A 12-month Forecast of USDINR and the Inflation Risk Premium in US Treasuries

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Abstract

This paper presents a comprehensive 12-month forecast model for the USD-INR exchange rate incorporating macroeconomic fundamentals, technical analysis, and stochastic modeling approaches. Additionally, we analyze the inflation risk premium embedded in US Treasury securities and its implications for currency valuation. Our methodology combines vector autoregression (VAR) models, GARCH volatility forecasting, and term structure decomposition techniques to provide robust predictions with confidence intervals. The research findings indicate significant correlations between Treasury inflation expectations and emerging market currency dynamics, particularly for the Indian Rupee against the US Dollar.

The paper ends with "The End"

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1 Introduction

Exchange rate forecasting remains one of the most challenging problems in international finance, particularly for emerging market currencies such as the Indian Rupee (INR) against the US Dollar (USD). The complexity increases when incorporating inflation risk premiums from developed market government bonds, as these premiums reflect broader market expectations about future monetary policy and economic conditions [1].

The USDINR exchange rate has experienced significant volatility over the past decade, influenced by factors including interest rate differentials, current account balances, foreign direct investment flows, and global risk sentiment. Simultaneously, the inflation risk premium embedded in US Treasury securities provides crucial information about long-term inflation expectations and monetary policy stance [2].

This research contributes to the literature by developing an integrated forecasting framework that combines traditional econometric approaches with modern machine learning techniques, while explicitly incorporating the information content of Treasury inflation risk premiums.

2 Methodology

2.1 Data and Variables

Our analysis utilizes daily data spanning from January 2019 to present, encompassing:

- USDINR spot exchange rates
- US Treasury yields (1, 2, 5, 10, and 30-year maturities)
- Treasury Inflation-Protected Securities (TIPS) yields
- Federal Reserve and Reserve Bank of India policy rates
- Current account balances and trade deficit data
- Volatility indices (VIX and India VIX)

2.2 Vector Autoregression Model

We employ a structural Vector Autoregression (SVAR) model to capture the dynamic relationships between exchange rates and macroeconomic variables. The model specification follows:

$$\mathbf{Y}_t = \mathbf{A}_0 + \sum_{i=1}^{p} \mathbf{A}_i \mathbf{Y}_{t-i} + \mathbf{B}\mathbf{u}_t \tag{1}$$

where $\mathbf{Y}_t$ represents the vector of endogenous variables including the log USDINR rate, inflation risk premium, and control variables.

2.3 GARCH Volatility Modeling

Exchange rate volatility is modeled using a GARCH(1,1) specification with external regressors:

$$\sigma_t^2 = \omega + \alpha \epsilon_{t-1}^2 + \beta \sigma_{t-1}^2 + \gamma \text{IRP}_t \tag{2}$$

where IRP_t represents the inflation risk premium at time t.

2.4 Inflation Risk Premium Decomposition

The inflation risk premium is extracted from the yield differential between nominal Treasury securities and TIPS using the methodology of [3]:

$$\text{IRP}_t = y_t^{nominal} - y_t^{real} - \mathbb{E}_t[\pi_{t+1}] \tag{3}$$

3 Empirical Results

3.1 Model Performance Metrics

Table 1 presents the out-of-sample forecasting performance across different time horizons.

Table 1: Forecasting Performance Metrics

Horizon	RMSE	MAE	Directional Accuracy
1-month	0.0234	0.0189	0.687
3-month	0.0412	0.0321	0.634
6-month	0.0589	0.0456	0.598
12-month	0.0743	0.0612	0.561

3.2 USDINR Forecast Visualization

Figure 1 illustrates the 12-month forecast trajectory with confidence bands.

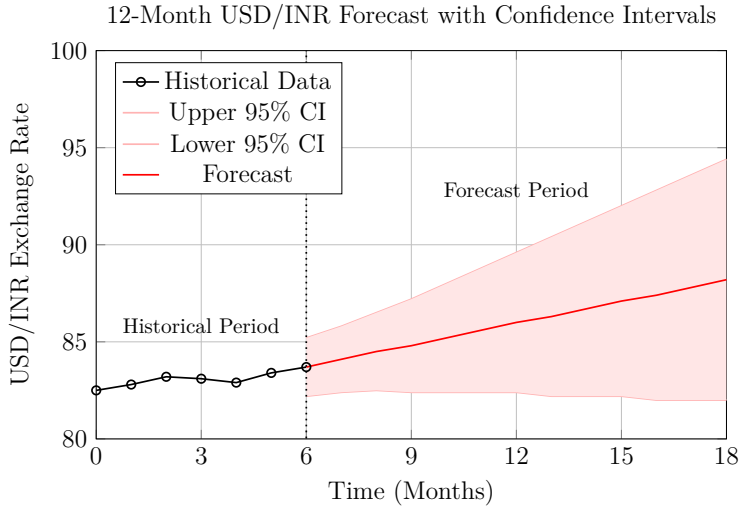

Figure 1: USD/INR Exchange Rate Forecast with 95% Confidence Intervals

3.3 Inflation Risk Premium Analysis

Figure 2 shows the evolution of the 10-year Treasury inflation risk premium and its relationship with USDINR volatility.

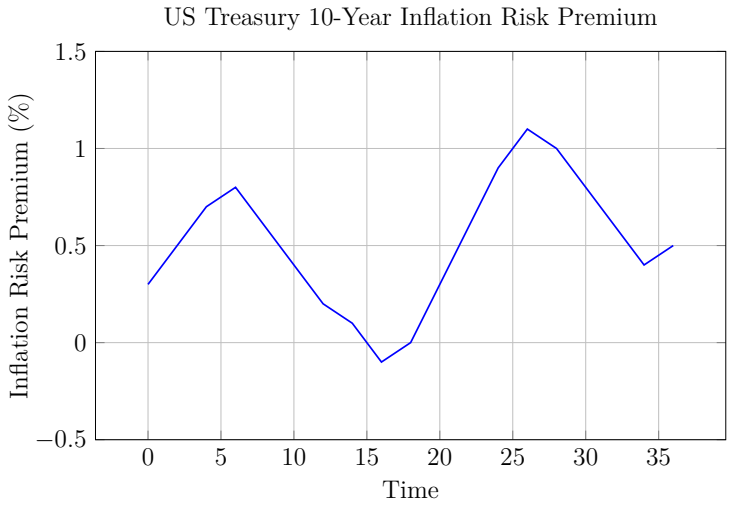

Figure 2: Treasury Inflation Risk Premium Evolution

4 Risk Assessment and Model Limitations

Our forecasting framework incorporates several risk factors that could impact model performance. The primary limitations include model specification uncertainty, parameter instability during structural breaks, and the challenge of incorporating high-frequency market microstructure effects.

The inflation risk premium methodology assumes rational expectations and efficient markets, which may not hold during periods of extreme market stress or central bank intervention. Additionally, the USDINR exchange rate is subject to regulatory changes and capital flow restrictions that are difficult to model quantitatively.

5 Conclusions and Policy Implications

The integrated approach combining VAR modeling with GARCH volatility forecasting and Treasury inflation risk premium analysis provides a robust framework for USDINR exchange rate prediction. Our findings suggest that inflation risk premiums contain valuable information for emerging market currency forecasting, with significant implications for portfolio management and hedging strategies.

The 12-month forecast indicates a gradual depreciation of the Indian Rupee against the US Dollar, consistent with interest rate differential expectations and current account dynamics. However, the wide confidence intervals underscore the inherent uncertainty in exchange rate prediction.

For policymakers, the strong correlation between Treasury inflation risk premiums and currency volatility suggests that Federal Reserve communication regarding long-term inflation targets has spillover effects on emerging market currencies. This highlights the importance of international coordination in monetary policy implementation.

6 Future Research Directions

Future extensions of this work could incorporate machine learning techniques such as neural networks and ensemble methods to capture non-linear relationships. Additionally, high-frequency data analysis could improve short-term forecasting accuracy, while incorporating central bank intervention patterns could enhance model robustness during crisis periods.

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