

TJHSST Computer Systems Lab Senior
Research Project
An Analysis of a Dynamic Application of
Black-Scholes in Option Trading
2009-2010

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Abstract

For decades people have invested in the stock market in with stocks, options, and bonds. Various groups of people have worked towards modeling the stock market with mathematics. One of the earliest is Black-Scholes. Developed by Fischer Black and Merton Scholes in 1973, it remains one of the most prevalent tools used by European investors today. However, the Black-Scholes model is catered toward European options, which have a definite time towards maturity. American stocks, on the other hand, do not have such constraints and can be bought and sold at any time. This project explores the way in which Black-Scholes can be applied to the more dynamic American option trading market.

Keywords: genetic algorithms, financial modeling

1 Introduction - Elaboration on the problem statement, purpose, and project scope

1.1 Purpose

The purpose of this project is to investigate the Black-Scholes model, a popular tool in helping European investors determine the calls and puts of European options. The goal however, is to adapt the European model into an American model. Because unlike European options, which are held until a certain time (maturity), American options can be sold at any time, making the market much more dynamic. Conforming the model to American parameters can be a helpful investment tool to traders and investors alike.

1.2 Scope of Study

Most of the work revolves around the Black-Scholes model and the input of its required variables. Because the B-S model revolves around a constant time period, it will first be evaluated as such. Then, the B-S model will be revised to output the inputs of the next time period, making the model dynamic.

1.3 Methodology

The program will be coded in Java consisting of two main components. One is the stock class, holding all the required inputs. The other, perhaps the most important part of the project, is the Black-Scholes class containing the B-S formula and model. Outputs will be a series of numerical data. This data will then be outputted into a spreadsheet and graphed as a time-series plot. Inputs will be price, volatility, and interest rates. For testing purposes, pre-determined values will be used. However, historical data on stocks and options can also be used as inputs. To determine accuracy, the price can be compared to a calculator or historical data. The computation of each variable in the output will be a different sub-function, and each will be debugged and checked separately.

2 Expected Results

The results obtained should give insight into future option pricing, as well as underline the main differences in American and European option trading. The results will be presented in both table and graphical format (using spreadsheets and time-series plots). Although this is only one dynamic application of Black-Scholes, it may provide ideas for other investing tools that branch from models of markets of different nationalities.