HOMEWORK # 3

Pricing Financial Derivatives II

Eulalia Nualart, Barcelona GSE

To be done in groups of 2-3 students. To be submitted by email as a unique pdf file, and include the code in the pdf file. The answers need to be justified. Copied exercises between groups implies a 0 in the homework of both groups.

Deadline for submission : Tuesday March 2nd 2021 at 10 :00 a.m.

Exercise 1 : Delta-hedged portfolio

Consider a European call with maturity T (years) and strike K. We assume that the underlying stock price follows the Black-Scholes model with initial price S_0, volatility σ and interest rate r. Assume that you are long on the call and you Delta-hedge by going short Δ_0 units of S_0. Assume the stock moves by x units immediately after you Delta-hedge. Choose fixed values for the parameters and plot the exact value of the profit and loss portfolio as a function of x together with its second order approximation. Comment the plots.

Exercise 2 : Pricing Barrier options

Consider a one-year out-call struck at K with barrier at $H < K$ with daily setting dates (you can choose $N = 365$). Assume that the underlying stock satisfies Black Scholes with S_0, σ, r fixed. Choose the parameters and plot some realizations of the stock price plotting also the barrier with a line. Choose two realizations, one with the barrier crossed and one without the barrier crossed and plot the value of a down-and-out call and down-and-in call and the corresponding plain vanilla call as a function of time. Plot also the 3 options as a function of the stock price for 3 fixed times to maturity : 1 year, 6 months and 3 months. Comment all the plots.