

# INCORPORATING LONG-TERM DEPENDENCE: A FRACTIONAL BROWNIAN MOTION APPROACH TO INDIAN STOCK PRICING

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## ABSTRACT

Long-term dependence in stock simulation is crucial for accurately capturing the complex dynamics of financial markets, allowing for better prediction of future stock prices based on past performance. In this study, we investigate the presence of Long-term dependence in the Indian stock market and its implications for forecasting models. Our analysis reveals strong evidence of long-range dependence in stock returns, indicating persistent trends over time. We then proceed to compare the performance of traditional models like GBM (Geometric Brownian Motion) with FBM (Fractional Brownian Motion), with a focus on their ability to forecast prices during periods of high market volatility. We used two parameter estimation methods and four different simulations, comparing them using RMSE and ARPE metrics. Although GBM outperforms FBM overall, FBM demonstrates slightly superior performance during times of high market volatility. This advantage is attributed to FBM's ability to capture long memory and volatility dynamics effectively. Moreover, we observe that MLE (Maximum Likelihood Estimation) consistently yields lower errors compared to PSO (Particle Swarm Optimization), and incorporating implied volatility data enhances the accuracy of both models.

**Keywords:** Long-term dependence, Stock simulation, GBM , FBM , Implied Volatility, PSO , MLE