

FE621

HW1

September 2019

Instructions

Use any programming language that can do the task. A code needs to be commented and results must be nicely presented. The outcome of your solutions must be in .pdf file.

Problem 1

1. (10pts)

Write a program (function) that enables downloading data from the following sources:

- Google finance <http://www.google.com/finance>
- Yahoo Finance <http://finance.yahoo.com>
- Bloomberg

The function should be able to download a security price time series and options. For Bloomberg data, access a Bloomberg terminal, if you use R to interface with the Bloomberg data, a useful package is Rblpapi but feel free to use other packages.

2. (10pts) For any two trading days, using the function created in the previous step, download data for the equity and options of

- AMZN
- BA

Download the time series of SPY, VIX and VXX. To be specific you should download at least all the option chains until the ones maturing two and three months from the date you are downloading. Refer to data of the first day as DATA1 and data of the second day as DATA2.

3. (10pts) Explain what the SPY, VIX and VXX are.

4. Obtain the short-term interest rate from <http://www.federalreserve.gov/releases/H15/Current/>. Use the Effective Federal Funds rate.

5. (10pts) Using your choice of programming language and without toolboxes, implement the Black-Scholes formulas of the European call and put.
6. (10pts) Using AMZN, BA, SPY in DATA1, generate the implied volatility, using a root finding method, with the option value as the average of (bid+ask)/2. Calculate the average of the implied volatilities for options between in-the-money and out-of-the-money. Define moneyness whenever the ratio of today's price S_0 divided by the strike K is between 0.95 and 1.05.
7. (10pts) Make a table reporting the implied volatility values obtained for every maturity, option type and stock in DATA1 (AMZN, BA, SPY). Also compile the average volatilities as described in the previous point. Comment on the observed difference in values obtained for AMZN, BA and SPY. Compare with the synchronized value of the VIX. Comment on what happens when the maturity increases. Comment on what happens when the options become in the money respectively out of the money.
8. (10pts) Using the second dataset DATA2. For each strike price in the data use the Stock price for the same day, the implied volatility you calculated from DATA1 and the current short-term interest rate (corresponding to the day on which DATA2 was gathered). Use the Black-Scholes formula, to calculate the option price.

Problem 2

(30pts)

For AMZN, for 3 different maturities (1 month, 2 months, and 3 months) and 10 strike prices. For each strike price in the data, calculate the corresponding implied volatility. Calculate the option prices (European Calls and Puts) using the binomial tree, and compare the results with the same prices obtained applying the Black-Scholes formula. Use 200 steps in your construction and report the results in a table.