RUPEE VOLATILITY AND STOCK PERFORMANCE

AN EMPIRICAL STUDY

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Abstract

The research tries to understand the volatility of the Indian Rupee (INR) / US Dollar ($) exchange rate and its relationship with Indian stock market. The data used is monthly opening and closing prices of SENSEX and NIFTY over the aeon of 11 years (2003 - 2013). Testing persistence for SENSEX and NIFTY found a weak correlation but they had a correlation coefficient of 0.99 indicating movement in the same direction. A negative correlation was found between stock returns and the returns from dollar with less significant impact which means a positive correlation with the returns from Rupee. As stock market gains a positive sentiment prevails, improving investments in Indian capital market. This in turn increases the demand for INR and the price of INR in terms of $ increases, thereby depreciating the value of $ and vice versa. Hence, it is statistically established that $ fluctuations are influenced by stock market performance in India.

1. Introduction

This study attempts to establish a relationship between the fluctuations in INR/ $ with the stock indicators of the Indian stock market, SENSEX and NIFTY.

The rupee was pegged to the value of a basket of currencies of major trading partners till 1991. But India started having Balance of Payments deficit since 1985, and by the end of 1990, we found our country in a serious economic crisis. The Government's position was close to default and its foreign exchange reserves had dried up to the point that India could barely finance three weeks' worth of imports. This situation was followed by huge budget deficits. This situation turned the government to devalue the rupee twice in the last decade of the 20th century.

During the period 2000–2007, the rupee stopped depreciating and stabilized between Rs. 44 and Rs. 48 per USD. In late 2007, the Indian Rupee reached a record high of Rs.39 per USD, due to growth of foreign investment into the country. This posed problems for major exporters, IT and BPO firms located in the country who were incurring losses in their earnings given the appreciation in rupee. This trend later reversed in 2008 during the global recession as foreign investors took back funds from India to their own countries. This appreciation reflected in many currencies, e.g. the British Pound, which had gained against the dollar and then lost again during the global recession of 2008. Some studies in the past discussed the relationship between Currency and stock performance which are presented here.

Apte (2001) investigated the relationship between the

volatility of the stock market and the exchange rate fluctuations on the daily closing INR/USD exchange rate, Sensex and Nifty over the period 1991 to 2000 and the study suggests that there appears to be a spillover from the foreign exchange market to the stock market but not the reverse.

Richard A.Ajayi and Mbodja Mougoue (1996) have studied recent advances in the time-series analysis to examine the inter-temporal relation between stock indices and exchange rates for a sample of eight advanced economies. An error correction model (ECM) of two variables was employed to simultaneously estimate short-run and long-run dynamics of variables. The ECM result revealed significant short-run and long-run relationship between two financial markets. Specifically, the results show that increase in aggregate stock prices has negative short-run effect on domestic currency value. In the long-run, however, stock prices have positive effect on domestic currency value. On the other hand, currency depreciation has negative short-run and long-run effects on stock market.

Alok Kumar Mishra, Niranjan Swain, and D.K. Malhotra (2007) explored volatility spillovers between the Indian stock and foreign exchange markets. The results indicated that there exists a bidirectional volatility spillover between the Indian stock market and the foreign exchange market with the exception of NIFTY and CNX S&P 500. The findings of the study also suggested that both the markets move in tandem with each other and there is a long run relationship between these two markets. The results of significant bidirectional volatility spillover suggest that there is an information flow (transmission) between these two markets and both these markets are integrated with each other.

Christopher K, Ma And G. Wenchi Kao (1990) found that the exchange rate level is positively related to the stock index relative at the one percent level, while the exchange rate change is negatively related at the five percent level. The entire model is significant at the one percent level.

K N Badhani, Rajani Chhimwal and Janki Suyal (2009) examined the interaction between changes in the exchange rate of Indian Rupee and returns on different BSE-based indices representing the firms of different sizes and industries. The returns on all the stock portfolios were found to be positively correlated with the external value of Indian Rupee. However, the analysis with an extended market model of asset pricing shows that the indices of export-oriented industries are negatively associated with change in exchange rate, after making the adjustment for market trend. Among them, IT, technology and knowledge-based sectors show high sensitivity

towards exchange rate fluctuations. On the other hand, the indices of financial sector and import-intensive industries show a positive association with the exchange rate of rupee.

Agrawal Gaurav, Srivastav Aniruddh Kumar, Srivastava Ankita (2010) analyzed the relationship between Nifty returns and Indian rupee-US Dollar Exchange Rates. It was found that Nifty returns as well as Exchange Rates were non-normally distributed. Through unit root test, it was also established that both the time series, Exchange rate and Nifty returns, were stationary at the level form itself. Correlation between Nifty returns and Exchange Rates was found to be negative. Further investigation into the casual relationship between the two variables using Granger Causality test highlighted unidirectional relationship between Nifty returns and Exchange Rates, running from the former towards the latter.

Santosh Kumar, Raju G and Tanveer Shahab (2012) investigated the sensitivity of return on various indices with respect to change in exchange rate, especially in dollar and euro. They found that appreciation of rupee with respect to dollar, and euro has adverse impact on the returns of indices and vice versa. However, the exposure of euro is vindicated only in large and most liquid stocks as compared to wider exposure of dollar. On the other hand, significantly varying sensitivity coefficients of various indices have far-reaching importance in deciding the optimal volume of currency to be hedged in order to make it competitive and profitable. Thus, having continually widening current account deficit in India, resilience of capital account flows also plays an important role in offsetting the impact of currency exposure in India.

2. Research Objectives

The purpose of the study is to understand the volatility of the INR / $ and its relationship with stock markets with special reference to SENSEX and NIFTY.

3. Methodology

3.1 RESEARCH DESIGN AND HYPOTHESIS

The study uses Causal Research Design where the objective is to identify variables and analyze whether any cause and effect relationship exists among them, and if so, to quantify the extent of the relationship. A causal relationship can be interpreted if some external factor, (an independent variable) produces a change in the dependent variable. The research assumes the stock indicators to be independent and tries to examine the impact of the performance of stock markets on the volatility of INR. This research helps to establish a cause-and-effect linkages between the volatility of the Indian Rupee and

the stock markets through its indicators with special emphasis on SENSEX and NIFTY.

The research also tries to examine the extent of relationship of the time series to its own past using auto correlation so as to enable us to identify the trend. The Approach used for hypothesis testing is the classical or sampling theory approach. In this approach, the hypothesis is accepted or rejected on the basis of sampling information alone. Any sample might vary from its population and so it is important to judge whether the result from the sample is statistically significant or not. To test the significance null (H0) and alternate hypotheses (H1) are used.

The Hypotheses for the study are:

a)   To test the relationship between SENSEX and NIFTY:

Null Hypothesis (H0): The movement of NIFTY is independent of the performance of SENSEX. r = 0

Alternative Hypothesis (H1): The movement of NIFTY is not independent of the performance of SENSEX. r ≠ 0

b)   To test the relationship between SENSEX and INR / $ Exchange Rate:

Null Hypothesis (H0): The movement of INR / $ is independent of the performance of BSE Sensex. r = 0

Alternative Hypothesis (H1): The movement of INR / $ is not independent of the performance of BSE Sensex. r ≠ 0

c)   To test the relationship betweenNIFTY and INR / $ Exchange Rate:

Null Hypothesis (H0): The movement of INR / $ is independent of the performance of Nifty. r = 0

Alternative Hypothesis (H1): The movement of INR / $ is not independent of the performance of Nifty. r ≠ 0

3.2 SAMPLING DESIGN

The Population considered for the study is the stock market indicators, SENSEX and NIFTY. Non-probability sampling design is adopted to select a sample from the population of Indian stock indicators.

From the population of Indian stock indicators, purposive judgment sampling technique was adopted to select SENSEX and NIFTY.

3.3 LIMITATIONS

- As this study revolves around the Volatile Upshots of the Indian Rupee and its relationship with Indian stock market, the sampling unit is restricted only to the Indian stock market.

- The study assumes the stock indicators are independent and tries to measure its impact on the volatility of the INR.

- Data for 2013 is considered till August 2013.

3.4 DATA USED

The study relies mainly on secondary data. The data consists of monthly opening and closing prices of SENSEX and NIFTY for the period 2003 to 2013. These values are used to calculate the monthly returns, average monthly returns to correlate it with the average monthly returns on $.

3.5 DATA ANALYSIS TECHNIQUES

The following techniques are used for data analysis:

For Capital Market's performance: For SENSEX and NIFTY the opening and closing prices for each month for the period 2003 to 2013 was used to calculate the monthly returns and then the average monthly returns was calculated.

For Currency performance:

The movement of INR against $ were tracked over the period 2003 to 2013. The opening and closing values for each month were used to calculate the returns and average of all monthly returns was calculated and compared with the average monthly returns of SENSEX and NIFTY.

End of month price – Beginning of month price

Monthly returns (%) =

_____ x 100

Beginning of month price

3.5 STATISTICAL TECHNIQUES USED

a)   Pearson's product moment correlation coefficient r symbolizes the coefficient's estimate of linear association based on sampling data. This study uses correlation coefficient to express the relationship of the Performance of SENSEX and NIFTY with the performance of INR / $.

b)   The t-test for correlation tests the significance of r assuming the population coefficient, and the formula used is that of small samples for size < 30. The critical value of t is considered in the table for a significance level of 0.05. This

research considers the level of significance for a two-tailed test. If the calculated t value is larger than the critical value, the result rejects the null hypothesis and supports the alternate hypothesis. If the critical value is larger than the calculated value then the null hypothesis is not rejected.

4. Analysis and Interpretation.

The data collected with reference to performances of SENSEX, NIFTY and INR/$ was used to calculate the returns for the stated time periods and comparison of their performances was done using Karl Pearson's Correlation Coefficient, r. The analysis is presented as follows: The SENSEX, NIFTY and INR/$ opening and closing values for each month for the period 2002 to 2013 was used to calculate the monthly returns and the average monthly returns. The average monthly returns for the time period t and t+1 is used to calculate auto correlation which is a measure of persistence of a time series data with its own past and it accuracy to predict the future.

TABLE 4.1: AUTO CORRELATION OF SENSEX

YEAR T	SENSEX AVG MONTHLY RETURNS %	YEAR t + 1	SENSEX AVG MONTHLY RETURNS %
2002	0.095823293	2003	4.691318891
2003	4.691318891	2004	0.99930885
2004	0.99930885	2005	2.901738692
2005	2.901738692	2006	3.160677196
2006	3.160677196	2007	3.229111915
2007	3.229111915	2008	-5.883703706
2008	-5.883703706	2009	5.258384758
2009	5.258384758	2010	1.30362289
2010	1.30362289	2011	-2.667792588
2011	-2.667792588	2012	1.946757318
2012	1.946757318	2013	-0.806201656

Auto Correlation: -0.419997117

Graph : BSE SENSEX

Legend:
◆ AVG monthly returns for the year t
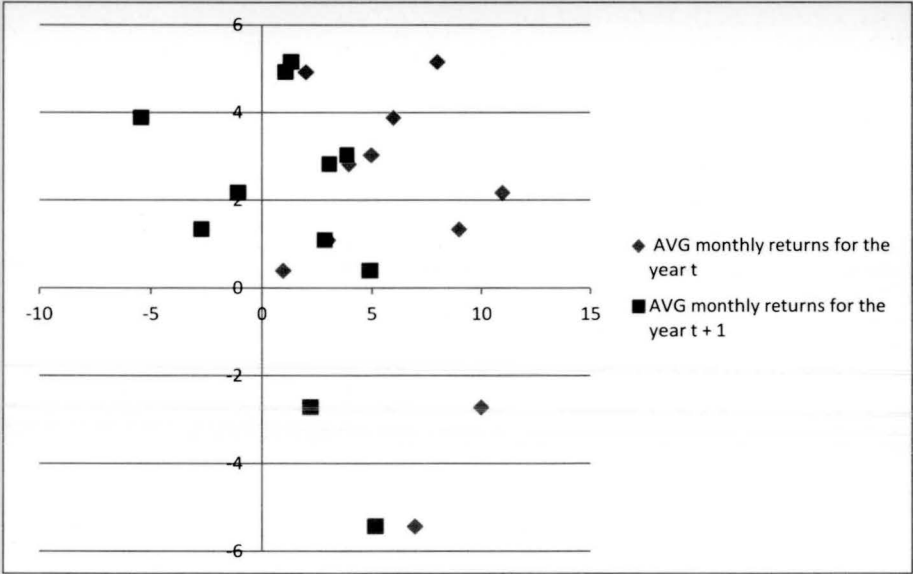■ AVG monthly returns for the year t + 1
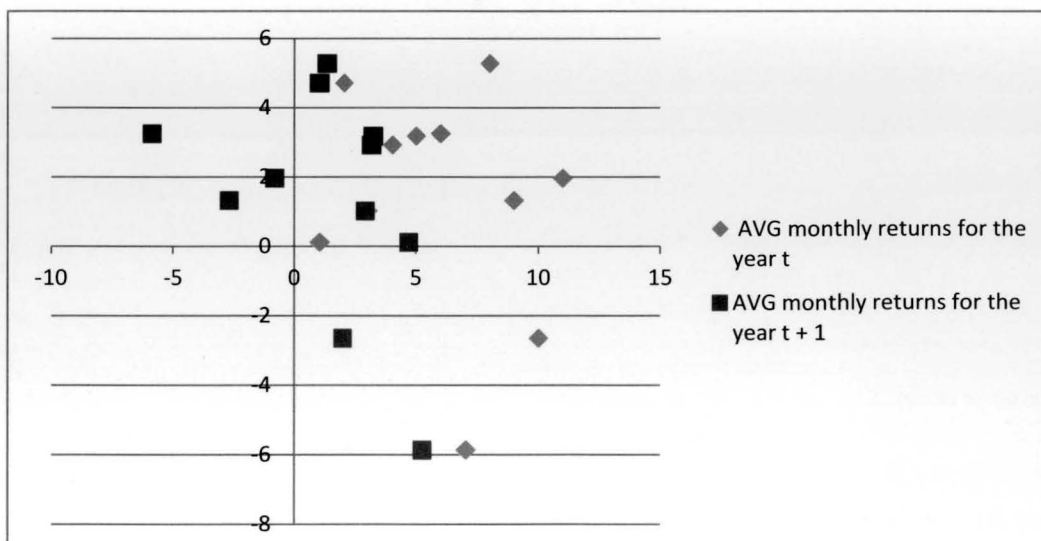
The auto correlation data of -0.4199 is not significantly different from 0 which indicates a weak correlation of the data with its own past and using this data to predict future returns t will have a very low level of accuracy.

TABLE 4.2: AUTO CORRELATION OF NIFTY

YEAR t	NIFTY AVG MONTHLY RETURNS %	YEA R t + 1	NIFTY AVG MONTHLY RETURNS %
2002	0.405563227	2003	4.933184686
2003	4.933184686	2004	1.09980869
2004	1.09980869	2005	2.831848495
2005	2.831848495	2006	3.041211509
2006	3.041211509	2007	3.893091109
2007	3.893091109	2008	-5.422019585
2008	-5.422019585	2009	5.166150854
2009	5.166150854	2010	1.347825226
2010	1.347825226	2011	-2.710014035
2011	-2.710014035	2012	2.182504514
2012	2.182504514	2013	-1.071446018

Auto Correlation: -0.440918053

Graph : NIFTY

The auto correlation data of -0.4409 is not significantly different from 0 which indicates a weak correlation of the data with its own past and using this data to predict future returns will have a very low level of accuracy.

TABLE 4.3: AUTO CORRELATION OF INR / $

YEAR	INR / $ AVG MONTHLY RETURNS %	YEAR	INR / $ AVG MONTHLY RETURNS %
2002	0.005456296	2003	-0.368456624
2003	-0.368456624	2004	-0.386036897
2004	-0.386036897	2005	0.222560174
2005	0.222560174	2006	-0.03829147
2006	-0.03829147	2007	-0.735920659
2007	-0.735920659	2008	1.616991539
2008	1.616991539	2009	-0.189559571
2009	-0.189559571	2010	-0.055679679
2010	-0.055679679	2011	1.664082413
2011	1.664082413	2012	0.582263683
2012	0.582263683	2013	2.88713469

Auto Correlation: 0.00570636

The above table indicates a comparison of the performances of two major indicators SENSEX and NIFTY. A correlation coefficient of 0.99 between Average Monthly Returns of SENSEX and NIFTY for the period 2003 to 2013 indicates a very high degree of correlation between them confirming their movement in the same direction. The T test carried out to test the significance of 'r' presented a calculated value of 35.9. The critical t value of 2.201 was found from the t distribution table for a significance level of 5% for a two tailed test. In this case, the critical value is lesser than the calculated t value failing to accept the null hypothesis.

Table No. 4.4: Comparison of performance of NIFTY with performance of $

YEAR	NIFTY AVG MONTHLY RETURNS %	INR / $ AVG MONTHLY RETURNS %
2003	4.933184686	-0.368456624
2004	1.09980869	-0.386036897
2005	2.831848495	0.222560174
2006	3.041211509	-0.03829147
2007	3.893091109	-0.735920659
2008	-5.422019585	1.616991539
2009	5.166150854	-0.189559571
2010	1.347825226	-0.055679679
2011	-2.710014035	1.664082413
2012	2.182504514	0.582263683
2013	-1.071446018	2.88713469

Karl Pearson's Correlation Coefficient, r = -0.761311288
T Test Cal = 3.522488015; T Test Table value = 2.201

The above table indicates a correlation coefficient of -0.76 between Average Monthly returns of NIFTY and $ in terms of INR for the period 2003 to 2013. As the NIFTY gains, $ in terms of INR is depreciating showing a negative correlation which in turn indicates a positive correlation between SENSEX and INR. The T test carried out to test the significance of 'r' presented a calculated value of 3.52. The critical t value of 2.201 was found from the t distribution table for a significance level of 5% for a two tailed test. In this case, the critical value is lesser than the calculated t value failing to accept the null hypothesis.

Graph : INR / $
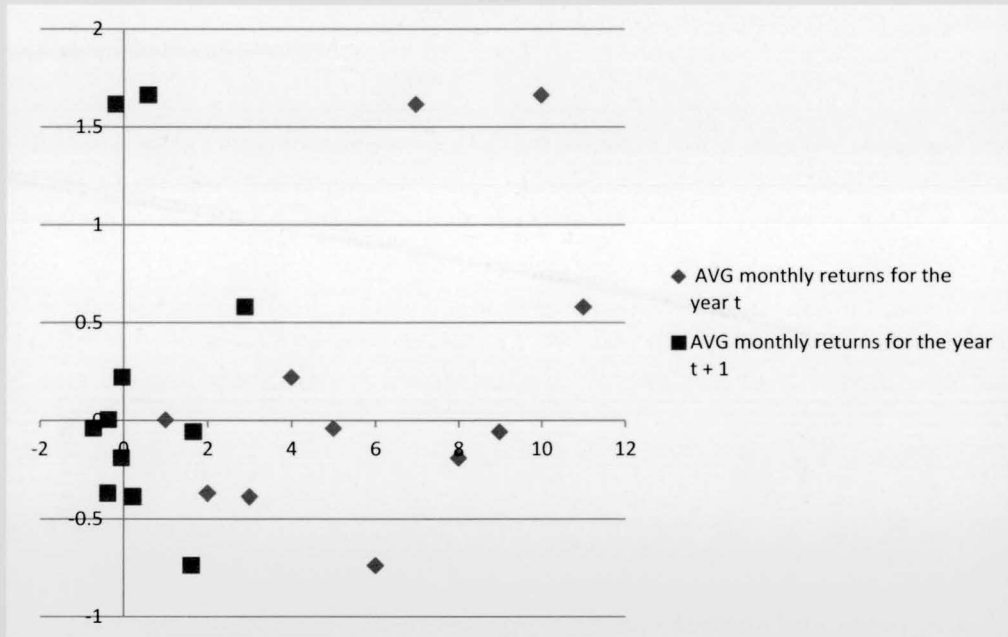
The auto correlation data of 0.0057 is not significantly different from 0 which indicates a weak correlation of the data with its own past and using this data to predict future returns will have a very low level of accuracy.

TABLE NO. **4.5**: Comparison of performance of SENSEX with NIFTY

YEAR	SENSEX AVG MONTHLY RETURNS %	NIFTY AVG MONTHLY RETURNS %
2003	4.691318891	4.933184686
2004	0.99930885	1.09980869
2005	2.901738692	2.831848495
2006	3.160677196	3.041211509
2007	3.229111915	3.893091109
2008	-5.883703706	-5.422019585
2009	5.258384758	5.166150854
2010	1.30362289	1.347825226
2011	-2.667792588	-2.710014035
2012	1.946757318	2.182504514
2013	-0.806201656	-1.071446018

Karl Pearson's s Correlation Coefficient, r = 0.996527872
T Test Cal = 35.9066727; T Test table value = 2.201

5. Findings and Conclusion

The study conducted for the period 2003 to 2013 correlating the performance of SENSEX and NIFTY with the performances of $ in terms of INR presented the following findings:

1. The measure of persistence for SENSEX and NIFTY revealed the auto correlation data to be significantly different from 0 which indicates a weak correlation of the data with its own past and using this data to predict future returns will have a very low level of accuracy.

2. A comparison of the performances of two major indicators SENSEX and NIFTY presented a correlation coefficient of 0.99 for the period 2003 to 2013 which indicates a very high degree of correlation between them confirming their movement in the same direction

3. As the BSE Sensex gains, $ in terms of INR is depreciating showing a negative correlation which in turn indicates a positive correlation between SENSEX and INR and vice versa. The T test carried out to test the significance of 'r' fails to accept the null hypothesis. This is in favor of the alternate hypothesis which proves the INR / $ fluctuation is dependent on the performance of SENSEX

4. As the NIFTY gains, $ in terms of INR is depreciating showing a negative correlation which in turn indicates a positive correlation between NIFTY and INR and vice versa. The T test carried out to test the significance of 'r' fails to accept the null hypothesis. This is in favor of the alternate hypothesis which proves the INR / $ fluctuation is dependent on the performance of NIFTY.

Hence, it is statistically established that $ fluctuations are influenced by stock market performance in India.

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