Abstract

For a long time, stock market researchers have confronted the problem of modeling stock prices. One of the most widely accepted methods for modeling the stock price is to assume that the price process follows Geometric Brownian motion. Using this assumption, researchers have tried to understand the critical link between the investors' decision and price dynamics. Even though such models could explain the observed price behavior to some extent, they were unable to explain the stylized facts, namely significant skewness and leptokurtosis, observed in the stock prices. In an attempt to explain the behavior of prices better, various researchers introduced several different stochastic processes in the past, some of which could predict and explain the stock prices more effectively compared to the classical Geometric Brownian motion. Even though better models were introduced over time, practitioners still depended mostly on Geometric Brownian motion as it has various desirable properties that make it's implementation simple.

In this thesis, we have focused on understanding how the process of Brownian motion changes in case we introduce certain microscopic changes in a popular mathematical construction of it. The analysis looks at how such changes made at the microscopic level can help in introducing certain desirable properties, which can help explain the prices process in a simple and better way compared to the existing models.

First, an overview is given of the basic concepts of the stochastic process, details of the process of Brownian motion, and several other processes that are available in the existing literature for understanding the financial phenomena.

Next (Ch. 2,3,4), we present three new stochastic processes. Their construction, properties, and applications are discussed subsequently. Finally, the proposed models are compared with the most used, well-known Brownian motion and another existing model, namely Normal Inverse Gaussian Process. The proposed models are found be a good candidate for modelling stock prices.