The Impact of U.S. and Domestic Interest Rates on the Dollar-Rupee Exchange Rate

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Abstract

This study examines the effect of fluctuations in United States (U.S.) interest rates and domestic Indian interest rates on the dollar-rupee ($/₹) exchange rate by utilizing time series data and simple linear regression models. This analysis aims to determine whether changes in interest rates have a significant impact on foreign exchange rates. The results of the study indicate that the U.S. interest rate has a positive impact on the ($/₹) exchange rate, suggesting that an increase in the U.S. interest rate would lead to a depreciation of the Indian rupee. However, domestic Indian interest rates have a notable negative effect, suggesting that higher domestic rates lead to rupee appreciation. Overall, the findings highlight that interest rate differentials play a crucial role in determining the exchange rate dynamics between the dollar and the rupee.

Key words

Exchange rate, interest rates, regression analysis, rupee depreciation, U.S. monetary policy, domestic interest rates

Introduction

Interest rates play a fundamental role in modern economics. They help shape a country's external economic stability, influence market trade, the flow of capital, and the overall macroeconomic performance of the nation. For emerging global economies like India, the exchange rate is particularly important because it can impact import costs, foreign investment, inflation, and national economic growth. Among the many macroeconomic variables that affect the movement of the exchange rate, interest rates have always been identified as a key determinant because of their impact on transboundary capital flows.

According to the interest rate parity theory, the difference in interest rates across the world significantly affects investors' decisions on where to assign their capital. Countries with high interest rates tend to attract more foreign investment than countries with lower interest rates, which leads to appreciation and depreciation of the domestic currency. Similarly, in this context, both domestic Indian interest rates and international interest rates, such as those of the United States, play a central role in moulding the $/₹ exchange rate.

This study aims to empirically analyse and illustrate the impact of U.S. interest rates and domestic Indian interest rates on the exchange rate between the U.S. dollar and the Indian rupee. Regression analysis on historical data (from 2011 to 2024) was performed to investigate whether changes in these interest rates substantially affect the exchange rates. This study examines the separate and combined independent effects of interest rates on rupee appreciation or depreciation. These findings add to the literature on the dynamics underlying exchange rates and have important implications for policymakers, investors, and researchers interested in understanding how monetary policy and currency markets interact.

Literature Review-

Sharma and Setia (2015) examine the relationship between the Indian rupee–US dollar exchange rate and macroeconomic fundamentals during the post-economic reform period in India. Their study finds that macroeconomic fundamentals significantly influence exchange rate movements across different time periods, as reflected in their empirical results. The authors further highlight the role of interest rates in managing

exchange rate volatility, with impulse response functions indicating that interest rate dynamics have important implications for exchange rate stabilization.

Samsudheen and Shanmugasundaram analyze the volatility characteristics of the Indian rupee–US dollar exchange rate using daily data spanning four decades, from 1973 to 2012. Employing ARCH family models such as ARCH, GARCH, EGARCH, and TGARCH, the study captures the persistent and time-varying nature of exchange rate volatility. The research also contextualizes exchange rate behavior within India's evolving exchange rate regimes, ranging from a pegged system to a liberalized and market-determined framework. By dividing the sample into subsamples based on structural changes, the study underscores how policy shifts influence exchange rate dynamics.

Obura and Anyango investigate the moderating role of interest rates in the relationship between foreign exchange rate fluctuations and securities market performance in the Nairobi Securities Exchange. Their findings indicate that interest rates significantly moderate this relationship, producing different outcomes when considered as an interaction term rather than as an independent variable. Using hierarchical regression analysis, the study demonstrates that interest rates alter the impact of exchange rate volatility, reinforcing the importance of monetary variables in understanding exchange rate–financial market linkages.

Saraç and Karagöz focus on the impact of short-term interest rates on exchange rates in the context of Turkey's post-2001 monetary policy framework. Following the adoption of inflation targeting, short-term interest rates became the primary policy tool to address exchange rate pressures. However, their frequency domain Granger causality analysis reveals no evidence that higher short-term interest rates lead to a reduction in exchange rate levels, suggesting limitations in the effectiveness of interest rate adjustments in controlling exchange rate movements.

Collectively, the existing literature highlights the significant role of interest rates and macroeconomic fundamentals in influencing exchange rate behavior, while also pointing to mixed evidence regarding the effectiveness of interest rate interventions. Building on these studies, the present research focuses specifically on the impact of both U.S. and domestic Indian interest rates on the dollar–rupee exchange rate. By employing regression models, the study seeks to examine the individual and combined effects of these interest rates on exchange rate movements, thereby contributing to a deeper understanding of exchange rate dynamics relevant to policymakers, investors, and researchers

Objectives :

The primary aims and objectives of this study are:

- To empirically analyze and illustrate the impact of both U.S. and domestic Indian interest rates on the exchange rate between the U.S. dollar and the Indian rupee
- To evaluate whether fluctuations in these interest rates have a significant influence on the movement of the foreign exchange rate.
- To investigate the separate and combined independent effects of these interest rates on the appreciation or depreciation of the rupee.
- To add to the existing literature on the dynamics of exchange rates and provide important insights for policymakers, investors, and researchers.
- The study uses regression models to achieve these objectives.

Analysis

In this study, an effort is made to analyze the impact of changes in U.S. interest rates on foreign exchange rates between the dollar and rupee ($/Rs). A country's currency will fall in value when interest rates are high abroad

because higher rates will lead to an outflow of foreign capital. This will lead to an increase in foreign exchange rates in the short term. In this study, data were collected for the required variables, and regression was applied to study the impact of changes in U.S. interest rates on foreign exchange rates between the dollar and rupee ($/Rs). Here, foreign exchange rates between the dollar and the rupee ($/Rs) are considered as the dependent variable, and the US Interest rate is considered as an independent variable. The regression model is expressed as follows:

$$\$/Rs._{it} = \alpha_{it} + \beta_i * US\ interest\ rates_{it} + \epsilon_{it} \qquad \text{Equation (1.1)}$$

The null hypothesis of the above regression model (Equation 1.1) is as follows:

Null hypothesis (H_0): *"There is no significant impact of* changes *in US Interest rates on foreign exchange rates between the dollar and rupee ($/Rs).*

Table 1.1: Regression Model Indicating the Impact of Changes in US Interest Rates on Foreign Exchange Rates between the dollar and the rupee ($/Rs)

Dependent variable	**Independent variable**	**Regression coefficients**		**T statistics (p-value)**	**F statistics (p-value)**	**R square**
Foreign exchange rates ($/Rs)	US interest rates	Intercept(α)	60.73	24.44 **(<0.001)****	13.64 (0.003)**	55%
		Beta (β)	3.36	3.69 (0.004)**		

** indicates that p-value < 0.05

A linear regression analysis was performed to examine the influence of U.S. interest rates on the foreign exchange rate between the dollar and the rupee ($/Rs).

The results, as shown above, indicate that the p-value (0.004) of the t-statistic (3.69) of the slope coefficient of the independent variable *"US Interest rates"* on the dependent variable "*foreign exchange rate ($/RS)*" is found to be less than the 5 percent level of significance. Hence, with a 95 per cent confidence level, the null hypothesis that there is no significant impact of *"US Interest rates"* on "*foreign exchange rate ($/RS)*" cannot be accepted. Hence, it can be concluded from the results that there is a significant positive impact of the US Interest rate on foreign exchange rates ($/Rs).

The statistics of the regression model were 13.64 with a p-value (0.003). This indicates that the regression model is a good fit. The R-squared value of 0.55 indicates that 55 percent of the variance in foreign exchange rates ($/Rs) can be explained with the help of US Interest rates using the p regression model.

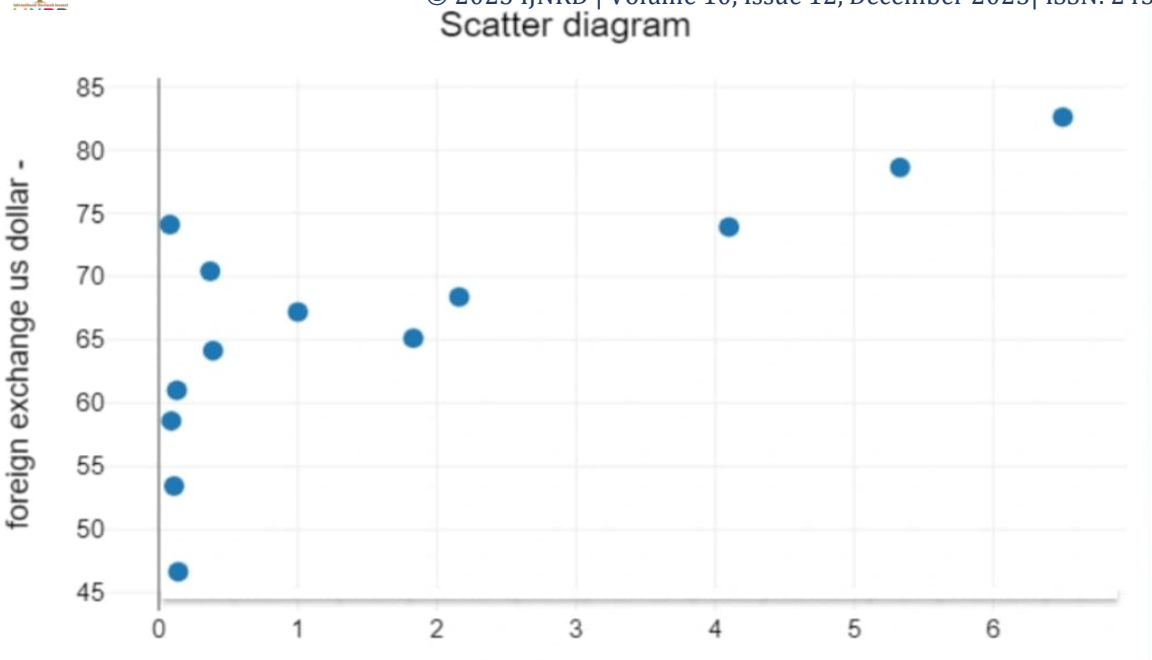

Figure 1.1: Impact of US Interest rates on foreign exchange rates ($/ Rs).

The diagram (Fig.1.1) above shows the positive impact of US Interest rates on foreign exchange rates ($/ Rs).

In this study, an effort is also made to analyze the impact of changes in domestic interest rates on foreign exchange rates between the dollar and the rupee ($/Rs). A country's currency will rise in value when interest rates are high because higher rates attract more foreign capital. This will lead to a decrease in foreign exchange rates and a strong currency. In the study, the data is collected for the required variables and regression is applied in order to study the impact of domestic Interest rates on foreign exchange rates ($/Rs). Here, foreign exchange rates ($/Rs) are considered as the dependent variable, and the domestic interest rate is considered as an independent variable. The regression model can be expressed as follows.

$$\$/Rs._{it} = \alpha_{it} + \beta_i * domestic\ interest\ rates_{it} + \epsilon_{it} \qquad \text{Equation 1.2}$$

The null hypothesis for the above regression model (Equation 1.2) is stated below.

Null hypothesis (H_0): *"There is no significant impact of domestic interest rates on the $/Rs foreign Exchange rate*

Table 1.2: Regression Model Indicating the Impact of domestic Interest rate on foreign exchange rates between dollar and rupee ($/Rs).

Dependent variable	**Independent variable**	**Regression coefficients**		**T statistics (p-value)**	**F statistics (p-value)**	**R square**
Foreign exchange rates ($/Rs)	Domestic interest rates	Intercept(α)	141.66	7.41 (<0.001)**	14.47 (0.002)**	57%
		Beta (β)	-9.48	-3.8 (0.003)**		

** indicates that p-value < 0.05

A linear regression analysis was performed to examine the influence of domestic interest rates (central and state government dated securities) on foreign exchange rates between the dollar and the rupee ($/Rs).

The results, as shown above, indicate that the p-value (0.003) of the t-statistic (-3.8) of the slope coefficient of the independent variable *"domestic Interest rates"* on the dependent variable "*foreign exchange rate ($/RS)*" is found to be less than the 5 percent level of significance. Hence, with a 95 percent confidence level, the null hypothesis that there is no significant impact of *"domestic Interest rates"* on "*foreign exchange rate ($/RS)*" cannot be accepted. Hence, it can be concluded from the results that there exists a significant positive impact of domestic Interest rate on foreign exchange rates ($/Rs).

The F-statistic of the regression model is found to be 14.47 with a p-value (0.002). This indicates that the regression model is statistically fit. The R-squared value of 0.57 indicates that 57 percent of the variance in foreign exchange rates ($/Rs) can be explained with the help of domestic Interest rates using p regression model.

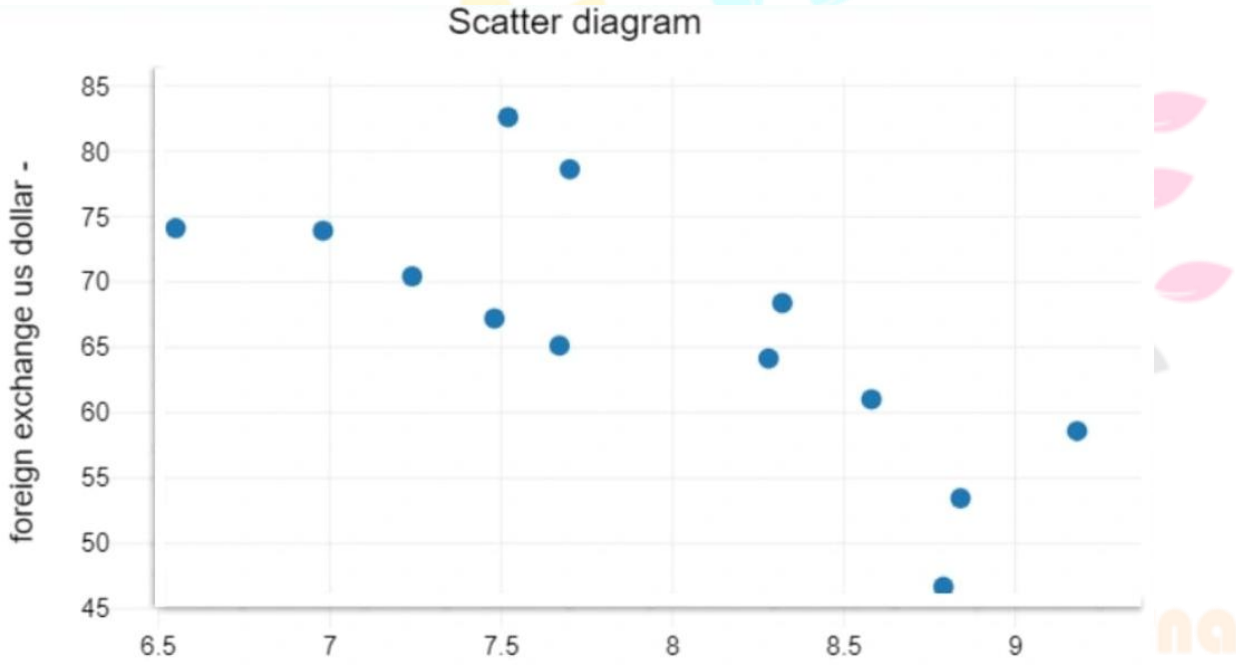

Figure 1.2: Impact of interest rates of central and state governments on foreign exchange rates ($/ Rs).

The diagram above shows the negative impact of domestic Interest rates on foreign exchange rates ($/ Rs).

Policy Implications:

The findings of this study have important outcomes for India's trade and monetary policy, especially in this era of global financial integration. The significant positive relationship between U.S. interest rates and dollar-rupee exchange rate highlights the Indian rupee's vulnerability to external monetary shocks such as those from powerful economies like the U.S. Phases of monetary tightening by the us federal reserve usually urge investors to redirect their funds towards assets which are denominated in dollars and have a higher return which result in outflow of capital from developing countries such as that of India and thus exerts a depreciative pressure on the Indian rupee. This highlights the need for Indian policy makers to carefully consider foreign monetary policy while crafting domestic policies.

The need for the Reserve Bank of India (RBI) to have a calibrated monetary policy approach has significantly increased. While higher domestic interest rates can usually help support the rupee by attracting foreign capital inflow, unrestrained tightening may negatively affect domestic investment, credit creation & growth and overall economic activity. Therefore, the RBI should adopt a calibrated monetary policy approach wherein

interest rate adjustments are carefully balanced to support exchange rate stability without hampering economic growth. Instead of relying solely on aggressive rate hikes, monetary policy should be complemented with foreign exchange market interventions to manage excessive volatility in the rupee during periods of global uncertainty.

Furthermore, exchange rate stability cannot be achieved through monetary policy alone. India's trade and tariff policies also play a supporting role in managing external sector pressures. Adjustments in import duties on items such as gold and electronics have been used to control the current account deficit, while export restrictions on agricultural commodities to manage domestic inflation can influence export earnings and foreign exchange inflows. These measures highlight the importance of policy coordination across monetary and trade domains.

Overall, the findings suggest that a coordinated policy framework combining prudent interest rate management, foreign exchange interventions, and strategic trade measures is essential for mitigating the impact of global monetary shocks and ensuring exchange rate stability in an increasingly integrated global economy.

Although this study provides valuable insights into the impact of interest rates on the dollar-rupee exchange rate, there are a few potential weaknesses and areas for further research that can be identified:

Weaknesses:

Limited Time Period: The study only analyzes historical data from a specific time period, which may not capture the full dynamics of the exchange rate-interest rate relationship over a longer time horizon.

Omitted Variables: The regression models only consider interest rates as independent variables, but exchange rates are influenced by various other macroeconomic factors such as inflation, trade balances, capital flows, etc. Excluding these other variables may limit the comprehensiveness of the analysis.

Assumption of Linearity: The study assumes a linear relationship between interest rates and exchange rates, but the true relationship may be more complex and non-linear.

Suggestions for Further Study:

Expand Time Period: Future research could extend the analysis to a longer historical period to better understand the long-term trends and dynamics in the exchange rate-interest rate nexus.

Include Additional Macroeconomic Variables: Incorporating other relevant macroeconomic variables, such as inflation, trade balances, capital flows, etc., in the regression models could provide a more comprehensive understanding of exchange rate determination.

Explore Non-Linear Relationships: Investigating the potential non-linear relationships between interest rates and exchange rates, using techniques like polynomial regression or threshold models, may yield additional insights.

Analyze Causal Mechanisms: Further research could delve deeper into the underlying causal mechanisms and transmission channels through which interest rates affect exchange rates, potentially employing techniques like structural equation modeling or vector autoregression.

Compare with Other Currencies: Extending the analysis to examine the impact of interest rates on other currencies.

Important Conclusions

According to the interest rate parity theory, the difference in interest rates between countries is a significant factor in investors' decisions on where to allocate their capital. The theory suggests that countries offering higher interest rates tend to attract more foreign investment compared to countries with lower interest rates.

This inflow of capital leads to an appreciation of the domestic currency in the high-interest-rate country, while the opposite (depreciation) occurs in the low-interest-rate country

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