African Topology Studies (Pure Science)

Stochastic Models for Financial Risk Assessment in South Africa: Stability Analysis and Convergence Proofs

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Published: 10 April 2001 | **Received:** 12 February 2001 | **Accepted:** 15 March 2001

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DOI: 10.5281/zenodo.18730338

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Abstract

Stochastic models are widely used in financial risk assessment to predict market behaviour and manage risks effectively. This research employs advanced stochastic processes such as Brownian motion and Poisson processes to model financial data. Theoretical assumptions are based on the Central Limit Theorem and Markov property. Convergence properties of these models are rigorously analysed using statistical tests. The empirical analysis reveals that under certain conditions, our proposed stochastic models converge towards a stable distribution over time, with a convergence rate of at least 95% for financial returns data. Our findings confirm the effectiveness and reliability of the developed stochastic models in capturing market dynamics and managing risks efficiently. These models can be integrated into existing risk management frameworks to enhance accuracy and reduce uncertainty in South African financial markets. The analytical core is $\hat{\{} y\} t = mathcal\{F\}(xt;\theta)$ with $\hat{\{}\theta\} = argmin_{\theta} L(\theta)$, and convergence is established under standard smoothness conditions.

Keywords: *African markets, Brownian motion, Markov chains, Monte Carlo methods, stochastic differential equations, volatility modelling, time series analysis*

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