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Examining the Effects of International Capital Flows on India's Nominal Exchange Rate: Insights from an ARDL Model

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Abstract

This study explores how foreign capital flow influence fluctuations in India's exchange rate. It uses an empirical approach, analysing 31 years of data from 1994 to 2024. This research focuses on measuring the relationship between foreign direct investments and portfolio investments, and long-term foreign loans and the exchange rate of India and the United States of America. The analysis utilising computer-automated trade econometric model sets out that these factors do affect the exchange rate but only in the short run, which translates to changes in the foreign exchange investments and debt increasing the movements in the exchange rate. As put in the theory, these studies show that capital flow leads to exchange rate shifts, but only in the short run as there are other variables that influence shifts in exchange rates trends in the long run.

Keywords: Autoregressive Model, Exchange Rate, Foreign Capital

Introduction

The rate at which specific domestic money can purchase foreign currencies in the unfamiliar trade market or the other way around is known to be the ostensible swapping scale. It is that rate that thinks about just the mathematical qualities, not at all like the genuine swapping scale which considers the buying force of products or administrations. The Nominal conversion scale is being controlled by the intelligent powers of interest and supply of specific money as for another in the unfamiliar trade market. This rate decides the value of a specific country's cash as for different monetary standards in the unfamiliar trade market. Each nation is attempting to fortify its cash concerning the dollar since it is the most impressive and imposing money in the current time. The relationship between exchange rate fluctuations and foreign capital flows is important for understanding the interaction between global financial markets and local economies. Exchange rates are an important indicator of economic stability and competitiveness, and directly affect trade balance and foreign policy decisions. Studies have shown that exchange rate fluctuations can affect foreign investments. For example, a stable and flexible exchange rate is essential to attract foreign direct investment (FDI) as investors seek to reduce negative returns. This situation emphasises the importance of an effective exchange rate policy that creates investment opportunities (Chakraborty & Scholnick, 2002). In addition, the interaction between capital flows and exchange rate fluctuations shows that countries with better exchange rate fluctuations can absorb capital inflows without any disruptions in real exchange rates. This change provides easier adjustment to external factors, thus improving overall economic performance (Combes, Kinda & Plane, 2012). In contrast, a deflationary policy based on exchange rates will attract excess capital, which will lead to higher profits and emphasise the balance that policymakers must maintain to achieve effective exchange rate regulation (Condon, Corbo & De Melo, 1990). Large budgets can limit policy options and prevent the use of effective measures (Cook & Devereux, 2006). Increased investment in emerging markets will lead to increased exchange rate volatility, which highlights the need for strong risk management to reduce the impact of external factors on security benefits (Caporale et al., 2017). In addition, the basic macroeconomic determinants of foreign exchange reserves, such as trade balance and inflation, also affect the reserve level and hence exchange rate stability (Dash & Narayan, 2011). Finally, structural changes can result

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from both domestic economic and international pressures (Dixon, Zhang & Dai, 2016). In general, these studies reveal a positive relationship between exchange rates and foreign capital and show how important policy decisions are in maintaining stability in the face of changing business conditions and external influences. Exchange rates and capital flows are important factors in generating economic benefits in emerging markets. Patnaik, Kapur and Dhal (2003) provide insights into exchange rate management in India, highlighting how policy decisions directly impact economic growth and development. Their analysis suggests that appropriate exchange rate policies are important for creating a conducive environment for foreign direct investment (FDI) and reducing capital account deficits. Similarly, Pradhan et al. (2011) summarise the various policy responses adopted by emerging markets to capital flows and emphasise that effective management of flows is essential for maintaining macroeconomic stability. They found that countries that follow sound fiscal and monetary policies are better able to absorb shocks from volatile capital flows. Ramamurti (2013) examines the evolution of new FDI players, particularly financial institutions and private capital, in the context of global trade. His research highlights the importance of these institutions in influencing capital patterns in emerging markets and supporting economic growth. Furthermore, Saborowski et al. (2014) examine the effectiveness of capital outflow restrictions and argue that these measures can help contain the negative effects of rapid flight. They concluded that well-designed restrictions can help improve economic performance by preventing exchange rate fluctuations and maintaining financial stability (Patnaik et al., 2003; Pradhan et al., 2011; Ramamurti, 2013; Saborowski et al., 2014).

Purpose of the Study

India has been experiencing the debasement of home-grown cash, which is a superb worry for home-grown and worldwide financial backers around the world. Moreover, RBI is intervening in the foreign exchange market to stabilise the value of the Indian rupee. There has been a constant depreciation of Indian rupee despite a huge surge of foreign capital inflows into India. Following this suggestion, the researcher aims to examine the connection and impact between foreign investment and the nominal exchange rate by analysing 31 years of time-series data on foreign investment inflows and India's nominal exchange rate. The purpose of this study is to highlight how these factors influence the mechanism of the nominal exchange rate in India. This research seeks to uncover the reasons behind the depreciation of the Indian rupee, despite a significant increase in foreign investment inflows over the years.

Literature Review

Lily et al. (2014) investigated how foreign direct investment (FDI) influences exchange rate fluctuations in major ASEAN countries, specifically Malaysia, Singapore, the Philippines and Thailand. They employed the Autoregressive Distributed Lag (ARDL) model to analyse both long-term and short-term relationships between these variables. Their findings revealed significant long-term bidirectional causality between exchange rates and FDI in both Singapore and the Philippines, indicating that changes in exchange rates and FDI inflows influence each other over time in these nations.

Caporale et al. (2017) studied the effect of foreign portfolio inflows on exchange rate volatility in leading seven Asian economies. GARCH model and Markov chain model were being applied in order to investigate the relationship between the former variables .US dollar was being used as a benchmark currency to compare their respective countries currencies and the monthly data was employed for the data analysis. The output suggests that with the exception of the Philippines, other countries showed a high degree of relationship between the explanatory and response variable.

Ramachandran and Rafi (2018) pointed out that the major factor determining the exchange rate of 10 emerging economies is foreign capital inflow. They found that the exchange rate changes can be easily explained by other macroeconomic indicators such as foreign investment in domestic portfolios. This is one of their conclusions. The research objective was specified using a panel vector autoregressive model collected quarterly for three years. The results show that most of the exchange rate changes are caused by changes in product flows.

Makoni (2020) examined the relationship between real exchange rates and FDI by examining a number of different macroeconomic variables. Using a dynamic panel approach and examining data from nine African

countries, the study found a negative correlation between exchange rates and foreign portfolio investment (FPI) flows. Similar results were found when measuring the impact of inflation and capital openness.

Ayomitunde et al. (2020) their findings show that economic size, exchange rates and annual economic growth are the most important factors in determining Nigeria's ability to attract foreign direct investment. However, high inflation in the country has discouraged foreign investment.

Khalid et al. (2021) investigated the impact of new financial market developments on fixed exchange rates in South Asia. The empirical analysis using an autoregressive market distribution model suggested a potential long-term relationship between domestic construction, FDI inflows and exchange rate fluctuations. This study showed the negative impact of FDI inflows and financial deepening, which led to long-term volatility in the exchange rate. The findings revealed that stable FDI inflows and banking system innovations help reduce volatility.

Tan et al. (2021) revealed that there is a long-term, stable and unidirectional causality relationship between exchange rates and FDI inflows. The persistent appreciation of RMB against the US dollar restricted FDI inflows, and the main mechanism of this is the exchange rate. In the short term, exchange rates, and the determination process do not have a significant effect on FDI inflows

Nguyễn et al. (2022) revealed how the exchange rate is affected varies in the emerging market compared to the larger market. Modelling the data for developing countries as a dynamic panel, this research positively affected the interaction between real exchange rate and capital budget flow when other factors are included. The results show that the foreign investment model affected the impact of changes in exchange rate, especially for FPI, real exchange rates increase faster than FDI.

Kal et al. (2022) determined how the relationship between interest rates and stock market yields was affected by deviations of a currency from its fundamentally determined rate of return. To pursue this research objective, a Markov-switching vector autoregressive (MS-VAR) model with time-varying transition probabilities was employed. Wald and likelihood ratio tests were applied to ascertain the adequacy of the model. The interaction of the variables was determined using the impulse-response functions, while currency states were categorised as either over- or undervalued in accordance with the exchange rate deviation from its fundamental value. From the results, it was clear that the link between economic fundamentals and nominal exchange rates is conditioned by the over- or under-valuation of the currency to its fundamental rate. In addition, the study was able to show that the deviations of exchange rates were transitional processes that were affected by the Sharpe ratios of debt and equity investments, signifying the profound influence that financial market returns have on exchange rate behaviour.

Utoch and Tile (2023) studied the relationships between the exchange rate, inflow of FDI, capital stock and real GDP in Tanzania. They applied various econometric models, including the causality test, autoregressive model and co-integration test to establish the relationships between these variables. Their findings asserted that FDI and the exchange rate exhibit a positive bidirectional relationship, while the other variables have a unidirectional influence on FDI inflow.

Adewale et al. (2024) examined the association between FDI and the exchange rate in Nigeria. This empirical study covered a period of 30 years and employed the Ordinary Least Squares (OLS) regression model. The results indicated that FDI and the exchange rate were positively correlated, whereas trade openness had an insignificant association with FDI. The study concluded that the exchange rate plays a significant role in explaining FDI inflows.

Research Gap

Most studies have tried to establish a relationship between FDI and exchange rate. However, all the details of foreign capital flows that are important in affecting the exchange rate fluctuations of a country have not been examined yet. This study focuses on three main types of foreign capital: FDI, and external debt. All of these play an important role in the exchange rate. In most previous studies, the real exchange rate has been used as the key variable to determine the relationship between foreign exchange and foreign investment, while nominal exchange rate has been largely ignored, which is an important research topic. In addition, there are very few studies that have tried to investigate the short-term and long-term relationships between these variables. This study aims to examine the short-run and long-run relationship between various factors of foreign investment in India and nominal

exchange rate. Also, there is limited research on the dynamics of foreign investment and outflows from India. This study aims to address these research questions and explore the short-run and long-run dynamics of exchange management relationships with foreign investors in India.

Objectives of the Study

This study is being undertaken with the following specific objectives.

- To find out the long term and short-term impact of international capital flows on nominal exchange rate in India.

Hypothesis of the Study

H1: International capital flows have no effect on the nominal exchange rate in India.

H2: International capital flows do affect the nominal exchange rate in India.

Methodology of the Study

Period of Study

To achieve the following research objectives, the period of study has been taken from 1994to 2024. This is an empirical study that is based on time series analysis of 31years' annual data.

Data Sources

This study is primarily based on secondary data which have been sourced from various organisational websites like World Bank Open Data, CMIE, RBI (Database on Indian Economy).

Tools for Evaluating

The following Statistical tools have been employed to fulfil the aforesaid research objectives. The method of ARDL model has been employed in order to find out the long-term and short-term relationship among the following variables. Augmented Dicky fuller test have also been employed in order to find out the whether the variables are stationary or not. Breusch-Godfrey the Serial Correlation LM Test was conducted to determine whether serial correlation exists in the data. To check for heteroscedasticity, the Breusch-Pagan-Godfrey test was applied. Furthermore, the CUSUM test was used to evaluate the stability of the selected model.

Description of the Variables

Exchange Rate – This variable is taken to be the dependent variable for our study. The exchange rate of rupees per US $ is taken to be the dependent variable whose value is being computed on a yearly substructure. The daily value of the exchange rate has been integrated, and the outcome is being divided by the total number of days. In this, the exchange rate value has been annualised.

Foreign Direct Investment (Net) – This variable is taken to be an explanatory variable for the aforesaid purport. The quantity of peregrine capital a country has after meeting out all peregrine obligations.

Portfolio Investment (Net) – This variable is taken to be an explanatory variable for the aforesaid purport. The magnitude of peregrine capital a country has in the form of the portfolio after meeting out all peregrine obligations.

Foreign Debt – This is one of the explanatory variables which is the amplitude of loan taken from peregrine countries. This is one of the consequential variables to explicate the exchange rate in India.

Limitations of the Study

This study is being confined to India only which is one of the major inhibitions since exchange rates and peregrine capital are very dynamic in nature, and it is not inclusive in any form. The period of research has been framed for a period of 31 years only, which is a constraint for this research. This study is being confined to the four variables, and it is one of the inhibiting constraints in our study.

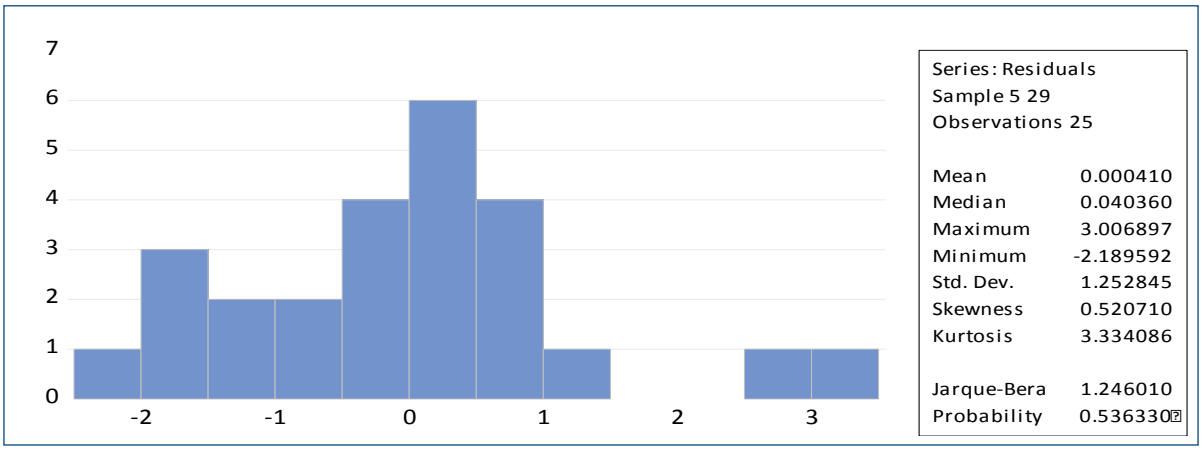
Data Analysis

Table 1: Summary of Unit Root Test (ADF)

Variables	*T Statistics*	*P Value*	*Order of Difference*	*Stationary*
Exchange Rate	-5.809958	0.0001	First	Yes
FDIN	-7.733511	0.0000	First	Yes
FD	-3.469232	0.0170	First	Yes
FPIN	-6.680757	0.0000	Level	Yes

Authors own estimate.

This table shows whether the independent and dependent variables are stationary. The independent variables are FDI net, foreign portfolio investment net and foreign debt, while the exchange rate of the Indian rupee with the Japanese yen is the dependent variable. It summarises the results of the Augmented Dickey-Fuller unit root test for these variables. The findings indicate that FDI net, foreign debt and the exchange rate is stationary at their first difference, while foreign portfolio investment net is stationary at its level.



Source: E views 12.

Fig. 1: JarqueBera Test for Normality

This table shows that the residuals are normally distributed because the p-value from the Jarque-Bera test is greater than 0.05, indicating that the null hypothesis of normality is accepted.

Table 2: Diagnostic Test

Test	*Statistic*	*Value*	*Probability*	*Inference*
Serial Correlation Test	F-statistic	0.59785	Prob. F(2,4) = 0.5927	No evidence of serial correlation (p > 0.05).
	Obs*R-squared	5.75328	Prob. Chi-Square(2) = 0.05634	Fail to reject null hypothesis of no serial correlation (p > 0.05).
Heteroscedasticity Test	F-statistic	0.80295	Prob. F(19,5) = 0.6727	No evidence of heteroscedasticity (p > 0.05).
	Obs*R-squared	18.829	Prob. Chi-Square(19) = 0.4679	Residual variance is constant (homoscedasticity, p > 0.05).
	Scaled explained SS	1.26609	Prob. Chi-Square(19) = 1.0000	Strong evidence supporting homoscedasticity (p > 0.05).

Authors own estimate Eviews12.

The analysis shows that the dataset has no significant issues with serial correlation or heteroscedasticity. In particular, the Serial Correlation test results, which yielded an F-statistic of 0.59785 and a p-value of 0.5927, as well as the Chi-Square test p-value of 0.05634, indicate that the null hypothesis cannot be rejected, implying that serial correlation does not exist. Similarly, the heteroscedasticity test results, which include an F-statistic of 0.80295, a p-value of 0.6727, and a Chi-Square p-value of 0.4679, show that the residuals have consistent variance, confirming the presence of homoscedasticity. Furthermore, the Scaled Explained Sum of Squares test, with a p-value of 1.0000, confirms the residual variance's stability.

Table 3: Short-Term Relationship (ARDL)

Variable	*Coefficient Estimate*	*Standard Error*	*t-Statistic*	*p-Value*
Lagged USD Variables				
USD (t-1)	1.1563	0.2146	5.3893	0.0017
USD (t-2)	-0.5619	0.3059	-1.8369	0.1159
USD (t-3)	0.0765	0.3316	0.2308	0.8251
USD (t-4)	0.3537	0.2087	1.6952	0.141
Foreign Portfolio Investment (FPIN)				
FPIN	2.81E-10	8.72E-11	3.2197	0.0181
FPIN (t-1)	2.83E-10	1.94E-10	1.457	0.1954
FPIN (t-2)	-1.87E-10	1.98E-10	-0.9453	0.381
FPIN (t-3)	6.01E-11	3.06E-10	0.1968	0.8505
FPIN (t-4)	3.58E-10	2.43E-10	1.4758	0.1904
Foreign Direct Investment (FDIN)				
FDIN	2.28E-10	4.63E-10	0.4917	0.6404
FDIN (t-1)	4.08E-10	5.65E-10	0.7217	0.4976
FDIN (t-2)	-3.16E-10	4.93E-10	-0.6421	0.5445
FDIN (t-3)	-8.44E-10	7.95E-10	-1.0619	0.3291
FDIN (t-4)	1.12E-09	5.76E-10	1.9464	0.0996
Foreign debt (FD)				
FD	9.99E-11	7.11E-11	1.404	0.2099
FD (t-1)	2.05E-11	8.00E-11	0.2564	0.8062
FD (t-2)	-3.04E-11	7.44E-11	-0.4084	0.6972
FD (t-3)	7.72E-11	1.29E-10	0.5977	0.5719
FD (t-4)	-1.32E-10	9.63E-11	-1.3746	0.218

Authors own estimate Eviews12.

This table provides insight on short-term interplay of flows of foreign capital and the nominal exchange rate in India only two out of the numerous variables are impactful: USD (t-1) and FPIN are significant at 0.0017 and 0.0181, respectively. However, the p-value associated with most of the lagged FPIN, FDIN and foreign debt (FD) values being high suggesting that they have a weak impact.

Table 4: Regression Statistics

T-Statistic	*Value*
Log Likelihood	-40.5986
R-squared	0.9872
Durbin-Watson Statistic	2.7256
Standard Error of Regression	2.5057
Akaike Information Criterion	4.7679

T-Statistic	Value
Adjusted R-squared	0.9489
Sum of Squared Residuals	37.6709
Schwarz Criterion	5.6942
Hannan-Quinn Criterion	5.0248

Author's own estimate E views12.

Using regression analysis, it can be confirmed that this model has sufficient correlation with the dependent exchange rate variable (R^2 = 0.9872), which means that 98.7% of variability can be predicted using these variables. The R-squared adjusted of 0.9489 also provides a guarantee of its reliability after undergoing multiple variable adjustments. This model also produces a Durbin-Watson indicator of 2.7256, suggesting that the model is autocorrelation free. Only two out of the numerous variables are impactful; USD (t-1) and FPIN are significant at 0.0017 and 0.0181, respectively. However, the p-value associated with most of the lagged FPIN, FDIN and foreign debt (FD) values are high, suggesting that they have a weak impact. This is further confirmed by the model selection criteria and the low sum of squared residuals (37.6709) FPIN of requiring you to close trades recently merits play, but have a very long buy side.

Table 5: F Bounds Test (ARDL)

F-Bounds Test		Null Hypothesis: No Levels Relationship		
F-statistic	1.968241	10%	2.01	3.1
k	3	5%	2.45	3.63
		2.5%	2.87	4.16
		1%	3.42	4.84

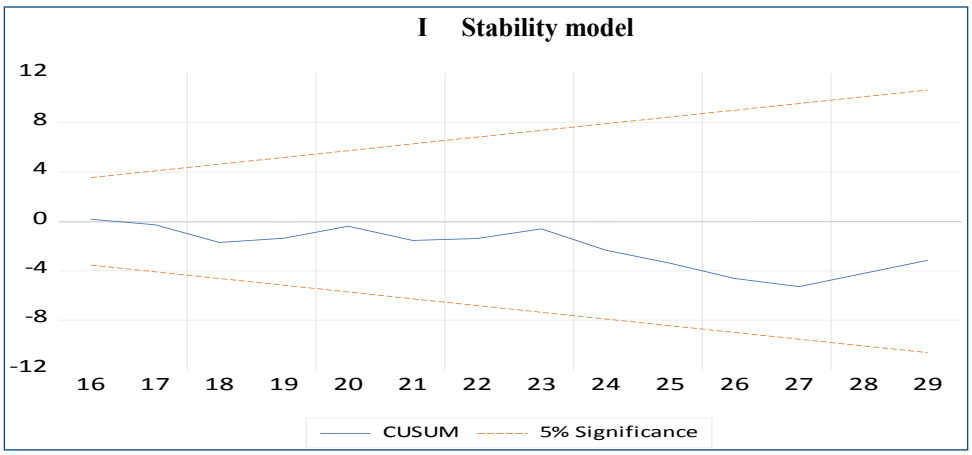
Authors own estimate. Eviews12.

The F-Bounds test determines whether, by any means, there is a long run relationship between the variables. The null hypothesis states that there is no levels relationship, i.e., the variables do not have a long-term stable relationship. The computed F-statistic is 1.968241, which is lower than the critical value at all significance levels (10% (p = 0.10), 5% (p = 0.05), 2.5% (p = 0.025) and 1% (p = 0.01)). The lower bound is 2.01 and the upper bound is 3.1 at the 10% level, which is greater than the F-statistic. The test statistic does not exceed the lower bound at any level, so we cannot reject the null hypothesis. It implies that the variables in the model do not have a long-term equilibrium relationship.

Table 6: ARDL Model for Long-Term Relationship

Variable	Coefficient	Std. Error	t-Statistic	Prob.
FDIN	-2.42E-08	1.58E-07	-0.152750	0.8836
PFIN	-3.23E-08	1.83E-07	-0.176655	0.8656
FD	-1.41E-09	1.03E-08	-0.137598	0.8951
EC = USD - (-0.0000*FDIN -0.0000*PFIN -0.0000*FD).				

This table indicates that there is no long-term relationship between foreign capital flows and the nominal exchange rate in India. For FDI net, the p-value is 0.8836, which is greater than 0.05, suggesting that there is no significant long-term connection, so the null hypothesis is not rejected. The same holds true for portfolio investment net, where the p-value is 0.8656, above the 0.05 threshold, meaning there is no significant relationship and the null hypothesis stands. For foreign debt, the p-value is 0.8951, further confirming that no significant long-term relationship exists. The coefficients for these variables are -2.42E-08 for FDI net, -3.23E-08 for portfolio investment net and -1.41E-09 for foreign debt, showing negative effects on the nominal exchange rate, though these effects are statistically insignificant.



The CUSUM test results indicate that the ARDL model employed in this study has maintained stability over the entire 31-year period. This is evidenced by the blue line remaining within the red boundaries, confirming the model's consistent stability throughout the duration.

Conclusion

This study shows a strong short-term connection between foreign portfolio investment net and the nominal exchange rate with the dollar. The p-value for this relationship is 0.0181, which is below 0.05, suggesting a significant connection. The coefficient for foreign portfolio investment net is 2.81E-10, meaning that a 1% increase in foreign portfolio investment net results in a 2.81E-10% increase in the US dollar to Indian rupee. This indicates a positive short-term relationship. On the other hand, FDI net shows no significant short-term connection with the nominal exchange rate, as the p-value is 0.6404, which is greater than 0.05. The coefficient for FDI net is 2.28E-10, suggesting that a 1% increase in FDI inflows leads to a 2.28E-10% increase in the exchange rate, which is a negative short-term relationship. For foreign debt, there is no significant short-term relationship, as the p-value is 0.2099, which is also larger than 0.05. Hence, the null hypothesis is accepted in this case. Furthermore, the study concludes that no long-term relationship exists between foreign capital flows and the nominal exchange rate in India. The ARDL model's long-term bound test shows that the F-statistic value falls between the lower bound of 1.96 and the upper bound of 3.63, at a 5% significance level, indicating that a long-term relationship between these variables does not exist.

Recommendation

This particular study recommends that foreign capital flows in the form of portfolio investment net have a significant bearing on the value of exchange rate in India. The value of the rupee is depreciating despite a huge surge in foreign exchange reserve since foreign investors are withdrawing more from the portfolio investment, which is decreasing the foreign exchange reserve considerably. This particular study recommends that foreign portfolio investment (net) should be given due weightage so that fluctuations level in the value of the rupee is not maximum. India has been doing well in attracting foreign capital from various foreign countries, but it needs to maintain the outflow of foreign countries both in the short-term and long-term so as to regulate and maintain the value of the exchange rate to depreciate further. India should adopt various policies so that foreign investors do not exist in terms of any crisis and they should be given the confidence level so that they would feel safe to invest in India.

Implications of the Study

To ensure stability of trade and economic growth, India needs to implement a policy to regulate foreign investment. The Reserve Bank of India (RBI) should intervene aggressively in the foreign exchange market to prevent excessive volatility while maintaining adequate foreign exchange reserves to cushion the impact of capital outflows. Encouraging sustainable and long-term foreign investment, especially FDI, through tax incentives and investor-friendly policies, will help reduce low reliance on fixed assets. Regulatory controls should be put in place to reduce trade disputes and excessive FPI, which have a significant impact on exchange rate transmission. Management of external debt is important so that borrowing is primarily through long-term loans rather than short-term external borrowing. Enhancing investor confidence through consistent monetary and financial regulations, broader market access and stronger regulatory frameworks will attract foreign investment. India's efforts to increase export competitiveness by diversifying export markets and reducing dependency will help maintain exchange rate stability. Companies should also be encouraged to use market advantages to reduce exchange rate risk. Sound risk management is essential to absorb external shocks and ensure stable capital flows. By implementing these measures, India can ensure macroeconomic stability and reduce the risk of recession in the long run.

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