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HYPER IVANCEVIC MODEL USING L'ÉVY PROCESS

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Abstract

This work develops a Hybrid Fractional Ivancevic (Hyperd) option-pricing model that combines fractional diffusion with nonlinear wave dynamics to capture both exogenous shocks and endogenous market feedback. The model extends classical jump-diffusion frameworks by incorporating fractional derivatives to represent L'Évy-type jumps and cubic nonlinearities to model herding and instability in financial markets. We provide a semi-closed-form Fourier pricing formula, implement numerical solutions using the Split-Step Fourier method, and compare the model with classical Merton and Kou jump models. The study emphasizes the impact of global market events, particularly from the United States and Europe, on the Saudi stock market (Tadawul). Results show that the Hyperd model more accurately captures jump behavior, volatility clustering, and extreme events in the Saudi market, highlighting its suitability for risk management, stress testing, and portfolio optimization in markets sensitive to international shocks. Empirical results indicate that the Hyperd model more accurately captures jump behavior, volatility clustering, and extreme market events, especially during periods influenced by global shocks from the United States and Europe. The proposed model demonstrates su-

perior pricing accuracy and risk sensitivity, making it suitable for risk management, stress testing, and portfolio optimization in internationally exposed markets. Future research may extend the model to multi-asset frameworks, stochastic volatility settings, and real-time calibration using high-frequency data.

Keywords:

Option Pricing, Split-Step Fourier Method, Jump-Diffusion, Lévy Processes, Saudi Stock Market, Volatility Clustering processes