Assignment 1

Option price in Matlab

Price a European Call Option with the following characteristics:

Strike price:	1 Euro
value date:	15th of February 2008
time-to-maturity (ttm):	1 year
volatility:	20%
ttm-zero-rate:	3%
Underlying:	equity stock
Dividend:	no dividends
Settlement:	cash settlement
Number of contracts:	1 MIO
Underlying price	1 Euro

Questions

a. Price the option,
   considering an underlying price equal to 1 euro (i.e a derivative Notional of 1 MIO Euro) and the ttm exactly equal to 1:
   i) via blkprice Matlab function;
   ii) with a CRR tree approach;
   iii) with a Monte-Carlo (MC) approach.

b. Consider M, as the number of intervals in CRR and as the number of simulations in the MC. Focus on a call. For the CRR M equal to 100 and for the MC M equal to 10^6 can be considered adequate? Why in your opinion?
   [Hint: As error for the CRR consider the difference in absolute value w.r.t. to the exact value, while as error for the MC an estimation of the unbiased standard deviation of the MC price]

c. [Facultative]. Show that the errors for a call rescale with M as $1/M$ for CRR and as $1/M^{1/2}$ for MC.
   [Hint] Show, for a call, the error for CRR and MC varying M in a log-log scale.

d. For a call and a put, plot exact option price, Delta and Vega as a function of the underlying price with the underlying price between 0.8 Euro and 1.2 Euro.

Function signatures

a. optionPrice=EuropeanOptionClosed(F0,K,B,T,sigma,flag)
b. optionPrice=EuropeanOptionMC(F0,K,B,T,sigma,N,flag)
c. optionPrice=EuropeanOptionCRR(F0,K,B,T,sigma,N,flag)
d. [M,errorCRR]=PlotErrorCRR(F0,K,B,T,sigma); M=2^m with m=1:9; (return row vectors)
e. [M,stdEstim]=PlotErrorMC(F0,K,B,T,sigma); M=2^m with m=1:20; (return row vectors)
f. delta = DeltaBlackScholes(F0,K,B,T,sigma,flag) (function returning single value not the plot)
g. vega = VegaBlackScholes(F0,K,B,T,sigma,flag) (function returning single value not the plot)

Comment codes, use explicative variable names and divide into sections. It's IMPORTANT to use **exactly the same** signatures provided above.

Delivery Date: Friday the 1st of March. Pay attention to the delivery address below.

Email Subject: Follow rules instructions