**Monte Carlo Simulation for Option Pricing**

* Compare with Black-Scholes price.

The model followed the standard Geometric Brownian Motion (GBM) formula incorporating drift:

Where:

* = $117.44, Current Price of the Stock as of March 31st 2025
* = 0.39905, Annualised Drift (Based on Vistra’s Annualised Returns)
* = 0.78901, Annualised Volatility
* = 0.01, Time Increment (100 Steps Total)
* = A Standard Normal Random Variable

Example of Formula Used in Excel 🡪

Each simulation produced a final asset price ​, and the corresponding payoff was calculated as follows:

The average of these payoffs was then discounted using the risk-free rate to reflect the present value:

A screenshot of a spreadsheet

Description automatically generated

The Monte Carlo simulation estimated the option price at $18.21, whereas the Black-Scholes model yielded a significantly lower price of $3.80.

This large discrepancy could be due to several factors:

* Monte Carlo simulations can incorporate more complex dynamics, such as path dependency, volatility skew, or non-constant interest rates, which the standard Black-Scholes model does not.
* Black-Scholes assumes constant volatility and a log-normal distribution of returns, while Monte Carlo can reflect more realistic or tailored assumptions.
* With only 100 iterations, the Monte Carlo result might still be noisy or less stable, leading to a higher estimate. Increasing iterations can improve accuracy.

In summary, the difference reflects the limitations of the Black-Scholes assumptions and the flexibility of Monte Carlo methods to model more nuanced or realistic scenarios.

