

## **An Empirical Study on Indian Stock Market and Foreign Exchange Rates – A Review on Relationship**

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**Abstract:** *The connection between the two financial variables-stock returns and exchange rates-became particularly considerable in the wake of the 1997; Floating exchange rate makes easy greater volume of trade and high volatility in equity as well as Forex market, increasing its exposure to economic and financial risks. The present study analyses the return relationship between the Indian Stock Market and Foreign Exchange Rates. For the purpose, the secondary data were collected for the period of five year from January 2011 to December 2015 covers 1203 available harmonized days with closing prices of each variable. Then the collected data were converted for fitness and used various statistical tools to achieve results. The research found and strongly believes that both the time series, Stock and Exchange Rate Returns, were stationary at the level form itself and correlation confirmed that there were inverse relationship between Returns from Indian Stock Market and Forex Rate Returns during the elected study period.*

**Keywords:** Exchange Rate, Forex Rate, Nifty, Sensex, Stock Return, and Volatility

**JEL Classification:** GO2, G12 and O16

### **Introduction**

The activities in the financial markets and their associations with the real sector have held significance in recent past. Various reform measures have brought in a vibrant change in the functioning of the financial sector. Floating exchange rate that has been implemented in India since 1991 made easy greater volume of trade and high volatility in equity as well as Foreign Exchange market, increasing its exposure to economic and financial risks as well.

The connection between the two financial variables-stock returns and exchange rates-became particularly considerable in the wake of the 1997 economic crisis in Asian countries, which sourced stock prices and exchange rate to fall diagonally in Asian markets.

Furthermore, in the recent years, because of mounting international diversification, cross-market return correlations, gradual abolishment of capital inflow blockades and foreign exchange limits or the acceptance of more flexible exchange rate arrangements in emerging and transition countries, these two markets have become significantly dependent. These changes have increased the variety of investment prospects as well as the volatility of exchange rates.

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Any remaining errors or omissions rest solely with the author(s) of this paper

## An Empirical Study on Indian Stock Market and Foreign Exchange Rates – A Review on

Stock Market in India registered 28.03 per cent average growth from 2011 to 2015, reaching an all-time high of 29681.77 Index points from BSE in January of 2015 and 8996.3 Index points from NSE in March of 2015. The rapid growth and volatility contributed country's economy and financial restructuring in different mode attracted the global interest as well as some questions. Revisit on the magnitude of two important legs of the country's economy has often been looked after? Where they were then and where they are now? Does Return from Foreign Exchange Rates affect India Stock Market return? Though economic theories suggested that difference in expected stock returns should be related to changes in exchange rates, this study attempts to examine how changes in exchange rates and stock prices are related to each other over the selected period.

### Review of the Literature

#### **Bala Ramasamy and Yeung M (2001)**<sup>3</sup>

Tried to figure out the causality between stock returns and exchange rates by touching nine East Asian economies. They stated that there has been a renewed interest in the determination of causality between stock markets and exchange rates. They employed the standard Granger causality methodology to a research setting similar to that of Granger et al. (2000). By considering the causality between the two markets in nine East Asian economies, the researchers found that the direction of causality tends to demonstrate a hit-and-run behaviour and switches according to the length of period chosen.

The hit-and-run pattern of causal behaviour across all countries in the analysis raises doubts as to whether the results can be used to make any meaningful policy recommendations other than to accept the fact that movements in the stock and exchange rate markets are highly robust and vigorous. Also the authors mentioned that great caution must be employed when interpreting the results of such Granger causality results.

#### **Jorge Canales-Kriljenko and Karl Habermeier (2004)**<sup>4</sup>

Examined the factors affecting exchange rate volatility, with an emphasis on structural features of the foreign exchange regime. The authors used 85 developing and transition economies in 2001.

It draws for the first time on detailed survey data collected by the IMF on foreign exchange market organization and regulations.

Key findings are that decentralized dealer markets, regulations on the use of domestic currency by non-residents, acceptance of Article VIII obligations, and limits on banks' foreign exchange positions are associated with lower exchange rate volatility. The paper also provides support for earlier results on the influence of macroeconomic conditions and the choice of exchange rate regime on volatility.

#### **Vikram K. Joshi and Richa Saxena (2011)**<sup>5</sup>

Jointly attempted to study the impact of FII on Indian Stock Market by referencing the BSE Sensex. For analyzing the impact of FII on SENSEX, the authors collected the data of Sensex,

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<sup>3</sup> **Bala Ramasamy and Yeung, M**, "The Causality between Stock Returns and Exchange Rates: Revisited", Research Paper Series, Division of Business and Management, The University of Nottingham, Malaysia, November 2001.

<sup>4</sup> **Jorge Canales-Kriljenko and Karl Habermeier**, "Structural Factors Affecting Exchange Rate Volatility: A Cross-Section Study", Working Paper, International Monetary Fund, WP/04/147, August 2004.

<sup>5</sup> **Vikram K. Joshi and Richa Saxena**, "Analytical Study of Impact of FII on Indian Stock Market with Special Reference to BSE Sensex", Management Insight, SMS Varanasi, Vol. VII, No. 2, December 2011, PP 40-55.

FII in terms of Total Investment (Equity + Debt) and FII in terms of Total Turnover (Purchase & Sales of Equity + Debt) for the period of three months January, February and March in the year 2011. The study used Regression model and Trend analysis to find the answer to the questions what they had. The authors mentioned in their concluding remark that from the comparative analysis done, when the relationship between Sensex vs. Total turnover & Sensex vs. Net investment exists and it is significant, it produces a positive impact in the Sensex as it starts moving up, but when the case is opposite, it tends to remain on a lower side. FII Investment when withdrawn up to a large extent causes the Sensex to fall just as it happened in the case of January & February. But if a proper balance between FII inflow & outflow is there, it prevents the BSE SENSEX from falling as evident from the case of March 2011.

### **Abdulrasheed Zubair (2013)<sup>6</sup>**

Examined the causal relationship between stock index and exchange rates in Nigeria, before the global – financial crisis. He used Johansen’s co- integration to test for the possibility of co- integration and Granger-causality to estimate the causal relationship between stock market index and monetary indicators (exchange rate and M2) before and during the global financial crisis for Nigeria, using monthly data for the period 2001–2011. The results suggested that the absence of long-run relationship before and during the crisis. The Granger-causality tests had shown a uni-directional causality running from M2 to ASI before the crisis while during the period of the crisis there is absence of causality between the variables. This suggests that ASI shows responsiveness to M2. Thus, absence of the direct linkage between ASI and Exchange rate shows that the market is inefficient and perhaps not derived or guided by the fundamentals.

## **Methodology**

### **Data, Source of Data and Period of the Study**

The present research is based on Secondary Data (Sensex, Nifty and Exchange Rates USD, EURO, GBP and YEN against INR) collected mainly from Bombay Stock Exchange Ltd (BSE), National Stock Exchange of India Ltd (NSE) and Reserve Bank of India (RBI).

The study covers a period of 5 years (daily data) from the calendar year 2011 to 2015; the absolute days available are accounted then which include 1203 days.

### **Framework of Analysis**

Study attempts to find out the relationship between Return from Indian Stock Market Volatility and Return from Foreign Exchange Rates as a focal objective. The daily returns on BSE Sensex, NSE Nifty and Foreign Exchange Rates have been calculated by using the below formula:

$$R = (C-P)/P*100$$

Where, R = Return, C = Closing Points or Rate and P = Previous Points or Rate. The values so obtained have been employed for studying the relationship between stock returns and exchange rates.

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<sup>6</sup> **Abdulrasheed Zubair**, “Causal Relationship between Stock Market Index and Exchange Rate: Evidence from Nigeria”, CBN Journal of Applied Statistics, Volume.4 No.2, December 2013, PP 87-106.

## An Empirical Study on Indian Stock Market and Foreign Exchange Rates – A Review on

Applied various statistical tools in the study based on the needs and wants to meet the set objectives. Jarque-Bera (JB) for normality check on both the series to determine the nature of their distributions.

After the confirmation of non-normal distribution of selected variables, the question of stationarity of the time series posed concerns, Unit Root Test (ADF) further been applied to find the stationarity.

Further, the study used Correlation Analysis to measure the relationship between the variables and Granger Causality Test to find the cause and effect, post which conclusion arrived.

### Empirical Results

#### Normality Test

**Table 1: JB Test Result on Returns from Indian Stock Market**

Description	BSE - SENSEX	NSE - NIFTY
<b>N</b>	1203	1203
<b>S</b>	-0.11	-0.11
<b>K</b>	1.49	1.45
<b>JB</b>	115.63	122.16
<b>Result</b>	Not Normal	Not Normal

**Source:** Calculated based on data from BSE and NSE Ltd

Table 1 presents with JB test result on Returns from Sensex and Nifty from the year 2011 to 2015. At 5 percent significance and 2 degrees of freedom, the critical chi-square value is 5.99 and the computed JB value is far away. The result shows that data is not normal during selected period with obtained JB statistics of 115.63 along with -0.11 left skewness and kurtosis of 1.50 when it comes to BSE Sensex. On other hand, based on the decision rule and the calculated statistics of NSE Nifty, it is designated under not normal. JB statistics of 122.17 along with -0.11 left skewness and kurtosis of 1.46 proves the decision.

**Table 2: JB Test Result on Returns from Foreign Exchange Rates**

Description	USD	GBP	EURO	YEN
<b>N</b>	1203	1203	1203	1203
<b>S</b>	0.45	0.24	0.31	0.09
<b>K</b>	5.25	2.01	2.59	2.97
<b>JB</b>	296.35	60.21	28.37	1.84
<b>Result</b>	Not Normal	Not Normal	Not Normal	Normal

**Source:** Calculated based on data from RBI

Table 2 exhibits with Jarque-Bera test result on Returns from USD/INR, GBP/INR, EURO/INR and YEN/INR during the study period from the year 2011 to 2015 and indicates that all variables are not normal. JB statistics of USD/INR, GBP/INR, EURO/INR and YEN/INR with 296.36, 60.21, 28.37 and 28.37 respectively proves the decision.

#### Unit Root Test

Having affirmed the non-normal distribution of the two variables, the question of stationarity of the two time series posed concerns.

Augmented Dickey-Fuller (ADF) test has been carried out to find the stationarity of the variables.

**Table 3: ADF Unit Root Test Result on Returns from Indian Stock Market**

<b>Null Hypothesis:</b> Indian Stock Market has a unit root				
<b>Exogenous:</b> Constant				
<b>Lag Length:</b> 2 (Automatic - based on AIC, maxlag = 10)				
		<b>t-Statistic - BSE</b>	<b>t-Statistic - NSE</b>	<b>Prob.</b>
Augmented Dickey-Fuller test statistic		-20.81583	-20.72201	0.0000
Test critical values:	1% level	-3.435585	-3.435585	
	5% level	-2.86374	-2.863740	
	10% level	-2.567991	-2.567991	

Table 3 reveals the Augmented Dickey-Fuller Unit Root test result on returns from Indian Stock Market during the study period from the year 2011 to 2015. Based on the call from decision rule of ADF test, the computed t is lower than ADF critical value that leads to reject the null hypothesis that Indian Stock Market has a unit root.

It becomes evident that the obtained statistics for Sensex returns -20.81583 fall behind the critical values at 1 per cent significance level of -3.435585 along with probability values of 0.00. Nifty returns -20.72201 falls behind the critical values even at 1 per cent significance level of -3.435585 along with probability values of 0.00. Hence, it can be safely concluded on the basis of ADF test statistics that Indian Stock Market are found to be stationary at level form.

**Table 4: ADF Unit Root Test Result on Returns from Foreign Exchange Rates**

<b>Null Hypothesis:</b> Foreign Exchange Rates has a unit root						
<b>Exogenous:</b> Constant						
<b>Lag Length:</b> 5 (Automatic - based on AIC, maxlag=10)						
		<b>t-Statistic - USD</b>	<b>t-Statistic - GBP</b>	<b>t-Statistic - EURO</b>	<b>t-Statistic - YEN</b>	<b>Prob.</b>
Augmented Dickey-Fuller test statistic		-12.76134	-12.35151	-14.51198	-34.03655	0.0000
Test critical values:	1% level	-3.435599	-3.435599	-3.435595	-3.435576	
	5% level	-2.863746	-2.863746	-2.863744	-2.863736	
	10% level	-2.567995	-2.567995	-2.567994	-2.567989	

Table 4 designates the Augmented Dickey-Fuller Unit Root test result on returns from Foreign Exchange Rates during the study period from the year 2011 to 2015. ADF critical values of returns from Foreign Exchange Rates leads to reject the null hypothesis that foreign exchange rates has a unit root.

It becomes evident that the obtained statistics for USD/INR, GBP/INR, Euro/INR and Yen/INR returns -12.76, -12.35, -14.51 and -34.03 respectively falls behind the critical values even at 1 per cent significance level of -3.43 along with probability values of 0.00.

Hence, it is found that returns from Foreign Exchange Rates to be stationary at level form based the results and decision rule of ADF test.

### Correlation Analysis

To find the answer to the question whether there is any relationship between Indian stock market and foreign exchange rates, the correlation analysis has been used below.

**Table 5: Correlation Matrix – Returns from Indian Stock Market and Foreign Exchange Rates**

Description	BSE	NSE	USD	GBP	EURO	YEN
<b>BSE</b>	1					
<b>NSE</b>	0.995633	1				
<b>USD</b>	-0.3229	-0.33338	1			
<b>GBP</b>	-0.18293	-0.19399	0.663062	1		
<b>EURO</b>	-0.15004	-0.15773	0.51716	0.697129	1	
<b>YEN</b>	-0.27945	-0.28788	0.679636	0.584914	0.482168	1

**Source:** Computed based on data from BSE, NSE and RBI

Table 5 illustrates the relationship between the returns from Indian Stock Markets and Foreign Exchange Rates during the study period of 5 years from the year 2011 to 2015 along with the returns relationship from currency to currency.

The result clearly endorsed that Indian Stock Markets moves together with positive correlation of 0.995633, and inversely related to currency returns by BSE Sensex Returns to USD/INR, GBP/INR, EURO/INR and YEN/INR stands with -0.3229, -0.18293, -0.1500 and -0.27945 respectively and NSE Nifty Returns to USD/INR, GBP/INR, EURO/INR and YEN/INR stands with -0.33338, -0.19399, -0.15773 and -0.28788 respectively.

On the other hand, the relationship between currency returns to other currency returns against INR shows the positive association among them. The highest positive correlation attained at 0.697129 between EURO/INR and GBP/INR, while the lowest side is 0.482168 between YEN/INR and EURO/INR during the study period.

### Cause and Effect Analysis

One may state that the two series are weakly correlated as the coefficient of correlation depicts some interdependency between the two variables. However, correlations may be spurious. The correlation needs to be further verified for the direction of influence by the Granger causality test. Also, to capture the degree and the direction of long-term correlation between Indian stock market returns and exchange rates under study, Granger Causality Test was conducted and presented below.

**Table 6: Granger Causality between Returns from BSE Sensex and Exchange Rate USD/INR**

Pairwise Granger Causality Tests			
Date: 02/15/16 Time: 15:17			
Sample: 1/03/2011 12/31/2015			
Lags: 2			
Null Hypothesis:	<b>Obs</b>	<b>F-Statistic</b>	<b>Prob.</b>
<b>USDR does not Granger Cause BSER</b>	1201	0.98576	0.3735
<b>BSER does not Granger Cause USDR</b>		32.4327	2.00E-14

Table 5 represents the Pairwise Granger Casualty Test result between reruns from BSE Sensex and exchange rate USD/INR during the study period from the year 2011 to 2015 with lags of 2. For the null hypothesis 1, in the above figure F-Statistic of 0.98576 is less-than the critical value of 3.84, therefore null the hypothesis is going to be accepted which means USDR does not cause BSER, whereas for the null hypothesis 2, in the above figure F of 32.4327 is greater-than the critical value of 3.84, therefore the null hypothesis can be rejected and the alternative hypothesis is going to be accepted which means BSER cause USDR. Hence this proves that the above cause and effect relationship is unidirectional and not bidirectional.

**Table 7: Granger Causality between Reruns from BSE Sensex and Exchange Rate GBP/INR**

Pairwise Granger Causality Tests			
Date: 02/15/16 Time: 15:17			
Sample: 1/03/2011 12/31/2015			
Lags: 2			
Null Hypothesis:	Obs	F-Statistic	Prob.
<b>GBPR does not Granger Cause BSER</b>	1201	0.04875	0.9524
<b>BSER does not Granger Cause GBPR</b>		25.2112	2.00E-11

Table 7 shows the Pairwise Granger Casualty Test result between reruns from BSE Sensex and exchange rate GBP/INR during the study period from the year 2011 to 2015 with lags of 2.

For the null hypothesis 1, in the above figure F of 0.04875 is less-than the critical value of 3.84, therefore the null hypothesis is going to be accepted which means GBPR does not cause BSER, whereas for the null hypothesis 2, in the above figure F of 25.2112 is greater-than the critical value of 3.84, therefore the null hypothesis can be rejected and the alternative hypothesis is going to be accepted which means BSER cause GBPR.

Hence this proves that the above cause and effect relationship is unidirectional and not bidirectional.

**Table 8: Granger Causality between Reruns from NSE Nifty and Exchange Rate EURO/INR**

Pairwise Granger Causality Tests			
Date: 02/15/16 Time: 15:18			
Sample: 1/03/2011 12/31/2015			
Lags: 2			
Null Hypothesis:	Obs	F-Statistic	Prob.
<b>EURO does not Granger Cause NSE</b>	1201	1.32458	0.2663
<b>NSE does not Granger Cause EURO</b>		35.3377	1.00E-15

Table 8 represents the Pairwise Granger Casualty Test result between reruns from NSE Nifty and exchange rate EURO/INR during the study period from the year 2011 to 2015 with lags of 2.

For the null hypothesis 1, in the above figure F of 1.32458 is less-than the critical value of 3.84, therefore the null hypothesis is going to be accepted which means EUROR does not cause NSER, whereas for the null hypothesis 2, in the above figure F of 35.3377 is greater-than

An Empirical Study on Indian Stock Market and Foreign Exchange Rates – A Review on the critical value of 3.84, therefore the null hypothesis can be rejected and the alternative hypothesis is going to be accepted which means NSER cause EUROR.

Hence this proves that the above cause and effect relationship is unidirectional and not bidirectional.

**Table 9: Granger Causality between Reruns from NSE Nifty And Exchange Rate YEN/INR**

Pairwise Granger Causality Tests			
Date: 02/15/16 Time: 15:18			
Sample: 1/03/2011 12/31/2015			
Lags: 2			
Null Hypothesis:	Obs	F-Statistic	Prob.
<b>YENR does not Granger Cause NSER</b>	1201	0.65944	0.5173
<b>NSER does not Granger Cause YENR</b>		60.3975	1.00E-25

Table 9 portrays the Pairwise Granger Casualty Test result between reruns from NSE Nifty and exchange rate YEN/INR during the study period from the year 2011 to 2015 with lags of 2.

For the null hypothesis 1, in the above figure F of 0.65944 is less-than the critical value of 3.84, therefore the null hypothesis is going to be accepted which means YENR does not cause NSER, whereas for the null hypothesis 2, in the above figure F of 60.3975 is greater-than the critical value of 3.84, therefore the null hypothesis can be rejected and the alternative hypothesis is going to be accepted which means NSER cause YENR.

Hence this proves that the above cause and effect relationship is unidirectional and not bidirectional.

### Conclusion

Sound and sustainable growth in economy is needed for a developing country like India. The Stock Market is a major contributor to the economy and financial structure of the country, and also an indicator too. Foreign Exchange Rates are also the joint holder in making a viable financial system. The combination and comparison of both the variables, Stock Market and Foreign Exchange Rates are the key areas to focus. The study attempted to find the relationship between Indian Stock Market and Foreign Exchange Rates, along with the said additional objectives.

Indian Stock Market publicized with relatively better growth year on year as a developing country and the cost of Indian Rupee to other countries becoming economical particularly to the United States of America, the United Kingdom and Europe unlike Japan. Having affirmed the non-normal distribution of the two variables, the question of stationarity of the two time series posed concerns and both variables are found to be stationary at level form during the study period.

Barometers of Indian Stock Exchanges, BSE Ltd and NSE Ltd move together with their indices Sensex and Nifty. Collectively, return from Sensex and Nifty exposed inverse relationship among returns from foreign exchange rates USD, GBP, EURO and YEN. On the other hand, the relationship between currency returns to other currency returns against INR shows the positive association among them. The study proves that the cause and effect relationship between Indian Stock Market and Foreign Exchange Rates is unidirectional and not bidirectional. Indian Stock Market causes the currency rate movement, by attracting more

FII/FPI into equity segment and retaining them for longer run would help India to get more foreign currency inflow which will lead the country to maintain currency reserves. By the way, Rupee value gets strengthened and this will result in the growth of Indian economy.

### References

- Deepti Gulati and Monika Kakhani, “*Relationship between Stock Market and Foreign Exchange Market in India: An Empirical Study*”, Pacific Business Review International, Volume 5 Issue 5, November 2012, PP. 66-71.
- Giulia Piccillo, “*Foreign Exchange and Stock Market: Two Related Markets?*”, September 2008, PP 1-39.
- Jerson B. Patosa and Agustina Tan Cruz, “*Factors affecting Exchange Rate Movements in Selected Asian Countries*”, Conference Paper, Research Gate, April 2012, PP 1-20.
- Julieta Yung, “*Can Interest Rate Factors Explain Exchange Rate Fluctuations?*”, Working Paper, Federal Reserve Bank of Dallas, October 2014, PP – 1-49.
- Kantesha Sanningammanavara, Kiran Kumar K V and Rakesh H M, “*Macro-Economic Forces and Indian Stock Market: An Empirical Relation*”, International Journal of Commerce, Business and Management, Vol. 3, No. 3, June 2014, PP 457-465.
- Pan, M.-S., Fok, R. C.-W., & Liu, Y. A, “*Dynamic Linkages between Exchange Rates and Stock Prices: Evidence from East Asian Markets*”, International Review of Economics and Finance, 2007, 16, PP. 503-520.
- Pareshkumar J. Patell, Narendra J. Patel and Ashok R. Patel, “*Factors affecting Currency Exchange Rate, Economical Formulas and Prediction Models*”, International Journal of Application or Innovation in Engineering & Management, Volume 3, Issue 3, March 2014, PP 53-56.