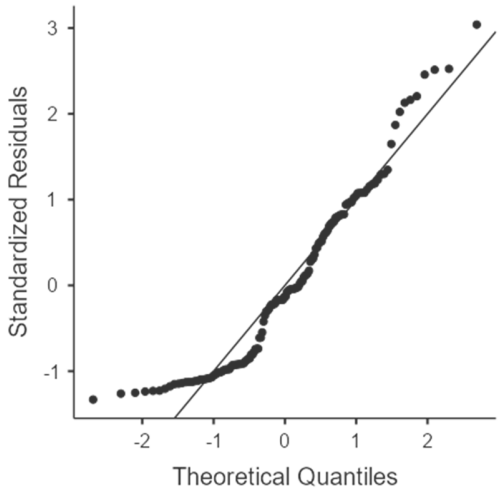

Chart-1 Grafical Depiction of RBEER

S&P BSE SENSEX

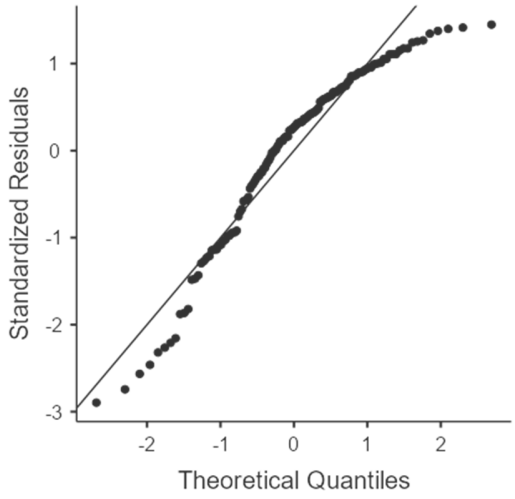

Chart-2 Grafical Depiction of S&P BSE SENSEX

6.3 Unit Root Test or Testing the Data for Stationarity

Unit root test helps us to test whether a time series variable is stationary or not. Stationarity and unit root are mutually exclusive to each other. In simple words a data series is said to be stationary if its mean and variance are constant over time and the value of covariance between two time periods depends only on the distance or lag between the 2 different time periods and not on the actual time at which the covariance is computed [D N. Gujrati (2003)]. A variable is said to be has unit root when it follows random walk, then it is very difficult to predict future trend, in order to enable future predictions, variables must contain stationary element. It means Unit root must not present in data set to facilitate predictions. A time series is said to be Stationarity if a shift in time

doesn't cause a change in the shape of the distribution. In this study Unit root test is conducted to test the variables for Stationarity by using widely used econometric tools like Augmented Dickey Fuller (ADF) Test and Phillips-Perron (PP) Test. the summary of above tests are presented in table-3 below

Table: 3 Highlights of Unit Root Test

Variables		**ADF TEST**			**PHILLIPS-PERRON (PP) TEST**		
RBEER		At Level	At First Difference	At Second Difference	At Level	At First Difference	At Second Difference
	t-stat	-1.4729	-3.2498	-3.9511	-1.9818	-10.4370	-35.5372
	5 %	-2.8829	-2.8844	-2.8846	-2.8822	-2.8824	-2.8825
	Accept/reject Ho	Reject Ho	Accept Ho	Accept Ho	Reject Ho	Accept Ho	Accept Ho
S&P BSE SENSEX	t-stat	-1.4811	-2.7952	-4.8742	-1.0997	-11.9825	-43.1654
	5%	-3.4455	-3.4458	-3.4461	-3.4424	-3.4427	-3.4429
	Accept/reject Ho	Reject Ho	Reject Ho	Accept Ho	Reject Ho	Accept Ho	Accept Ho

Source; Authors Calculation and Compilation

The above table clearly indicates that both Real Broad Effective Exchange Rate and S&P BSE Index are found to be stationary series at level form but found to be non stationary at first and second differences. Hence, both the variables are statistically significant and integrated at order I (1). Therefore, it is concluded that the variables selected for this study are stationary i.e. predictable. The outcome of this study was found to be parallel with the results of Nieh et al; (2001), and Sinha et al; (2015).

6.4 Testing of Relationship Between The Variables

The relationship between the Real Broad Effective Exchange Rate and S&P BSE Index are studied by using well-known statistical tool called correlation. Several methods of correlation like **Karl Pearson**, **Spearman's r and Kendall's Tau** are used to depict the correlation between the variables; the summary statistic of the correlation analysis is given in the following table.

Table: 4 Correlation Analyses

Measures	**Pearson's r**	**Spearman's rho**	**Kendall's Tau B**
Pearson's r	0.447	0.437	0.305
p-value	< .001	< .001	< .001

Source; Authors Calculation and Compilation

The above table throws light on the relationship that exists between the variables. Both Karl Pearson and Spearman's tests provide similar results that both variables have lower degree positive correlation. Therefore **First hypothesis** is rejected. This finding is in line with the study of Najang and Seifert (1992), it showed that absolute differences in stock returns have positive effects on exchange rate volatility. Now let us see the fluctuations of variables selected over the study period.

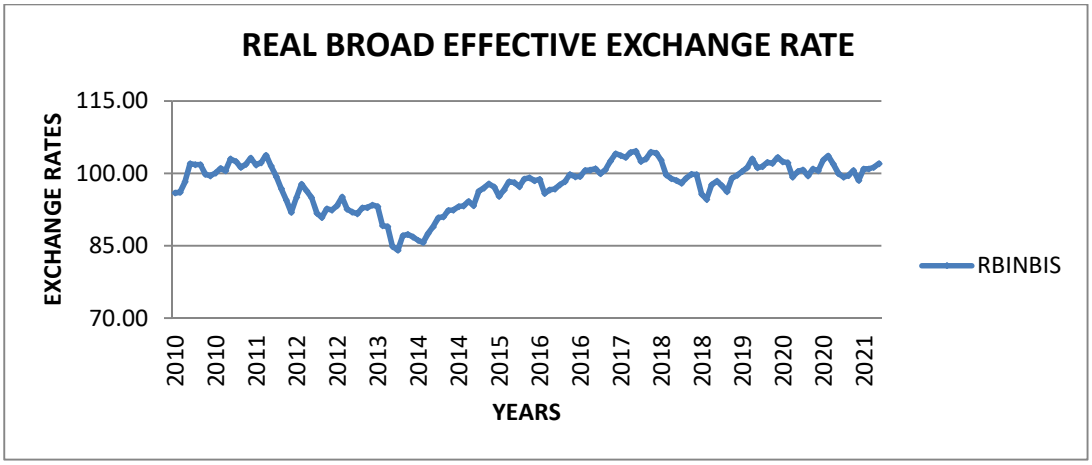

Chart-3 Time Series Plot of RBEER

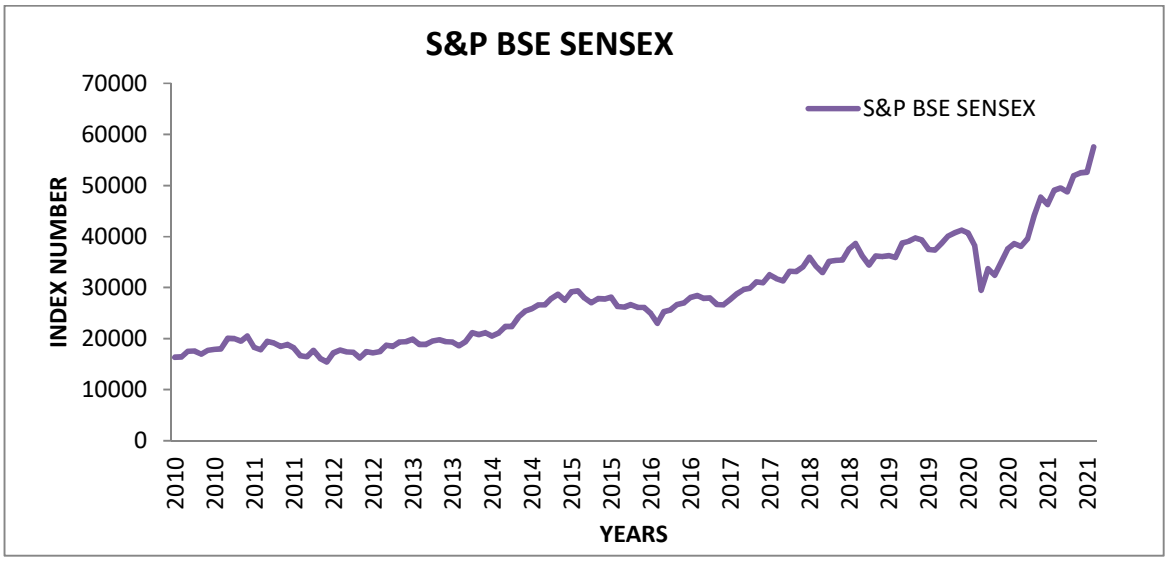

Chart-4 Time Series Plot of S&P BSE SENSEX

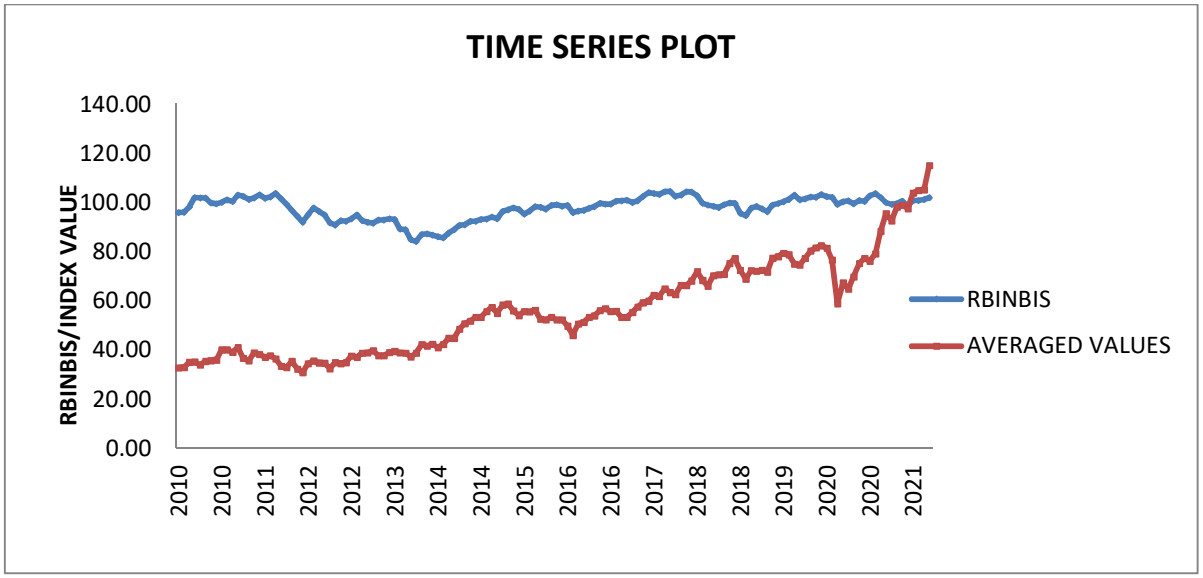

Chart-5 Time Series Plot of RBINBIS

6.5 Casualty Test

Correlation analysis only tells about the existence of correlation between the variables but it will not provide any information about cause and effect relationship between the variables, if we want to understand the cause and effect relationship between the variables it is necessary to conduct casualty test. Casualty test helps us to understand whether one variable causes another variable or not. For this purpose in this study we used Granger Casualty test to know whether Real Broad Effective Exchange Rate causes S&P BSE Index and vice versa. The result of Granger Casualty test is summarized in the following table.

Table: 5 Summary of Casualty Test

Pairwise Granger Causality Tests
Date: 12/12/21 Time: 16:16
Sample: 2010M01 2021M08
Lags: 2

Null Hypothesis:	Obs	F-Statistic	Prob.
S_P_BSE_SENSEX does not Granger Cause RBINBIS	138	0.84484	0.4319
RBINBIS does not Granger Cause S_P_BSE_SENSEX		1.66480	0.1931

Source; Test conducted and result taken from EViews.

The above analysis of pair wise granger casualty test reveals that there exists Bidirectional casual relationship between Real Broad Effective Exchange Rate and S&P BSE Index at 5% level of significance. Because the probability value is less than that of value of F- Statistic in both hypotheses. Therefore Second and Third Hypotheses are needed to be rejected. Hence it is concluded that Real Broad Effective Exchange Rate granger cause to change in S&P BSE Index and vice versa.

VII. FINDINGS OF THE STUDY

The major findings of this study are summarized in the following paragraph.

Firstly, Of the two variables Real Broad Effective Exchange Rate (**RBEER)** is said to be **relatively consistent** when it is compared with the S&P BSE Index because CV of Real Broad Effective Exchange Rate is less than (4.815) that of S&P BSE Index (34.060). It can inferred that S&P BSE Index is more volatile than Real Broad Effective Exchange Rate (**RBEER).** Secondly, it is found that neither Real Broad Effective Exchange Rate nor S&P BSE Index is perfectly normally distributed. It is evidenced by values of skewness and kurtosis and this finding is in consonance with the study of Bhuvaneshwari, D., & Ramya, K. (2017). it is also observed that the Real Broad Effective Exchange Rate is positively skewed and S&P BSE Index is negatively skewed. This finding is found similar to the results of the study of (Gaurav Agrawal December 2010)

Thirdly, both variables are platykurtic in their shape. But Real Broad Effective Exchange Rate has thicker tail than S&P BSE Index. This result is in consonance with the findings of Williams, Harley Tega. (2018). Both Real Broad Effective Exchange Rate and S&P BSE Index are found to be stationary series at level form but found to be non stationary at first and second differences. Hence, both the variables are statistically significant. Therefore it can be said be that the shift in time doesn't cause a change in the shape of the distribution. This finding is in consonance with that of Ramya, K.,

& Bhuvaneshwari, D. (2017). Fourthly, we observed **lower degree positive correlation** between real Broad Effective Exchange Rate and S&P BSE Index. As its value of r as per both correlation methods (Karl Pearson and Spearman) are less than .5 i.e., .447 and .437 respectively. This result is in line with the study of Polisetty (2016) and Finally, Granger casualty test reveals that there **exists bidirectional casual relationship** between Real Broad Effective Exchange Rate and S&P BSE Index at 5% level of significance. The result is supported by the findings of Bhuvaneshwari, D., & Ramya, K. (2017).

VIII. SUGGESTIONS AND CONCLUSION:

This study is conducted to know the relationship between the exchange rate fluctuation and stock market performance. The above study observed relatively **low degree positive correlation** along with **presence** of **bidirectiona**l cause and effect relationship between the variables. In this study we selected Real Broad Effective Exchange Rate as independent variable and S&P BSE Index as dependent variable. But in practice, the stock market performance is heavily influenced by several factors other than exchange rate alone like inflation rate, interest rate, BOP Level, employment rate, monetary policy of the central bank, fiscal policy of the government, and so on. Hence it is suggested that the result of the study are more accurate if one considers all macroeconomic factors which have bearing on the stock market performance.

REFERENCES

Bhuvaneshwari, D., & Ramya, K. (2017). Co integration and Causality between Stock Prices and Exchange Rate: Empirical Evidence from India. SDMIMD Journal of Management. *8*(1). http://www.informaticsjournals.com/index.php/sdmimd.

Perera H. A. P. K. (2015). Effects of Exchange Rate Volatility on Stock Market Return Volatility: Evidence from an Emerging Market. International Journal of Science and Research (IJSR). 5(1). www.ijsr.net

Fapetu, Oladapo., Adeyeye, Patrick Olufemi., Seyingbo, Oluwagbenga Abayomi., & woeye, Segun Daniel. (2017). Exchange Rate Volatility and Stock Market Performance in Nigeria. Nigerian Journal of Management Sciences. 6(1), 308-317.

Navita Nathani., Himani Saxena., Paramasivam, P., Poonam Mishra., Nandini Sharma., Vimlesh Singh., Nihal Kadam., & Jain Ragini. (2014). Determinants of Stock Price Movements: Empirical Study of Indian Stock Market. Research Perspectives in Social Sciences. Pp, 117-126

Fatbardha Morina., & Eglantina Hysa. (2020). The Effect of Exchange Rate Volatility on Economic Growth: Case of the CEE Countries. Journal of Risk and Financial Management. 2(2). doi:10.3390/jrfm13080177

Anil Vashisht. (2018). An Empirical Study of Relation Between Indian Stock Market And Inflation, Interest Rates And Exchange Rates. Journal of Emerging Technologies and Innovative Research (JETIR). 5(5), 599-606. www.jetir.org

Sood, G. S., Jain, Mukesh Kumar., and Kaur, Gurneet. (2018). Exchange Rate Fluctuations and its Impact on Stock Market in India: Empirical Analysis. International Journal of Trend in Research and Development. 5(3), 815-817. www.ijtrd.com

Chowdhury Piyali Roy., & Arthanari, Anuradha. (2018). Impact of Exchange Rate Fluctuation on Stock Market Volatility - A Study to Predict the Economic Scenario in India. International Journal of Pure and Applied Mathematics. 118(18), 4309-4315. url: http://www.ijpam.eu

Williams, Harley Tega. (2018). An Empirical Investigation Of The Impact Of Exchange Rate Fluctuations On The Performance Of Selected Listed Firms In Nigeria. Harley Tega Williams. 2(3), 1-10. Doi: 10.29226/TR1001.2018.22

Lyn ros., & Jose Nithin. (2020). Stock Market Reactions on Exchange Rate Volatility: An Indian Experience. International journal of research. 8(9), 256-265.

Polisetty Aruna., Prasanna Kumar, D., & Susan Kurian Jikku. (2016). Influence of Exchange Rate on BSE Sensex & NSE Nifty. IOSR Journal of Business and Management (IOSR-JBM). 18(9), 10-15. www.iosrjournals.org

Singh, Saurabh., Tripathi, L. K., & Lalwani, Kirti. (2012). An Empirical Study Of Impact Of Exchange Rate & Inflation Rate On Performance Of Bse Sensex. Spectrum: A Journal of Multidisciplinary Research.1(3),20-31. https://www.researchgate.net/publication/25606030

Bhutania, Kamini., & Rajnib. (2021). Nexus between Indian Stock Indices and Foreign Exchange Rate during Covid-19 Pandemic: An Empirical Study. Turkish Online Journal of Qualitative Inquiry (TOJQI). 12(7), 4161 – 4171.

Ashish Samarpit Noel., & Vidhu Grace Noel. (2012). An Empirical Study On Effect Of Changes In Forex Exchange Rates On Stock Market Fluctuations. Asian Journal of Business and Economics. 2(3), 1-19.