Trinomial CRR user's Instructions

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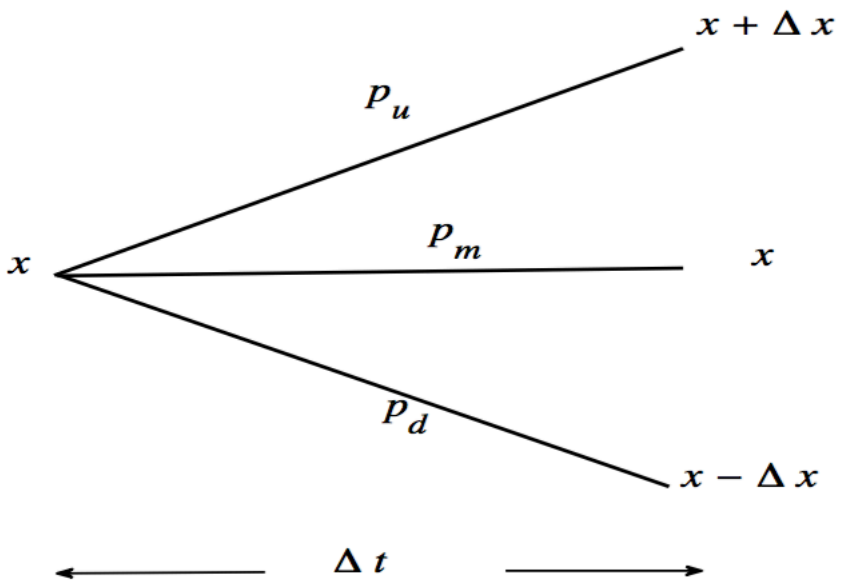

Overview

In this article we are going to illustrate how to use the compiled.exe. program. This article includes 3 parts about:

- Startup and Input data
- How to get Present Results
- Methods Implemented

1.Startup and Input Data

Startup

It is pretty easy to startup the compiled.exe file. After you unzipped the zip file, please just double left-click the “Jiachen_Xie_202021908.exe” file into the zip file. And it will be quickly started.

Input Data

After it has started, a terminal windows has been showed on the windows, and you will see the usage instructions inside the terminal. Please just follow the instructions and input data by keyboard.(Please press Enter button on your keyboard each time after you finishing input one data)

2.Results Present

There are 2 kinds of way to present results. Firstly, it will be directly presented in the terminal after you finish input. It is clearly easy to see that

Directly View

After it has started, a terminal window has been showed on the windows, and you will see the usage instructions inside the terminal. Please just follow the instructions and input data by keyboard. (Please press Enter button on your keyboard each time after you finishing input one data)

Output to Excel

At the same time, the program will also automatically create two xlm files in the program folder. You can also check the results from the xml files.

3.Methods Implemented

Mathematical Methods

In our program a Black-Scholes Model has been applied.The stochastic differential equation for the risk-neutral geometric Brownian motion (GBM) model of an asset price S paying a continuous dividend yield q is

$$dS = (r - q)Sdt + \sigma SdW$$

where r is the risk free interest rate, σ is the volatility of the asset and W is a Wiener process under the risk-neutral probability measure.

It is usually more convenient to work in terms of the logarithm of the asset price, x = ln(S) and from Ito's lemma we know that

$$dx = \nu dt + \sigma dW, \text{ where } \nu = r - q - \frac{1}{2}\sigma^2.$$

Based on this model, we are able to find expressions for the transition probabilities pu, pm and pd,:

$$p_u = \frac{1}{2}\left(\frac{\sigma^2\Delta t + \nu^2\Delta t^2}{\Delta x^2} + \frac{\nu\Delta t}{\Delta x}\right)$$
$$p_d = \frac{1}{2}\left(\frac{\sigma^2\Delta t + \nu^2\Delta t^2}{\Delta x^2} - \frac{\nu\Delta t}{\Delta x}\right)$$
$$p_m = 1 - p_u - p_d$$

And we can use this formula to calculate Option Price. And also Greeks can be approximated by

$$\Delta = \frac{\partial C}{\partial S} \approx \frac{H(1,1) - H(1,-1)}{S(1,1) - S(1,-1)};$$

$$\Gamma = \frac{\partial^2 C}{\partial S^2} \approx \frac{\left(\frac{H(1,1)-H(1,0)}{S(1,1)-S(1,0)}\right) - \left(\frac{H(1,0)-H(1,-1)}{S(1,0)-S(1,-1)}\right)}{\frac{1}{2}(S(1,1) - S(1,-1))};$$

$$\Theta = \frac{\partial C}{\partial t} \approx \frac{H(1,0) - H(0,0)}{\Delta t}.$$

Codes Implemented Methods

Class and inheritance: Class has been build to make the codes structure simple and efficiency. And also call and put are subclass of Euroption Class, because they have similar propery.

Virtual Function: As function payoff has two different subclass function. To deal with this situation, virtual function has been used.

fstream: To communicate with Excel, fstream has also been used.

memory management: function new and delete has been used to do memory management.