A Study on the Interrelationship between the Stock Markets and the Foreign Exchange Market in India

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ABSTRACT- This study aims at examining the short-run and long-run dynamic linkages among exchange rates and stock market index in India through a structured cointegration and Granger causality tests. Daily exchange rates of USD, EUR, JPY, and GBP to INR along with the daily movement of NSE NIFTY and BSE SENSEX for a period spanning 20 years from 1 January 2003 to 23 November 2022 were used for the analysis. The results reveal that there is no evidence for a stable long-run relationship between stock market index and the exchange rates under study. However, the VAR-based Granger causality test shows that USD and EURO have short-run causal relationship with NSE NIFTY and BSE SENSEX. The NSE NIFTY and BSE SENSEX also seemed to have an influence on USD and JPY expressed in terms of Indian rupee.

KEYWORDS- Foreign Exchange Market, NSE NIFTY, BSE SENSEX

I. INTRODUCTION

The association between a country's stock market and foreign exchange market has been empirically investigated for more than three decades. Exchange rate is an important economic variable for any economy. Capital market and growth of the economy is affected by the exchange rate. Exchange rate fluctuations directly or indirectly affect influence the performance of the organisations in the domestic as well as international market. Success of the organisations in the international market depends on the better understanding of the movement of exchange rate. It is important for organisations for taking improved operational decisions in the international business environment. The study of exchange rate movement is required to take effective hedging decision, target market decision, financing decision, capital budgeting decision and earnings assessment. Empirical study of linkage between stock price and exchange rate started few decades ago. Since then, a good number of research studies so far have been conducted to examine the relationship among the variables. But the researchers have found mix results regarding the presence of relationship and the direction of relationship which has made the area perplex environs of finance literature. Some of the studies claim that there is a significant positive relationship among the variables, like as, Aggarwal (1981), Jorion and Giovannini (1987), and Roll (1992). But some of the studies oppose this

argument and showed a significant negative relationship between the variables, such as, Hennigar and Soenen (1988). The other contributor finds that there is no significant relationship between the variables, such as, Franck and Young (1972), Solnik (1987), Chow et al. (1997), and Mukherjeeand Bhattacharya (2003). Sohrabian and Bahmani Oskooee (1992), Lee and Nieh (2001) found no long-run relationship between the variables. So, there is no empirical consonance among the researchers regarding the linkage among stock prices and exchange rates which claim the need of more research in this area to accord to the literature

II. LITERATURE SURVEY

Frank and Young (1972) conducted the research to investigate the relationship among exchange rate and stock market return. On the basis of their study, they concluded that no relationship exists among two variables.

Aggarwal (1981) studied the linkage among in the United States share prices and the changes in the exchange rate of the US currency Dollar during the period 1974 to 1978 and observe that the share prices and the value of the US currency dollar were strongly positively correlated and the linkage was stronger in the short term than in the long term.

Abdalla and Murinde (1997) in the year 1997 they investigated on the relationship among exchange rates and stock prices in countries like Korea, India, Pakistan, and Philippines by using Bi- variate Vector Autoregressive models on monthly data of stock price index and real effective exchange rate from the period from January 1985 to July 1994. The study found unidirectional short run causality from exchange rate to stock prices for Pakistan and Korea and a unidirectional long-run association ship for India and Philippines. For country like India, it was from exchange rates to stock prices, but for Philippines it was opposite, from stock prices to exchange rates.

Naka et. al. (1998), investigated the relationship ships among macroeconomic variables and Indian stock market. To investigate the relationship among the variables, the fact and figure were analyzed by applying tool like Vector Error Correction Model. On the basis of the finding of this empirical research work researchers concluded that domestic inflation acts vital role in Indian stock market performance.

Pathe and Karnik (2000) conducted research to investigate the interaction of Indian stock market and different macro-economic variables like prime lending rate, money supply and industrial production and they observe that there is no long-run stable association ship among stock prices and exchange rate.

Mohammed. N (2000) Investigated the long- run and short run relationship with stock- prices and exchange rates by taking data of four South Asian countries (India, Pakistan, Bangladesh and Sri Lanka) for the duration 1994 to 2000. The researcher applied the Co- integration and error correction model and Standard Granger Causality on monthly data. The study found that there is no long run relationship with stock prices and exchange rates for India and Pakistan. The Granger causality test analysis found that no short run relationship with the variables.

Apte (2001) conducted the empirical research to examine the relation among volatility of the exchange rate of India by applying the EGARCH model on the daily closing price and exchange rate. The BSE Sensex and NIFTY are taken for the duration 1991 to 2000. The empirical work found an appearance of the spill over from the foreign exchange market to the stock market.

Battacharya et al. (2002) investigated the characteristics of causal association among share price, trade balance. Exchange rate and foreign exchange reserves with respect to India from the duration April 1990 to March 2001 by using co-integration and long-run Granger causality test. The results concluded that there are no causal association among stock prices and the variables.

Nath and Samantha (2003) conducted the empirical research to investigate the casual relationship by using Granger causality test on daily data during the period March 1993 to December 2002. The empirical finding concluded that the two markets did not have any association ship. However, the detailed analysis of the research work did not find any positive association among exchange rate and stock price movements except for the year 1993, 2001 and 2002.

Ahmed (2008), tried to investigate the nature of causal association ship among stock prices and the economic variables. In this study, researchers use quarterly data of exports, Foreign direct investment, index of industrial production, exchange rate, money supply, interest rate, BSE-Sensex and NSE-Nifty in India. The tools like Johansen's Co-integration and Granger causality test were applied to explore the longrun. The study conclude that the fluctuations of stock prices was not only component of macroeconomic variables but it was also one of the reason of fluctuations in any economy.

Pal and Mittal (2011) investigated the association among the Indian stock markets and macroeconomic variables by using quarterly data for the duration January 1995 to December 2008. They applied Johansen's co-integration technique. Their analysis found that there was a long-run association exists among the stock market index and various macroeconomic variables. The research finding showed that inflation and exchange rate have a positive impact on BSE Sensex but interest rate and gross domestic saving were negative impact on sensex.

Dasgupta (2012), conduct empirical research to investigate the long-run and short-run association among BSE-Sensex and macroeconomic element like Exchange Rate, Call Money Rate, Index of Industrial Production (IIP) and Wholesale Price Index (WPI). In this research work they investigate the association ship among various variables monthly data from April, 2007 to March, 2012. They used various tools for analyzing like descriptive statistics, ADF Test, Granger Causality Test and Johansen & Juselius Co-integration Test. They concluded that at least one Co-integration vector and long-run association among BSE-Sensex with call money and IIP. The Granger Causality Test show that no short-run unilateral or bilateral causal association among BSE Sensex and macroeconomic elements

III. DATA AND METHODOLOGY

A. Research Objective

To investigate whether any long relationship run exists between Foreign Exchange rate and stock market indices.

B. Research Hypothesis

To achieve the above objectives the following hypothesis is formulated.

H0: There is no significant impact of exchange rate fluctuations on the stock Market Indices.

H1: There is significant impact of exchange rate fluctuations on the stock Market Indices.

C. Data Collection

The study uses daily exchange rates of USD, EUR, JPY, and GBP to INR along with the daily movement of NSE NIFTY and BSE SENSEX for a period spanning 20 years from 1 January 2003 to 23 November 2022.

IV. RESULT ANALYSIS AND INTERPRETATION

A. Unit Root Test

Unit root test to check the stationarity level

Table 1: Augmented Dickey Fuller (ADF) Unit Root Test at Level

Period	Variable	ADF test	Probability	Critical value @ 5 %
Level	INR-EURO	-1.55366	0.5063	-2.861946
	INR-GBP	-1.98465	0.2938	
	INR-JPY	-1.61013	0.4773	
	INR-USD	0.60754	0.99	
	NIFTY_50	0.78597	0.9939	
	SENSEX	0.8204	0.9944	

Table 2: Philips Perron (PP) Unit Root Test at Level

Period	Variable	PP test	Probability	Critical value @ 5 %
Level	INR-EURO	-1.58313	0.4912	-2.861946
	INR-GBP	-2.00576	0.2845	
	INR-JPY	-1.58143	0.492	
	INR-USD	0.47033	0.9857	
	NIFTY_50	0.73079	0.9928	
	SENSEX	0.7836	0.9938	

Table 1 and 2 depict the test results of ADF and PP test. It can be observed that the ADF and PP test value of statistics obtained for the variables under study are greater than the critical value (-2.861946) at 5% significance level. So, it is clear that the series are non-stationary at level.

Table 3: Augmented Dickey Fuller (ADF) Unit Root Test at First Difference

Period	Variable	ADF Test	Probability	Critical value @ 5 %
First Difference	INR-EURO	-67.9696	0.0001	-2.861946
	INR-GBP	-67.5116	0.0001	
	INR-JPY	-70.744	0.0001	
	INR-USD	-69.632	0.0001	
	NIFTY_50	-68.6948	0.0001	
	SENSEX	-68.9397	0.0001	

Table 4: Philips Perron (PP) Unit Root Test at First Difference

Period	Variable	PP test	Probability	Critical value @ 5 %
First Difference	INR-EURO	-67.9776	0.0001	-2.861946
	INR-GBP	-67.5048	0.0001	
	INR-JPY	-70.7706	0.0001	
	INR-USD	-69.8051	0.0001	
	NIFTY_50	-68.7164	0.0001	
	SENSEX	-68.95	0.0001	

ADF and PP test results at first difference are shown in Table 2 and 3. It can be observed that the ADF and PP test value of statistics obtained for the variables under study are less than the critical value (-2.861946) at 5% significance level. So, the timeseries variables are stationary at their first difference and are found to be integrated of order I (1).

B. Johansen's Co-integration Test

Johansen's Co-integration technique is used to determine if there is co integration relation among the variables. Two likelihood tests are used, the trace test and the maximum Eigen value test, to find out whether the series are co integrating. The estimation for series assumed as linear deterministic trend. The lag selection for 1st difference is based on the Swartz information criterion.

Table 5: Johansen's Co-integration Test Results

Unrestricted Cointegration Rank Test (Trace)				
Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	Critical Value @5%	Prob.**
None	0.00444	58.8649	95.75366	0.9623
At most 1	0.002715	37.49259	69.81889	0.9763
At most 2	0.002158	24.43682	47.85613	0.9328
At most 3	0.00157	14.06246	29.79707	0.8371
At most 4	0.001187	6.514698	15.49471	0.6347
At most 5	0.000169	0.810429	3.841466	0.368
Trace Test Indicates no Cointegration at the 0.05 Level				
Unrestricted Cointegration Rank Test (Maximum Eigenvalue)				
Hypothesized No. of CE(s)	Eigenvalue	Maximum Eigen value	Critical Value @5%	Prob.**
None	0.00444	21.37231	40.07757	0.9374
At most 1	0.002715	13.05576	33.87687	0.9953
At most 2	0.002158	10.37436	27.58434	0.979
At most 3	0.00157	7.547763	21.13162	0.9292
At most 4	0.001187	5.704269	14.2646	0.6514
At most 5	0.000169	0.810429	3.841466	0.368
Max-Eigenvalue Test Indicates no Cointegration at the 0.05 Level				

Interpretation

Table 5 show the results of the Johansen's Co-integration test. The Maximal Eigen statistic of 21.37231 is less than the 5 % critical value of 40.07757 and the trace test statistic of is 58.8649 less than the critical value of 95.75366. According to rule of co-integration if Trace statistics is lower than critical value it means we cannot reject null hypothesis. On the other side the maximum Eigen value is less than critical value then we can't reject the null hypothesis. The p value of above test is 0.9623 for trace test and 0.9374 is for maximum eigen value which show that it is more than 5% so we cannot reject the hypothesis.

C. Granger Causality Tests

Table 6: Pairwise Granger Causality Tests

Null Hypothesis	F-Statistic	Probability
INR-EURO and NIFTY_50		
NIFTY_50 does not Granger Cause EURO	12.6089	0.0000
EURO does not Granger Cause NIFTY_50	2.71798	0.0661
INR-EURO and SENSEX		
SENSEX does not Granger Cause EURO	11.3602	0.0000
EURO does not Granger Cause SENSEX	2.68955	0.0680
INR-GBP and NIFTY_50		
NIFTY_50 does not Granger Cause GBP	1.8522	0.1570
GBP does not Granger Cause NIFTY_50	0.76678	0.4646
INR-GBP and SENSEX		
SENSEX does not Granger Cause GBP	1.69796	0.1832
GBP does not Granger Cause SENSEX	0.65519	0.5194
INR-JPY and NIFTY_50		
NIFTY_50 does not Granger Cause JPY	23.413	0.0000
JPY does not Granger Cause NIFTY_50	1.39936	0.2469
INR-JPY and SENSEX		
SENSEX does not Granger Cause JPY	21.3995	0.0000
JPY does not Granger Cause SENSEX	1.27888	0.2784
INR-USD and NIFTY_50		
USD does not Granger Cause NIFTY_50	3.11266	0.0446
NIFTY_50 does not Granger Cause USD	40.6324	0.0000
INR-USD and SENSEX		
USD does not Granger Cause SENSEX	3.04059	0.0479
SENSEX does not Granger Cause USD	38.8127	0.0000

- **Interpretation**

The table 6 presents the results of granger causality test between exchanges rate and stock index. Both BSE Sensex and Nifty 50 Granger cause INR-EURO and INR-JPY exchange rate. There exists unidirectional Granger causality. Granger causality does not exist between BSE Sensex and INR-GBP exchange rate. Also there exist no Granger causality between Nifty 50 and INR-GBP exchange rate. There is bidirectional Granger causality between BSE Sensex, Nifty 50 and INR-USD exchange rate.

V. CONCLUSION

The research study was conducted to determine the relationship with exchange rate and stock price indices BSE Sensex and Nifty 50. The first step ADF and PP unit root test is applied to investigate the stationarity of all the variables and observe the non-stationary at their levels, but becomes stationary at the first difference. The Johansen maximum likelihood test is conducted to determine whether exchange rate and nifty Index is co-integrated. The result shows very clearly there is no co-integration vector between the exchange rate and BSE Sensex S&P indices. Then Granger causality test for the study period from 1 January 2003 to 23 November 2022 is performed as the next step. Granger causality test is applied to test the hypothesis of the study and it is observed that there is causal relationship between exchange rate and stock price indices BSE Sensex and Nifty 50.

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