
The Correlation Dynamics Between Sensex 30 Returns and INR/USD Exchange Rate Movements

Dr. Batani Raghavendra Rao*, Gaurav Kundekar**, Pallavi V P**, Rakshana S.**, Smruthi K.**, Mridu V.**, Ananya P R.**, Samarth G. K.**, Sumanth S**.

*Professor, Faculty of Management Studies, Jain (Deemed-to-be University), Bangalore.

**MBA, 2023-25, Faculty of Management Studies, Jain (Deemed-to-be University), Bangalore.

Abstract

The Sensex 30 is a benchmark index for India's largest companies, indicating the health of the stock market. Its movements are influenced by domestic economic conditions, corporate performance, and global trends. The INR/USD exchange rate, which represents the Indian rupee vs. the US dollar, is crucial for India's international trade and investment. A depreciating rupee benefits export-oriented companies but increases import costs, affecting market performance. Understanding this dynamic is essential for investors and policymakers. The fluctuating link between the INR/USD currency pair and SENSEX 30 stock index is examined in this study from 2014 to 2024, with an emphasis on how changes in the exchange rate affect stock market performance. As India continues to integrate into the global economy, the interaction between foreign investments and the Indian stock market has become increasingly relevant for understanding investor sentiment and economic stability. This study particularly examines how returns from the SENSEX 30, an index that monitors 30 of India's biggest and most traded firms, are impacted by changes in the INR/USD exchange rate. The research's main finding is that there is a strong positive correlation between the INR/USD exchange rate and the SENSEX 30 index, with a rise of 1 in the SENSEX 30 for every 0.90 increase in the exchange rate. This implies that the depreciation of the Indian currency (INR) in relation to the US Dollar (USD) may result in increased stock market returns, especially in industries that rely heavily on exports, as Indian goods become more competitive in international markets due to the weaker currency. On the other hand, persistent depreciation may also result in higher import prices and inflationary pressures, which might be detrimental to business profitability and the state of the economy as a whole. Given that currency changes may have an impact on their investment decisions, foreign institutional investors (FIIs) are essential to this dynamic.. Decreased international gains are eroded by a lower INR, which frequently leads to portfolio modifications and more market volatility. Exchange rate fluctuations and stock market performance are influenced by the participation of foreign institutional investors (FIIs) and the Reserve Bank of India's (RBI) monetary policy choices. For example, the RBI's changes to interest rates have an effect on investor mood and influence market movements. Global economic variables that affect the US stock market and exchange rate include geopolitical tensions, changes in the price of commodities, particularly oil, and US Federal Reserve policies. The study uses a variety of statistical techniques, including as trend analysis, a t-test, and correlation analysis, to assess the link between the performance of the SENSEX 30 and the INR/USD exchange rate during a ten-year period. The results of the t-test demonstrate that the difference between the mean values of the SENSEX 30 and the INR/USD exchange rate is statistically significant, with a t-statistic of 30.278 and very tiny p-values. The SENSEX 30 exhibits a significantly bigger variation than the INR/USD, suggesting that the stock market is more volatile than the currency rate. This result is in line with predictions because stock markets are often more erratic than exchange rates. As a result, the study emphasizes how much exchange rate fluctuations affect the Indian stock market. It is recommended that investors keep a careful eye on currency changes since they have the

potential to impact business profitability and stock market performance, particularly in industries that depend on imports or exports. The results also emphasize how crucial it is to diversify portfolios and hedge against risk related to currencies in order to successfully manage the intricate relationships between monetary policy, market volatility, and global economic situations.

1. Introduction

The exchange rate, in relation to stock market performance, is an area of emphasis for financial economists. Heavy scholarship in this area can be evidenced especially in emerging nations. For example, in a country like India, deviation of currency rates can be a determining and significant factor in local economic conditions and investor sentiment along with the financial markets. With the integration of India into the world economy, any person who would wish to know and or invest in the Indian Rupee (INR) and US Dollar (USD) exchange rate as well as the stock market indexes, such as the SENSEX 30, would be required to know the relationship between these variables. The relationship impacts the returns from investment, the nature of the market operation, and economic policies, particularly on international trade. Of the many currency values influencing the Indian financial market, the INR/USD is the most crucial currency value. Indian rupee and the United States dollar are two of the most important currencies in the world, not only pertaining to banking but also international trade. The fluctuations in exchange rates usually reflect larger macroeconomic conditions that might terribly affect investor psychology as well as business profitability. The SENSEX 30 is an index of the Bombay Stock Exchange and can be described as a benchmark, where tracking 30 of the country's largest and most frequently traded businesses affords insight into the health of the Indian stock market.

This research primarily focuses on how fluctuations in the INR/USD exchange rate affect the SENSEX 30 index. Given the strong economic ties between India and the United States, exchange rate movements can have significant impacts on company profitability, particularly in export-driven sectors. For example, when the INR depreciates against the USD, Indian exports become more competitive, potentially boosting the revenue of export-oriented companies. This, in turn, can lead to higher returns for the SENSEX 30 index. However, extreme depreciation of the INR can result in inflationary pressures and increased import costs, negatively affecting the overall economy and stock market performance.

In the Indian stock market, foreign institutional investors (FIIs) are also quite important. Exchange rate fluctuations can influence their investment decisions, as a weaker INR relative to the USD could erode returns on foreign investments. This dynamic often leads to portfolio adjustments, which can result in increased market volatility. The interaction between FII behaviour and exchange rate volatility is, therefore, an essential factor in understanding the overall performance of the stock market.

This study employs correlation technique to measure and analyse the changing relationship between SENSEX 30 returns and INR/USD exchange rate fluctuations. Understanding this dynamic relationship is critical to gaining deeper insights into how currency movements affect stock market performance in emerging markets like India

2. Literature Review

Alam and Mohammed (2018) discovered a significant correlation between foreign institutional investments and currency rates in India, emphasizing the crucial role of external capital flows in influencing domestic financial markets, especially in developing nations, for liquidity and stability.

Bhattacharjee et al.'s (2023) research examines how financial problems affect the dynamics of the stock market. Their findings indicate that structural breakdowns have a substantial impact on these dynamics, implying that changes in market circumstances or economic policy may have an effect on existing links. This emphasizes how crucial it is to take structural changes into account when assessing the effects of money on market prices.

Dahir, A. et al. (2018) used wavelet analysis to investigate the relationship between return on investments and currency exchange rates in the BRICS nations. It discovers favorable medium and long-term correlations, with currency rates driving Russian and Brazilian stock returns. On 64-day scales during 2008, 2010, 2012, and 2012-2015, stock returns lead exchange rates; however, a negative connection is shown in the India index pair.

Mahapatra and Bhaduri (2019) indicated that investors are becoming more sensitive to exchange rate concerns due to currency fluctuations and the Indian stock market, leading to increased risk management practices among businesses in a turbulent economic climate.

Moizz and Akhtar (2024) investigated how monetary policy interplays with stock market characteristics within a nation, emphasizing structural breakdowns. They contend that because of the complexity of these relationships, monetary policy is not enacted in a vacuum but rather in reaction to broader economic developments.

Mroua and Trabelsi (2020) used panel/GMM and ARDL analyses to examine the link between stock market indices and exchange rates in the BRICS nations. They discovered that variations in exchange rates have varying effects on stock market performance, indicating that regional factors affect these correlations.

Wong (2022) pays more attention to how real exchange rates effect actual stock values, and it is demonstrated that real exchange rate fluctuations have a significant impact on stock prices. This linkage is important to the investors and policy makers in developing countries, whose volatility of the exchange rate generally tends to be much higher.

Yildirim et al. (2022) found that all BRICS countries, except India, experience currency bubbles, indicating that while these bubbles could potentially destabilize stock markets in other developing countries, India's exchange rate dynamics were generally not destabilized by speculation during the study period.

Studies on the relationship between market prices and currency rates offer insightful information. Studies on broader stock indices, monetary policies, and BRICS economies have limited focus on Sensex 30 and lack detailed investigation into short-term versus long-term correlation dynamics. However, there are gaps in understanding the relationship between Sensex 30 returns and INR/USD exchange rate movements.

2.1 Objectives

1. To examine the dynamic correlation between SENSEX 30 index returns and INR/USD exchange rate movements.
2. To evaluate market volatility, focusing on its effects on stock price fluctuations.
3. To understand the role of foreign investors in SENSEX 30 index performance.

2.2 Methodology

This study utilizes secondary data analysis. A correlation analysis, a t-test to evaluate the connection between India's USD Exchange Rate and Sensex 30 over a period of 10 years in monthly duration. A t-test is also performed to assess to examine the dynamic correlation between SENSEX 30 index returns and INR/USD exchange rate movements. A trend analysis is used to assess market volatility, focusing on its effects on market price fluctuations. A qualitative analysis is performed to understand the role of foreign investors in SENSEX 30 index performance.

3. Findings and Data Analysis

Table 1. Correlation Test Between Sensex 30 and INR/USD

	<i>Sensex 30</i>	<i>INR/USD</i>
Sensex 30	1	
INR/USD	0.904754412	1

The correlation test is performed between Sensex 30 and INR/USD from the period 2014 to 2024. The correlation test result shows a strong positive correlation. A 0.90 increase in INR/USD would increase Sensex 30 by 1.

This indicates that the performance of the Indian stock market is significantly affected by the exchange rate movements between INR and USD, which could be due to factors such as foreign investments, global economic conditions, or India's export-import dynamics. The Sensex index values and INR/USD exchange rates show an inverse relationship during certain periods. In strong market performance, the INR weakens against the USD, while during market corrections, it strengthens due to fluctuating investor confidence. This correlation can impact investors as a strong Sensex often correlates with a weaker INR due to increased foreign investment inflows, while a depreciating INR can increase costs for imported goods, potentially impacting corporate profits.

The Sensex and the dynamics of the INR/USD exchange rate are greatly impacted by RBI's monetary policy decisions. Interest rate adjustments by the RBI can impact investor sentiment and market movements. Global economic conditions, including US Federal Reserve policies, geopolitical tensions, and commodity price fluctuations, also impact both indices. The INR typically faces depreciation pressures due to increased import costs during oil price spikes. Analysts predict continued volatility due to domestic economic reforms and global market trends. The potential for further appreciation of the Sensex exists if India maintains robust economic growth. Investors should diversify their portfolios to hedge against currency risk and capitalize on potential growth in Indian equities.

Table 2. T-Test Between INR/USD and Sensex 30

	<i>Variable 1</i>	<i>Variable 2</i>
Mean	43290.80417	72.08465
Variance	244494566	46.26552436
Observations	120	120
Hypothesized Mean Difference	0	
df	119	

t Stat	30.27804791	
P(T<=t) one-tail	4.73568E-58	
t Critical one-tail	1.657759285	
P(T<=t) two-tail	9.47136E-58	
t Critical two-tail	1.980099876	

The t-test results comparing the SENSEX 30 index and the INR/USD monthly closing prices over a 10-year period (120 observations each) provide significant insights into their statistical relationship.

Mean Values

The mean value of the SENSEX 30 is 43,290.80, while the mean value of the INR/USD exchange rate is 72.08. This substantial difference in means indicates that the average value of the SENSEX 30 index is significantly higher than that of the INR/USD exchange rate over the observed period. Over the course of the ten years, these means show the central trend of the exchange rate and the stock market index, respectively.

Variance

The variance of the SENSEX 30 is 244,494,566, which is considerably larger than the variance of the INR/USD exchange rate, which stands at 46.27. This indicates that the SENSEX 30 experiences much greater volatility compared to the INR/USD exchange rate. Such a high variance in the SENSEX 30 is expected, as stock markets typically exhibit more fluctuations than exchange rates, which tend to be relatively stable over shorter periods.

Hypothesis Testing

The hypothesis testing was conducted with the following hypotheses:

- **Null Hypothesis (H₀):** The mean difference between the SENSEX 30 and INR/USD is zero.
- **Alternative Hypothesis (H₁):** The mean difference between the SENSEX 30 and INR/USD is not zero.

Degrees of Freedom

The degree of freedom (df) for this test is 119, which is calculated based on the number of observations minus one for each variable.

T-Statistic

An extremely high positive value, 30.278, is the t-statistic value. This implies that there is a large gap between the INR/USD and SENSEX 30 means. The number of standard deviations the sample mean deviates from the estimated population mean difference is expressed as a t-statistic.

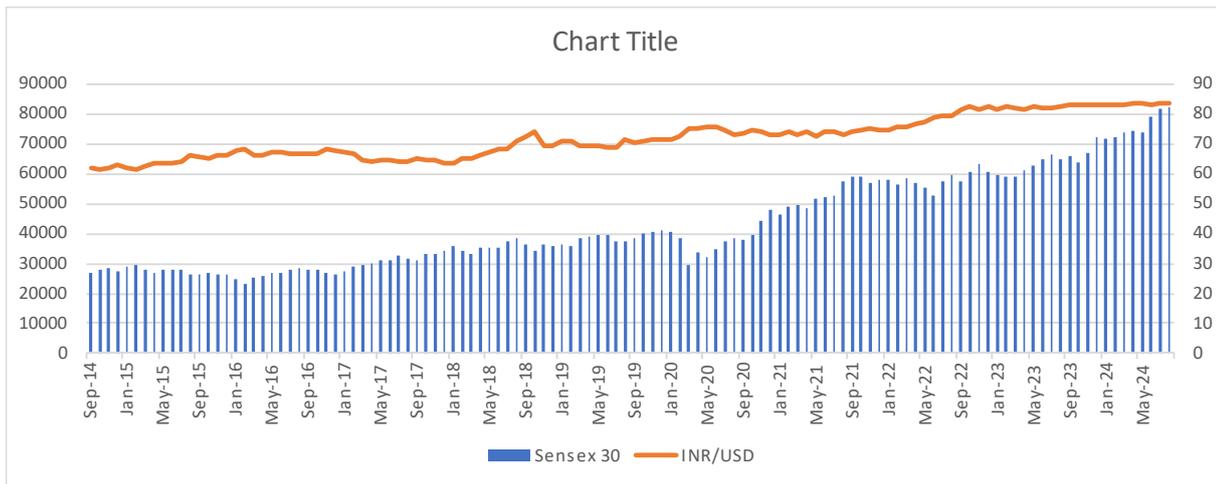
P-Values

The estimated values of the one-tail p-value and two-tail p-value are $(4.73568 \times 10^{-58})$ and 9.47136×10^{-58} , respectively. These incredibly modest p-values suggest that there is essentially no possibility that such a significant difference between the means could have been seen by coincidence. As a result, we reject the null hypothesis, demonstrating that the means of the SENSEX 30 and the INR/USD exchange rates differ statistically significantly.

Critical t-Values

The one-tail critical t-value is 1.6578, and the two-tail critical t-value is 1.9801. The calculated t-statistic (30.278) is far greater than both the one-tail and two-tail critical values, providing more proof that the null hypothesis is rejected. This means that the difference between the means of the SENSEX 30 and INR/USD is statistically significant.

Fig. 1 Trend Analysis between Sensex 30 and INR/USD from 2014-2024 on quarterly duration basis



This trend analysis graph presents a comparison between the performance of the Sensex 30 and the INR/USD exchange rate over a period from 2014 to 2024 on a quarterly basis. The Sensex 30 showed stable movement from 2014 to 2016, with a steady upward trajectory. However, a dip occurred in mid-2019, possibly reflecting market volatility. Early in 2020, the global pandemic had an impact on the Sensex, causing a steep decline but a robust rebound. From 2021, the Sensex showed sustained growth, peaking at nearly 90,000 by 2024. The INR/USD exchange rate remained relatively flat between 2014 and 2019, with minor fluctuations. However, during the pandemic, the Indian Rupee depreciated sharply, reaching around 75 INR/USD. This depreciation continued from 2021 to 2024, reaching 85 INR/USD, indicating a weakening trend.

Sensex 30 Index

- Growth Trajectory:** The Sensex has shown a significant upward trend from September 2014, starting at **26,630.51** and reaching **82,365.77** by August 2024. This represents an increase of approximately **209%** over ten years.
- Volatility:** The index experienced notable fluctuations, particularly between 2015 and 2016, where it dropped from a peak of **29,361.50** in February 2015 to a low of **23,002.00** in February 2016. This period marked a significant correction influenced by global market conditions and domestic economic challenges.

INR/USD Exchange Rate

- Depreciation and Appreciation:** The INR has shown both depreciation and appreciation trends against the USD. Starting at **61.925** in September 2014, it fluctuated significantly, reaching a high of **83.872** in August 2024.

- **Key Events Impacting Exchange Rate:** The exchange rate was notably affected during periods of economic uncertainty, such as the global financial impacts from COVID-19 in early 2020 when it surged to **75.333** in March.

The analysis reveals a divergence between the Sensex 30's robust growth and the consistent depreciation of the Indian Rupee against the USD. The COVID-19 pandemic significantly impacted both metrics, with the Sensex showing a quick recovery while the INR continued its weakening trend.

4. Conclusion

The performance of the SENSEX 30 index and the INR/USD exchange rate show a substantial positive association in this analysis, underscoring the important role that currency changes play in determining stock market returns. The analysis, covering a ten-year period from 2014 to 2024, shows that a 0.90 increase in the INR/USD exchange rate is associated with a corresponding rise in SENSEX 30, indicating that periods of rupee depreciation often coincide with market growth, particularly due to increased competitiveness of Indian exports and foreign institutional investments. Key findings include the statistically significant relationship revealed through the t-test, which confirms that the difference in means between the SENSEX 30 and INR/USD exchange rates is not due to random chance. Furthermore, the trend analysis highlights periods of significant market correction and recovery, particularly during global economic events like the COVID-19 pandemic, where the Sensex initially plunged but subsequently recovered, whereas the INR showed continued depreciation.

This relationship has practical implications for investors and policymakers. The correlation suggests that movements in the INR/USD exchange rate can serve as an indicator for stock market performance, particularly in export-driven sectors. The results also highlight the significance of monetary policy and exchange rate stability in affecting market sentiment, with the Reserve Bank of India's actions having a major impact on exchange rate dynamics and stock market performance.

Investors are urged to think about how currency changes could affect their portfolios in the coming future, especially in emerging nations like India. Diversification strategies to hedge against exchange rate risks and capitalize on Indian equity growth may be beneficial. Moreover, policymakers should remain vigilant in managing exchange rate volatility, as it can have profound effects on both market performance and broader economic stability.

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