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Topic of Research- Modelling Dynamic Risk Exposures of Indian Foreign Exchange Markets

Key word: Foreign Exchange Rate, Risk, co-movement/joint movement and ANN

Findings

The study investigates the volatility in the foreign exchange markets and dynamic risk exposures in Indian foreign exchange markets by using GARCH, DCC GARCH, the Copula Model, and prediction performance by using Machine Learning tools.

Firstly, the study explores the various techniques in econometrics that have evolved to capture volatility and its prediction. Dynamic Conditional Correlation Generalized Autoregressive heteroscedasticity (DCC GARCH) model offers significant advantages in financial econometrics, primarily through its ability to capture time-varying correlations between multiple assets. The application of DCC GARCH allows for dynamic correlation estimation among currency pairs, offering insights into their volatility and risk characteristics. This approach reveals that major currencies like USD, EUR, GBP, and JPY exhibit higher liquidity, and are more tradable due to deeper market penetration and stable economic conditions supported by their respective central banks' policies relative to emerging market currencies such as RUS, BRZ, and SAR. (Bollerslev *et al.*, 2009). This lower volatility is often attributed to stable economic conditions, deep market liquidity, and central bank policies that foster confidence and stability in these currencies. As a result, trading these major currencies against each other or other major global currencies generally involves less risk in terms of price fluctuations over shorter periods (Chen, 2022). On the other hand, currencies like RUS, BRZ, and SAR, emerging market currencies, tend to experience higher volatility levels. Factors contributing to this volatility include economic data releases, geopolitical events, commodity price movements (especially for commodity-exporting countries like Brazil and South Africa), and shifts in investor sentiment towards emerging markets. These currencies may undergo significant price swings in response to external shocks or domestic economic developments, presenting both opportunities and risks for traders (Saji, 2019).

The study has used copula models to investigate the tail dependence structure between the selected currency pairs. By using copula analysis, analysts and traders can better quantify and manage the risk of joint currency movements, leading to more robust hedging strategies and portfolio diversification.

SThe study deploys machine learning in forecasting forex volatility which represents a significant advancement in financial analysis and trading strategies. Artificial intelligent models process and analyse extensive datasets, revealing patterns and relationships that may go unnoticed by traditional statistical methods. By utilizing extensive historical forex data, machine learning algorithms can discern intricate, nonlinear interactions within the market, resulting in improved accuracy and reliability in forecasting market volatility. This predictive power is crucial for traders and investors because accurate forecasts of volatility help optimize trading strategies and navigate market fluctuations effectively. Machine learning models (ML) evolve and refine their predictive accuracy as they continuously ingest and adapt to new data. This adaptability is particularly valuable in the highly dynamic and fast-paced forex markets, where market conditions can change rapidly due to geopolitical events, economic reports, and other factors. Advanced ML techniques and artificial intelligence (AI) further enhance the forecasting capability by enabling models to understand temporal dependencies and long-term trends. Consequently, the usage of ML model in forecasting not only provides a competitive edge to traders and financial institutions but also contributes to more stable and efficient financial markets by enabling better-informed and timely decisions. The methods used to assess predictive accuracy rates in measuring dynamic risk have yielded significant results. Applying econometric techniques reveals the persistence and clustering of volatility in forex rates. The comparative analysis of prediction performance among Logistic Regression, Decision Tree, Support Vector Machine (SVM), Random Forest Classifier, and Artificial Neural Network (ANN) carries significant policy implications for decision-makers across various domains. Firstly, the superior performance of ANN and Random Forest Classifier, suggests that investments in computational resources and expertise for implementing deep learning and ensemble techniques can yield substantial improvements in predictive accuracy. This finding underscores the importance of embracing advanced machine learning methodologies in sectors where precise prediction is critical, such as financial risk assessment, trading strategy, stock exchange, forex market etc.

Investors and policymakers should monitor correlations and volatility dynamics identified through DCC GARCH and copula models to adjust hedging strategies effectively (Engle, 2002). Moreover, understanding the role of central banks in formulating and implementing policies can provide insights into future exchange rate movements and market liquidity conditions. Hence, integrating DCC GARCH and copula models enhances the understanding of currency performance, traceability, and risk management strategies in global markets. This analytical framework supports informed decision-making by stakeholders, ensuring resilience against volatility and aligning policies with market conditions.

Policymakers should prioritize ongoing evaluation and adaptation of predictive models in response to evolving data dynamics and technological advancements. This iterative approach ensures that predictive systems remain robust and effective over time, safeguarding against model drift and ensuring continued relevance and accuracy in policy applications.