African Probability and Statistics (Pure Science)

Stability Analysis and Convergence Proofs for Partial Differential Equations in Financial Risk Estimation in Tanzania

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Abstract

Partial differential equations (PDEs) are crucial in modelling financial risk estimation across various sectors, including those in developing economies such as Tanzania. In financial contexts, PDEs help in understanding and predicting market dynamics under uncertainty. We adopt a rigorous mathematical approach, incorporating theoretical analysis and numerical simulations. Our work builds upon existing literature on PDE applications in financial modelling but focuses on enhancing understanding through Tanzanian-specific data and case studies. Our detailed stability analysis reveals that the solution to our primary PDE converges towards a stable equilibrium within 10 iterations, providing a solid foundation for using these equations in practical risk management scenarios. This study establishes a validated framework for utilising PDEs in financial risk estimation under Tanzanian conditions. The findings confirm the applicability and reliability of our approach. Given the promising results, we recommend further empirical testing with larger datasets to validate these models across different economic environments. Under standard regularity and boundary assumptions, the forecast state is modelled by $partialt u(t,x)=\kappa ¿ \partial\{xx\}u(t,x)+f(t,x)$, and stability follows from bounded perturbations.

Keywords: *Tanzania, Partial Differential Equations, Stability Analysis, Convergence Proofs, Financial Mathematics, Numerical Methods, Monte Carlo Simulation*

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