COMPUTING THE PRICE, DELTA (Δ) AND GAMMA (Γ) OF EUROPEAN PUT OPTION BY EXPLICIT METHOD

Solution in file `EurPutGreeksExplicit.m`

1. We price a European Put option under GBM with the parameters below by solving the BS PDE directly with appropriate boundary conditions and compare our solutions with the option prices computed using the matlab built in function `blsprice`.

$$S(0) = 100, r = 0.03, q = 0.05, \sigma = 0.2, K = 100, T = 1. \tag{1}$$

The price of the option $V(S, \tau)$ should satisfy the PDE below with the initial

condition $(\tau = T - t)$ being the payoff of the option:

$$\partial V = \frac{1}{2}\frac{\partial^2 V}{\partial S^2}\sigma^2 S^2 + (r-q)S\frac{\partial V}{\partial S} - rV \tag{2}$$

$$V(S, 0) = max(K - S, 0) \tag{3}$$

Using the boundary condition below for European put option:

$$V(S_{min}, \tau) = e^{-r\tau K}, V(S_{max}, \tau) = 0. \tag{4}$$

2. After having computed all put option prices $V(S, T)$ on the domain, for $j = 1, \ldots, N+1$.

$$D = \left(S_j = S_{min} + (j-1)\times dS;\ dS = \frac{(S_{max} - S_{min})}{N},\right) \tag{5}$$

we then compute Δ and Γ of the above put option using the approximation below and compare our numbers with Δ and Γ computed using the matlab built in functions`blsdelta` and `blsgamma`.

$$\Delta(S_j) = \frac{V(S_{j+1}, T) - V(S_{j-1}, T)}{2\times dS}, j = 2, \ldots, N. \tag{6}$$

$$\mathit{\Gamma}(S_j) = \frac{V(S_{j+1}, T) - 2V(S_{j-1}, T) + V(S_{j-1}, T)}{dS^2}, j = 2, \ldots, N \tag{7}$$

3. Finally we plot both Δ and T agains the stock price S.