# Improving Exchange Rate Forecasting Accuracy Using Ensemble Learning Techniques: A Comparative Study

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**Abstract :** Introduction: Exchange rate forecasting is pivotal for informed financial decision-making, encompassing risk management, investment strategies, and international trade planning. However, traditional forecasting models often fail to capture the complexity and volatility of currency markets. This study explores the potential of ensemble learning techniques such as Random Forest, Gradient Boosting, and AdaBoost to enhance the accuracy and robustness of exchange rate predictions. Research Objectives The primary objective is to evaluate the performance of ensemble methods in comparison to traditional econometric models such as Uncovered Interest Rate Parity, Purchasing Power Parity, and Monetary Models. By integrating advanced machine learning techniques with fundamental macroeconomic indicators, this research seeks to identify optimal approaches for predicting exchange rate movements across major currency pairs. Methodology: Using historical exchange rate data and economic indicators such as interest rates, inflation, money supply, and GDP, the study develops forecasting models leveraging ensemble techniques. Comparative analysis is performed against traditional models and hybrid approaches incorporating Facebook Prophet, Artificial Neural Networks, and XGBoost. The models are evaluated using statistical metrics like Mean Squared Error, Theil Ratio, and Diebold-Mariano tests across five currency pairs (JPY to USD, AUD to USD, CAD to USD, GBP to USD, and NZD to USD). Preliminary Results: Results indicate that ensemble learning models consistently outperform traditional methods in predictive accuracy. XGBoost shows the strongest performance among the techniques evaluated, achieving significant improvements in forecast precision with consistently low p-values and Theil Ratios. Hybrid models integrating macroeconomic fundamentals into machine learning frameworks further enhance predictive accuracy. Discussion: The findings show the potential of ensemble methods to address the limitations of traditional models by capturing non-linear relationships and complex dynamics in exchange rate movements. While Random Forest and Gradient Boosting are effective, the superior performance of XGBoost suggests that its capacity for handling sparse and irregular data offers a distinct advantage in financial forecasting. Conclusion and Implications: This research demonstrates that ensemble learning techniques, particularly when combined with traditional macroeconomic fundamentals, provide a robust framework for improving exchange rate forecasting. The study offers actionable insights for financial practitioners and policymakers, emphasizing the value of integrating machine learning approaches into predictive modeling for monetary economics.

**Keywords :** exchange rate forecasting, ensemble learning, financial modeling, machine learning, monetary economics, XGBoost

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