



UNDERSTANDING THE INFLUENCE OF FOREIGN EXCHANGE RATE VARIATIONS ON STOCK MARKET INDICES OVER TIME

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ABSTRACT

This study investigates the dynamic relationship between foreign exchange rates and two key Indian stock market indices, BSE Sensex and Nifty 50, over a 20-year period from January 2003 to November 2022. The research employs rigorous econometric techniques including cointegration and Granger causality tests to explore both short-term and long-term linkages between these variables. Initial analyses using Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) unit root tests reveal that while the variables exhibit non-stationarity at their levels, they achieve stationarity upon first differencing, confirming integration of order 1 (1). Further investigation using Johansen's Co-integration test indicates no significant cointegration between exchange rates (USD, EUR, JPY, GBP) and the stock market indices at the 5% significance level. This finding suggests that exchange rates and stock indices do not move together in the long run. Subsequent Granger causality tests unveil compelling evidence of unidirectional causality, where changes in exchange rates Granger-cause movements in both the BSE Sensex and Nifty 50 indices. Specifically, the study finds that fluctuations in major currencies like USD, EUR, and JPY influence the daily movements of India's stock market, underscoring the critical role of global exchange rate dynamics in shaping local equity market trends. These findings contribute valuable insights for investors and policymakers, highlighting the interconnectedness between global financial markets and local stock exchanges. The study's results provide a nuanced understanding of how exchange rate fluctuations impact stock market volatility and performance in India, offering practical implications for risk management strategies and investment decisions. By elucidating these relationships, this research aims to enhance financial market forecasting capabilities and inform strategies aimed at navigating the complexities of global economic integration in the context of emerging markets like India.

Keywords: Exchange rates, stock market indices, cointegration, Granger causality, emerging markets, etc.

I. INTRODUCTION

The interplay between exchange rates and stock market indices has long been a subject of intense interest and scrutiny in financial research. Exchange rates, representing the relative value of one currency against another, are pivotal in global economic interactions, impacting trade flows, inflation rates, and overall economic stability. Concurrently, stock market indices serve as barometers of economic health and investor sentiment, reflecting the collective performance of listed companies within a particular market. Understanding the relationship between these two dynamics—exchange rates and stock market indices—is crucial for policymakers, investors, and analysts alike, particularly in the context of emerging markets like India where financial market integration with global economies is increasingly pronounced.

The volatility and unpredictability of exchange rates can significantly influence stock market behavior. Fluctuations in exchange rates affect the profitability of multinational corporations, as earnings and costs are often denominated in different currencies. Consequently, movements in exchange rates can impact corporate earnings, thereby influencing stock prices and market indices. Moreover, exchange rate movements can signal broader economic shifts, influencing investor sentiment and portfolio allocation decisions. "For instance, a strengthening local currency may boost investor confidence in domestic markets, while a depreciating currency might raise concerns about inflationary pressures and economic stability."

This study aims to delve into the intricate relationship between exchange rates and two prominent Indian stock market indices—BSE Sensex and Nifty 50—over a substantial historical period. By employing advanced econometric techniques such as cointegration and Granger causality tests, the research seeks to uncover not only the short-term dynamics but also the longer-term interactions between these variables. The findings promise to shed light on how global financial variables like exchange rates shape the performance and volatility of India's equity markets, providing critical insights for stakeholders navigating the complexities of global financial integration and market fluctuations.

II. REVIEW OF LITERATURE

In their study conducted in 2005, Phylaktis and Ravazzolo examined the immediate and long-term relationships between stock prices and currency rates in many Pacific Basin nations. They also investigated the mechanisms via which external shocks affect these markets. The study covered the period from 1980 to 1998. For the study, a structured cointegration and multivariate Granger causality test were used. The findings indicated a positive causal relationship in both the long-run and short-run between stock prices and currency rates. "Gulati and Kakhani (2012) conducted a research to determine a cause-and-effect link between INR/Dollar exchange rates and stock market indexes (SENSEX and NIFTY) from 2004 to 2012." The study used Granger causality and correlation analysis. Their findings demonstrated a modest positive association

between stock price indexes and exchange rates throughout the specified timeframe.

Divyang and Kagalwala (2013) examined the correlation between currency rates and stock market indexes via regression analysis. Based on 8 years of secondary monthly data, the researchers concluded that there is an insignificant correlation between the Dollar exchange rate and Nifty Sensex.

A research undertaken by Kumarasamy and Chellasamy (2017) examined the relationship between the Indian stock market and the foreign currency rates of USD, Euro, Yen, and Pound sterling versus the Indian rupee (INR) during a five-year period from 2011 to 2015. "The research used the Granger causality test to identify the causal link between the stock market index and the exchange rates." The study demonstrates an inverse correlation between stock market indices (Sensex and NIFTY) and returns from foreign exchange rates (USD, GBP, EURO, and YEN). Additionally, it reveals a positive correlation between currency returns against INR and returns from other currencies. This statement elucidates that the cause-and-effect connection is characterised by a one-way flow.

Narend, S., and Thenmozhi, M. (2019). Analyse the impact of country-specific exchange traded funds (ETFs) on the stock market indexes of the relevant countries, regardless of the underlying benchmark of these ETFs. An aggregated ordinary least square (OLS) study of a subset of 28 India ETFs traded in the US, UK, Canada, France, Japan, Israel, and Singapore indicates that India ETFs have a substantial influence on the stock indexes of the nation. We further record the inverse causal dynamics between country-specific exchange-traded funds (ETFs) and the corresponding stock indexes of the respective countries. The findings remain strong and unaffected even after considering and adjusting for global influences, fluctuations in stock market volatility, inflows from foreign institutional investors (FIIs), foreign currency rates, and the level of assets in India ETFs. The study's conclusions have significant ramifications for international investors and governments in both developing and established nations. Policymakers would find it advantageous to closely track the fund flows of nation ETFs into their respective countries, since the withdrawal of these ETFs might potentially have a domino impact on the economy.

Gajera, Alpesh. (2020). Experts extensively discuss the integration of key global stock indexes. This study work aims to build integration between the key stock indices of the globe by calculating correlation and using Anova on the daily return of 16 prominent stock indices. Research has shown that stock market participants may, to some degree, forecast the movement of stock indices that open later by analysing the performance of early opening stock indexes. There is a strong likelihood of a significant link between stock indexes that belong to the same

continent. Among the chosen main stock indexes worldwide, European stock indices have the highest level of correlation. All sixteen stock indexes in our analysis have a positive correlation, indicating that they are all heading in the same direction. There is a weaker association seen between stock indexes from various continents compared to those from the same continent. There is a positive correlation seen across all stock indexes, indicating that they are all advancing in the same direction. The intensity of motion is contingent upon the degree of correlation. A strong performance by the main stock indexes of a nation signifies the robust economic well-being and advancement of that nation. For instance, the financial markets in several nations are seeing a decline in value because to the coronavirus epidemic.

III. OBJECTIVES OF THE STUDY

The main objectives of the research study are stated as follows:

1. To examine the long-term relationship between foreign exchange rate fluctuations and stock market indices.
2. To assess the impact of exchange rate movements on the volatility and performance of stock market indices over a specified period.

IV. RESEARCH METHODOLOGY

Research Method:

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.

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.

Hypothesis of the Study:

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

H₀₁: There is significant impact of exchange rate fluctuations on the stock Market Indices.

V. ANALYSIS AND INTERPRETATIONS

Unit Root Test:

Unit root test to check the stationarity level

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

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

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 nonstationary at level.

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

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

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

Period	Variable	ADFtest	Probability	Criticalvalue @ 5 %
First Difference	INR-GBP	-67.5116	0.0001	-2.861946
	INR-EURO	-67.9696	0.0001	
	INR-USD	-69.632	0.0001	
	INR-JPY	-70.744	0.0001	
	SENSEX	-68.9397	0.0001	
	NIFTY_50	-68.6948	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).

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

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

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

UnrestrictedCointegrationRankTest(Maximum Eigen value)				
Hypothesized No. of CE(s)	Eigenvalue	MaximumEigen value	Critical Value @5%	Prob.*
Atmost5	0.000169	0.810429	3.841466	0.368
Atmost4	0.001187	5.704269	14.2646	0.6514
Atmost3	0.00157	7.547763	21.13162	0.9292
Atmost2	0.002158	10.37436	27.58434	0.979
Atmost1	0.002715	13.05576	33.87687	0.9953
None	0.00444	21.37231	40.07757	0.9374
Max-EigenvalueTestIndicatesnoCointegrationatthe0.05 Level.				
UnrestrictedCointegrationRankTest(Trace)				
Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	Critical Value@5%	Prob.*
Atmost5	0.000169	0.810429	3.841466	0.368
Atmost4	0.001187	6.514698	15.49471	0.6347
Atmost3	0.00157	14.06246	29.79707	0.8371
Atmost2	0.002158	24.43682	47.85613	0.9328
Atmost1	0.002715	37.49259	69.81889	0.9763
None	0.00444	58.8649	95.75366	0.9623
TraceTestIndicatesno Cointegrationatthe0.05Level.				

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.

Granger Causality Tests:

Table 6: Pairwise Granger Causality Tests

Null Hypothesis	F-Statistics	Probability
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-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-GBP and SENSEX		
SENSEX does not Granger Cause GBP	1.69796	0.1832
GBP does not Granger Cause SENSEX	0.65519	0.5194
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-JPY and SENSEX		
SENSEX does not Granger Cause JPY	21.3995	0.0000
JPY does not Granger Cause SENSEX	1.27888	0.2784
INR- JPY and NIFTY-50		
NIFTY-50 does not Granger Cause JPY	23.413	1.0000
JPY does not Granger Cause NIFTY-50	1.39936	0.2469
INR-USD and SENSEX		
SENSEX does not Granger Cause USD	38.8127	0.0000
USD does not Granger Cause SENSEX	3.04059	0.0479
INR- USD and NIFTY-50		
NIFTY-50 does not Granger Cause USD	40.6324	0.0000
USD does not Granger Cause NIFTY-50	3.11266	0.0446

The table 6 displays the results of the granger causality test conducted on the relationship between exchange rates and stock indices. Both the BSE Sensex and Nifty 50 have a Granger causality relationship with the INR-EURO and INRJPY exchange rates. Unidirectional Granger causality is a phenomenon that exists. There is no Granger causation between the BSE Sensex and the INR-GBP exchange rate. There is no Granger causation between the Nifty 50 and INR-GBP exchange rate. Bidirectional Granger causation exists between the BSE Sensex, Nifty 50, and the INR-USD exchange rate.

VI. CONCLUSION

The research study sought to examine the correlation between exchange rates and the stock price indexes BSE Sensex and Nifty 50. The stationarity of all variables was first evaluated using the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) unit root tests. The experiments showed that the variables were not stationary at their original values, but became stationary after taking the first difference. Afterwards, the Johansen maximum likelihood test was used to investigate the potential for cointegration between the exchange rate and the Nifty Index. The test findings unequivocally showed that there is no cointegration vector between these variables, indicating that they do not exhibit long-term movement in tandem.

After analysing cointegration, the research next conducted the Granger causality test from 1 January 2003 to 23 November 2022. This test was essential in establishing the causal relationship between exchange rates and stock price indexes. The results of the Granger causality test indicated a statistically significant causal association, suggesting that fluctuations in exchange rates had a causal effect on changes in the BSE Sensex and Nifty 50 indexes. "This result confirms the premise of the research and emphasises the impact of changes in exchange rates on movements in the stock market." It offers significant information for both investors and policymakers.

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