# Parameter Estimation for the Mixed Fractional Merton Jump Diffusion Model with Em Algorithm

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**Abstract**

This paper develops a robust framework for parameter estimation in a Mixed Fractional Merton Jump Diffusion (MFMJD) model using an Expectation-Maximization (EM) algorithm combined with Markov Chain Monte Carlo (MCMC) sampling. The model integrates fractional Brownian motion to capture long-range dependence and a jump diffusion component to account for discontinuities in financial data.

A Metropolis-Hastings scheme is employed in the E-step to estimate latent jump processes, while the M-step updates model parameters through likelihood optimization. The proposed method is applied to daily stock prices from the Helsinki Stock Index. Consistency and Asymptotic normality of the estimator were established.

The results indicate strong evidence of persistence, heavy-tailed behaviour, and discrete shocks. Simulation-based validation confirms that the model accurately reproduces both the statistical and structural properties of the observed data. Residual diagnostics and sensitivity analysis further demonstrate model adequacy and robustness.

The framework provides a comprehensive tool for modeling financial markets characterized by memory effects and sudden discontinuities.

**Index Terms**

Fractional Brownian motion, Jump diffusion, EM algorithm, MCMC, Metropolis–Hastings, Parameter estimation, Financial time series, Long memory, Heavy tails, Monte Carlo simulation