QF4102 Financial Modelling and Computation Assignment 2

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1 Forward Grid Shooting Method on American floating-strike arithmetic-average call

Statement of the problem

1.1 Description of work done

Data: $S_0, q, H, X, \tau, r, \sigma$
Result: C_do, Option Premium
$\lambda = \dfrac{(r-q)}{\sigma^2} - 0.5;$
$y = \dfrac{\log\left[H^2/(XS_0)\right]}{\sigma\sqrt{\tau}} + \lambda\sigma^2\tau;$
$x_1 = \dfrac{\log S_0/H}{\sigma\sqrt{\tau}} + \lambda\sigma^2\tau;$
$y_1 = \dfrac{\log H/S_0}{\sigma\sqrt{\tau}} + \lambda\sigma^2\tau;$
$d_1 = \dfrac{\log\left(S_0/X\right) + (r - q + \sigma^2/2)\tau}{\sigma\sqrt{\tau}};$
$d_2 = d_1 - \sigma\sqrt{\tau};$
$C = S_0 e^{-q\tau} N(d_1) - X e^{-r\tau} N(d_2);$
if $H \leq X$ **then**
$\quad C_do = C - S_0 e^{-q\tau}\left(\dfrac{H}{S_0}\right)^{2\lambda} + N(y - \sigma\sqrt{\tau}) X e^{-r\tau}\left(\dfrac{H}{S_0}\right)^{2\lambda-2};$
else
$\quad C_do = S_0 N(x_1) e^{-q\tau} - X e^{-r\tau} N(x_1 - \sigma\sqrt{\tau}) - N(y_1) S_0 e^{-q\tau}\left(\dfrac{H}{S_0}\right)^{2\lambda} + N(y_1 - \sigma\sqrt{\tau}) X e^{-r\tau}\left(\dfrac{H}{S_0}\right)^{2\lambda-2};$
end

Algorithm 1: Algorithm for pricing European down-and-out option

1.2 Comments on plot of option prices against current underlier price

1.3 Comments on plot of computation errors using BTM against theoretical values

1.4 Values of N that minimizes the errors

2 Explicit Difference Scheme III for vanilla call option

Statement of the problem

2.1 Newly issued European floating strike lookback put options

2.2 Previously issued European floating strike lookback put options

2.3 Analyze, compare and comment on the results