Integration of Exchange Rate and Stock Market : Evidence from the Indian Stock Market

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Abstract

The stock market represents the financial health of an economy, while the exchange rate represents the country's currency value against the value of international currency. After economic reforms in India post 1991, the economic and overall growth got a boom because of globalization and privatization. These reforms enhanced the imports and exports and brought volatility in the exchange rate. The current research work investigated the rapport among Nifty index returns in India and the Indian exchange rate in consideration with the U.S. dollar. The exchange rate volatility generates volatility in the stock market, which creates confusion in the minds of domestic investors as well as for foreign institutional investors. The main purpose of conducting this research was to find out the impact of change in the exchange rate in India on the trading volume and returns of Nifty index. To examine the relationship between stock market returns and exchange rate, econometric tools like ADF test, correlation, Johansen's co-integration test, and Granger causality test were applied with the help of EVIEWS program. The study was conducted during the period from April 2005 till March 2014. The empirical analysis showed that negative correlation existed among the stock market returns and exchange rate; however, the degree of correlation was not very significant. Co-integration test results showed that there was an absence of co-integration among the variables. The Granger causality test indicated that Nifty stock returns Granger caused the rupee-dollar exchange rates in India. This paper provides suggestions to the investors regarding the strategies that they can opt for trading in volatile stock markets to minimize risk or fear of bearing losses.

Keywords: stock market, exchange rate, volatility, correlation, Granger causality test & Johansen's co-integration test

JEL Classification : F65, G11, G15

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There are two major indicators of the financial condition of an economy - the stock market and foreign exchange market. As both are connected with the monetary condition of a country, so it is required to find out the relationship between the two markets. A number of research studies have been conducted to find out the relationship between the levels of stock market returns and exchange rate changes. It is a general thinking that a change in the exchange rate will directly have an impact on the returns of the stock market as a positive increase in the exchange rate has a positive impact over the stock market returns and a negative change in the exchange rate has a negative impact on the returns of the stock market. The current study aims to find out the interrelationship between returns of the Indian stock market and rupee-dollar exchange rates. Before finding out the relationship between the two, it is better to understand the past literature which suggested that after liberalization in India, the role of foreign exchange rate increased significantly.

Dornbusch and Fischer (1980) explained that one variable influenced the other, which means that a change in the value of exchange currency directly affected the global competitiveness and also affected the balance of payment within the country. The international cash flow in a country is affected by changing the exchange rate. More cash flows in the country create more investment in the industries as well, which shows a good state of the

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economy. FII's also like to make investments in stock markets with good economic conditions and hesitate to invest in weak economic conditions. This creates a fluctuation or volatility in the stock market. Increase or decrease in the stock prices influence the stock market returns of the investors and market participants.

Exchange rate is the rate of exchange of one currency with another currency; it may be two types - fixed or floating. A continuous change in the currency exchange rate will affect the investing decision of the domestic as well as foreign investors. If the value of exchange rate positively changes, investors are more interested to make investment in the stock market which enhances the liquidity and returns of the stock market. On the other hand, a decrease in the value of domestic currency will create fear in the minds of the investors and will bring negative influence in the stock market.

The Figure 1 shows the price of Nifty index and rupee dollar exchange rate, which represents that the price of Nifty index had an upward trend during 2005 to 2008. But it was not the same for exchange rate as the value of rupee declined during 2006 to 2008. This shows that it is not necessary that both stock market price and exchange rate are moving together.

So, the present study tries to find out the causal relationship between stock market returns and currency exchange rate. To examine the relationship between these two correlations, Granger causality and VEC model has been used. CNX Nifty and rupee-dollar exchange rate during the period from April 1, 2005 to March 31, 2014 have been examined to serve the objectives of the study.

Review of Literature

Zubair (2013) examined the relationship between stock market index and monetary indicators (exchange rate and M2) before and during the global crisis in Nigeria. Johansen's co-integration and Granger causality test results showed that there was an absence of long run relationship between the variables during the period from 2001 to 2011.

Rahman and Uddin (2009) examined the dynamic relationship between stock prices and exchange rate in South Asian countries. The results indicated that there was no relationship between stock market returns and currency exchange rate.

Nath and Samanta (2010) examined the dynamic linkages between the currency exchange rate and Indian stock markets during the period from 1993 to 2002. The analysis results revealed that the returns in these two markets were not related with each other.

Figure 1. CNX Nifty and Rupee-Dollar Exchange Rate Graph
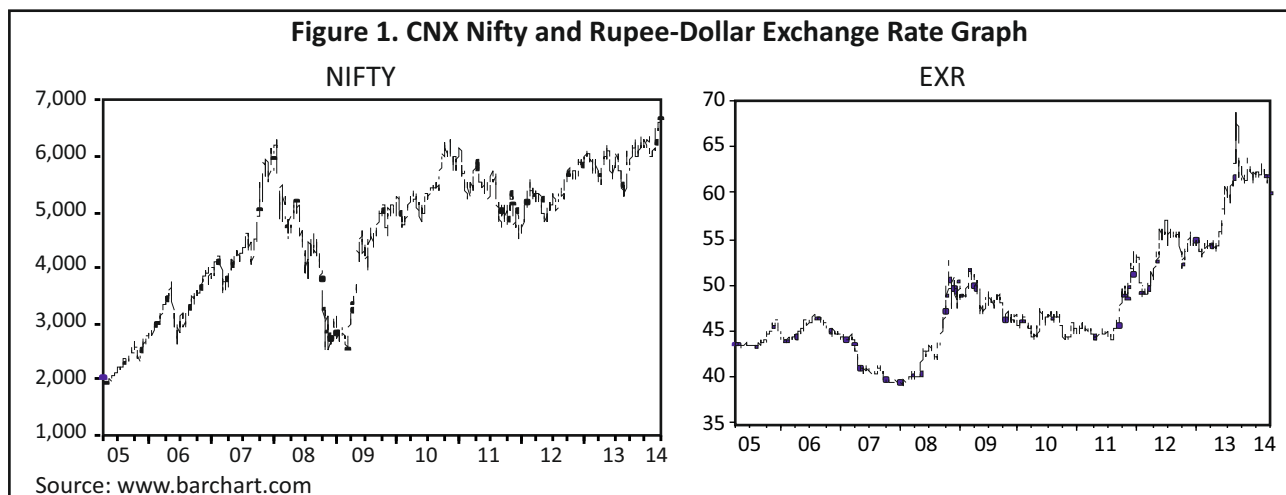
Research Gap and Research Problem

The judgment says that an increase in rupee value will escalate the Indian economy alongside the U.S. economy. But this statement might not be true as during the year 2006-07, there was a major downfall in the IT industry, but the value of rupee increased from ₹ 45.02 in October 06 to ₹ 39.07 in January 08. So, there is a requirement to know about the impact of fluctuation in the exchange rate on the stock market returns. It is a general perception that the exchange rate fluctuations have an impact on returns of the stock market. Various researchers have conducted studies on the same topic in developed and developing countries. This field can be used for academic research and practical investment analysis. This may provide insights for currency traders and investors to take decisions about short term and long term trading decisions in different economic climates.

The problem gives birth to new ideas and innovation. During the year 1991, there was an industrial revolution in India and doors were opened for the foreign investors and for exports also. Both foreign investments and exports of the country are based of the currency exchange rate. A variation in the currency exchange rate leads to an alteration in the investment decisions of FIIs, which leads to fluctuations in the Indian markets. Now, there is a question whether the stock market and currency exchange rate are connected with each other or not. The present research work makes an effort to find out the long run and the short run relationship between the stock market returns and currency exchange rates in India. Both variables represent the economic condition of the country. A change in the exchange rate is also an important criterion for the investors to take decisions for making investments in the stock market. So, it is required to find out up to what extent the relationship exists between stock market returns and exchange rate.

Objectives of the Study

- To find out the correlation between CNX Nifty returns and rupee-dollar exchange rate.
- To find out the co-integration between CNX Nifty returns and rupee-dollar exchange rate.
- To find out the cause and effect relation between rupee-dollar exchange rate and CNX Nifty returns.

Hypotheses

- **H01:** There is no correlation between CNX Nifty returns and rupee-dollar exchange rates.
- **H02:** There is an existence of co-integration between CNX Nifty returns and rupee-dollar exchange rates.
- **H03:** No causality exists between CNX Nifty returns and rupee-dollar exchange rates.

Research Methodology

(1) Sample & Data Collection : The research has been conducted on the daily closing price of CNX Nifty index and rupee-dollar exchange rates. The data were collected for the period from April 1, 1995 to March 31, 2014. This research is based only on secondary data that has been collected from National Stock Exchange of India and Onada websites.

(2) Statistical Tools : To test the connection between CNX Nifty index returns and rupee-dollar exchange rates, econometric models, that is, correlation, Johansen's co-integration test, and Granger causality test were used with E-Views 7 software.

Steps for finding out the correlation, co-integration, and Granger causality for CNX Nifty index returns and rupee-dollar exchange rates are as follows:

(i) Step 1 : First calculate the correlation coefficient between the two variables, this helps in identifying whether CNX Nifty index and rupee-dollar exchange rates are moving together or not. The range of correlation coefficient is between +1 (perfect positive) to -1 (perfect negative). For this, first convert both the series into the log return with the help of $rt = 100*\log(PT/PT(-1))$ formula. After that, the equation 1 has been applied for the correlation coefficient:

$$r_{xy} = \frac{\Sigma x_i y_i - n\overline{xy}}{(n-1)\, s_x s_y} = \frac{n\Sigma x_i y_i - \Sigma x_i \Sigma y_i}{\sqrt{n\,\Sigma x^2_i - (\Sigma x_i)^2 \quad n\,\Sigma y^2_i - (\Sigma y_i)^2}} \qquad (1)$$

(ii) Step 2 : The next step is to apply the Johansen's co-integration test. There is a precondition for this test that variables should be integrated at the same level, which means that both should be non-stationary at level and stationary at first difference. To check the stationarity of data, Augmented Dicker Fuller test was used and then I applied the Johansen's co-integration test. The result of the Johansen's co-integration is to be evaluated on the basis of a trace or eigenvalue of the variables.

(iii) Step 3 : The cause and effect relationship between two variables are to be analyzed with the help of Granger causality test. The Equation 2 represents the Granger causality with identification of the causal effect of X on Y:

$$P[Y(t+1) \in A \mid I(t)] \neq P[Y(t+1) \in A \mid I_{-x}(t)] \qquad (2)$$

where, A is an arbitrary non-empty set. The symbols $I(t)$ and $I_{-x}(t)$ denote all the information until a time t in the entire universe and the modified universe in which X is excluded, respectively. If the above hypothesis is accepted, we call that X Granger causes Y.

Data Analysis and Interpretation of Results

The collected data has been analyzed with the help of E-views 7 software. The Figure 2 and Figure 3 show the descriptive statistical analysis of the CNX Nifty returns and Indian rupee - U.S. dollar exchange rate. The mean returns of both the variables are positive, that is, 0.022888 for CNX Nifty and 0.006302 for the exchange rate during the period of the study. If the value of skewness is 0 and the value of kurtosis is 3, it indicates that the variables are normally distributed. However, in this case, the above descriptive statistics' analysis represents that both the variables are non-normally distributed, as the skewness values for Nifty returns and exchange rates are -0.019370 and 0.056705, respectively and the kurtosis values are 11.43950 and 10.01195, respectively.

The value of the Jarque-Bera is also high for both the variables, that is, 6624.086 for CNX Nifty returns and 4567.616 for exchange rate. The descriptive statistical analysis shows that both variables are not normally distributed during the period of the study.

The Augmented Dickey Fuller (ADF) test (Dickey & Fuller 1979) was conducted to check the stationarity of the data for the period of the study. The Table 1 shows that both variables have a unit root and are non-stationary at level as the p - value is 0.3985 for CNX Nifty and 0.9144 for the exchange rate, which are more than the significance level, that is, 5%. But after conducting the unit root test at first difference, both variables become stationary with the significant p value, that is, 0.0001 for both the variables at the 5% level. The hypothesis of unit root has been rejected at the first difference at the 5 % level of significance and both series are integrated at the same level of order, that is, $I(1)$.

The Table 2 shows the results of the correlation between CNX Nifty returns and exchange rate (Indian rupee - U.S. dollar). This represents that the correlation coefficient between the two variables is negative (-0.233075). Thus, it is to be affirmed that the two series are negatively correlated with each other. Thus, it is depicted that when
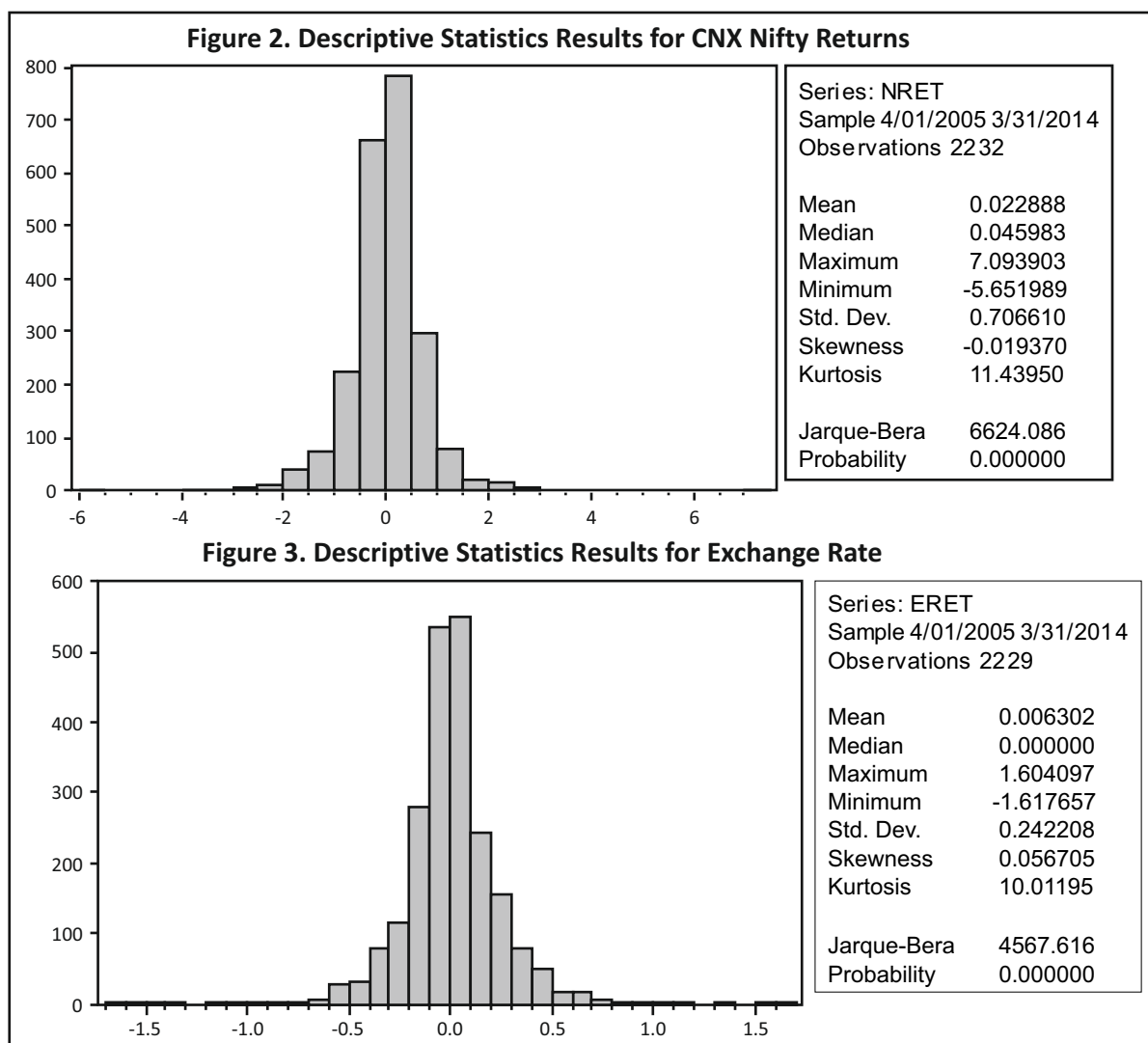
Figure 2. Descriptive Statistics Results for CNX Nifty Returns

Series: NRET	
Sample 4/01/2005 3/31/2014	
Observations 2232	
Mean	0.022888
Median	0.045983
Maximum	7.093903
Minimum	-5.651989
Std. Dev.	0.706610
Skewness	-0.019370
Kurtosis	11.43950
Jarque-Bera	6624.086
Probability	0.000000

Figure 3. Descriptive Statistics Results for Exchange Rate

Series: ERET	
Sample 4/01/2005 3/31/2014	
Observations 2229	
Mean	0.006302
Median	0.000000
Maximum	1.604097
Minimum	-1.617657
Std. Dev.	0.242208
Skewness	0.056705
Kurtosis	10.01195
Jarque-Bera	4567.616
Probability	0.000000

Table 1. ADF Test Results for CNX Nifty and Exchange Rate

Variable	ADF at Level	ADF at First Diff
CNX Nifty	-1.764594 (0.3985)	-44.59335 (0.0001)
(Exchange Rate) Rupee-US Dollar	-0.353291 (0.9144)	-46.09485 (0.0001)

Table 2. Correlation Test Results for CNX Nifty Returns and Exchange Rate

Variable	CNX Nifty Return	Exchange Rate
CNX Nifty Return	1.000000	-0.233075
Exchange Rate	-0.233075	1.000000

the exchange rate increases, the CNX Nifty returns come down or vice versa. However, correlations may sometime give counterfeit results, so there is a further need to check the direction of influence of the Granger causality test.

On the basis of above results, it can be concluded that the null hypothesis of no correlation existing between CNX Nifty returns and exchange rate has been rejected, which means that H01 has been rejected.

Table 3. Johansen's Co-Integration Test for CNX Nifty & Exchange Rate

	Trace	
No. of CE (s)	None	At most 1
Eigen Value	0.003139	4.47E-05
Statistic	7.089167	0.099324
Critical Value	15.49471	3.841466
P-value	0.5673	0.7526
	Maximum Eigenvalues	
No. of CE (s)	None	At most 1
Eigen Value	0.003139	4.47E-05
Statistic	6.989842	0.099324
Critical Value	14.26460	3.841466
P-value	0.4904	0.7526

Table 4. Granger Causality Test for CNX Nifty Returns and Exchange Rate

Null Hypothesis:	Obs	*F*-Statistic	Prob.
ERET does not Granger Cause NRET	2225	2.85676	0.0577
NRET does not Granger Cause ERET		74.0148	8.E-32

Johansen's co-integration test was conducted by taking variables at a level. The results of Johansen's cointegration test presents that there is an absence of co-integration among the variables. The Table 3 shows the trace test and max-eigenvalue test and represents that there is no co-integration at the 0.05 level. The value of probability is also not significant & is more than 5%, that is, 0.5673 for trace test and 0.4904 for the maximum eigen values ; hence, the null hypothesis could be rejected. The H02 hypothesis that there is an existence of co-integration between CNX Nifty returns and exchange rate in India has been rejected.

✤ **Granger Causality Test :** It is not sufficient to find out the correlation between variables to find out the relationship between existing variables. For this purpose, the Granger causality test was used to test the degree and direction of long term correlation between CNX Nifty returns and exchange rate during the period of the study. To find out the Granger causality between CNX Nifty returns and exchange rate, the null hypothesis (H03) has been set as follows:

✤ **H03:** Exchange rate return does not Granger cause stock market returns and vice-versa.

If the value of p is less than 5%, the H03 hypothesis is to be rejected and if it is more than 5%, the null hypothesis is to be accepted.

The Table 4 shows that the null hypothesis : Exchange rate does not Granger cause stock returns cannot be rejected as the value of F- statistics is 2.85676, with the probability value of 0.0577. This means that exchange rate does not Granger cause to the CNX Nifty returns. On the other hand, the null hypothesis that stock returns do not Granger cause exchange rate series has been rejected as the value of F-statistics is 74.0148 and value of probability is less than 5%. In other words, the results of the Granger causality test show that the stock returns clearly Granger cause the exchange rates. Hence, the H03 has been rejected.

Conclusion

The importance of currency exchange rate has increased during the past decades due to the globalization in the Indian economy. The exchange value of a country's currency represents the value of a country in response to other countries' currency. Globalization attracts the foreign institutional investors (FII's) to make investments in the stock market as well as this helps in increasing the trading value and market capitalization of the stock market. If the value of a country's currency has increased, it will help in developing the financial sector of the country. This study focused on analysing the dynamic relationship between the exchange rate (rupee-dollar) and Indian stock market (NIFTY). Various methods have been used to analyze the objectives of the study. Descriptive statistics (Figure 1 & Figure 2) of the variables explain that the data is not normally distributed. The ADF test (Table 1) has been used to check the stationarity of the data, which shows that both variables are non-stationary at level, but become stationary at the first difference. Thus, the series are integrated of order $I(1)$. The coefficient of correlation test (Table 2) for CNX Nifty returns and exchange rate indicate that the relationship between the two is negative during the period of the study, which means that if there is a decrease in the exchange rate, the rate of return on CNX Nifty increases.

Johansen's co-integration test (Table 3) helps in finding out the long run co-integration between two variables; the results indicate that there is no co-integration between CNX Nifty and exchange rate. After that, the pairwise Granger causality test (Table 4) for the study period from April 2005 to March 2014 is performed. The results reveal that the Nifty returns do not Granger cause the exchange rate, but exchange rate does Granger cause Nifty returns.

Most of the studies in the past were in favour of absence of long run relationships between stock market returns and exchange rate. However, this study finds (with the help of statistical analysis) that up to some extent, exchange rate has an impact on the trading of the stock market and creates volatility in the stock market. So, the regulatory authorities and the government should take some steps to control the exchange rate and should try to increase the value of our country's currency, which helps to develop the economy of the country as well as the financial market.

Limitations of the Study and Scope for Further Research

The existing literature provides the directions for further research. In the same manner, the limitations of the current research pave way for future research. There are certain limitations of the current study : the area of research is limited only to CNX Nifty returns and Indian rupee exchange rate. The research can be further extended by taking more stock returns. Another limitation is that the research has been conducted only for the Indian stock exchange and Indian rupee exchange rate. Future researchers can include more countries' stock exchanges and their exchange rates.

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