National University of Science and Technology

Think in Other Terms

FACULTY: *Commerce*

DEPARTMENT: *Insurance and Actuarial Science*

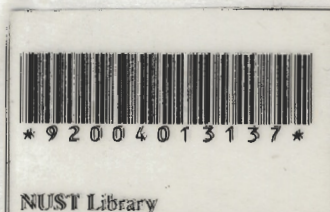**PROJECT TITLE:** *Simulation based European call option pricing: Assuming Stock prices follow a jump diffusion process*

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In fulfillment of the requirements of Bachelor of Commerce (Honors) Degree in Actuarial Science

Bulawayo, Zimbabwe

August 2009

ABSTRACT

The research was motivated by the failure of the geometric Brownian motion stock price model's failure to capture discontinuities in the actual stock prices. Understanding the dynamics of the risky asset, that is the stock, was at the heart of effective derivative pricing and portfolio risk management. Methods of pricing options were explored both analytic and numerical one finally settling for on Monte Carlo methods and the Black-Scholes formula.

The geometric Brownian motion underpinned the breakthrough Black-Scholes pricing formula, which assumes that log-returns are normally distributed when as yet they are not. Consequentially, the prices determined using this formula has been reported to be in discord with market prices of derivatives. The starting point of this research was an endeavor to model the characteristics of the stock price process that the geometric Brownian motion failed to capture, embodied in the Geometric Levy process.

The discontinuities in the stock price rendered invalid the assumption of the Black-Scholes formula that markets are complete. This exposed portfolios to hedging risk, since the payoffs of options could not be replicated by combination of stocks an example is the Black Monday.

Risk is ubiquitous, it exists everywhere and its existence is not dependent on our knowledge of it. Lord Kelvin (William Thomson) said: when you can measure what you are speaking about, and express it in numbers, you know something about it; but when you cannot measure it, when you cannot express it in numbers, your knowledge is of meager and unsatisfactory kind: it may be the beginning of knowledge, but you have scarcely in your thoughts, advanced to the stage of science. This adage motivated the pricing of options assuming a jump diffusion model (Geometric Levy Process). Comparison of the Black-Scholes prices and the jump diffusion process on the same underlying asset indeed, this research advance to the stage of science and proved that there is a difference between the Black-Scholes prices and those of the Geometric Levy Process.