

We consider an option with

type = call, maturity $T = 1$ and strike $K = 100$.

Its underlying stock has

spot price $S_0 = 100$ and volatility $\sigma = 20\%$.

Moreover, the interest rate is 5%.

You are expected to try the following tasks:

1. Compute BSM call value.
2. Recall that CRR(N) model is indeed equivalent to a FTCS with Grid ($\Delta x = \sigma\sqrt{\Delta t}, \Delta t = T/N$) for the number N of steps on $[0, T]$. Compute the value of CRR($N = 2000$) and observe if it is sufficiently close to BSM value?
3. Next, we want to demonstrate the convergence

$$\text{CRR}(N) \rightarrow \text{BSM}, \text{ as } N \rightarrow \infty.$$

To do that, we take the number of steps $N = 10 + 20k$, where k ranges over all integers in $\{0, 1, \dots, 49\}$.

pseudocode

- plot a graph of the mapping, for $k \in \text{range}(50)$

$$k \mapsto \text{CRR}(10 + 20k).$$

- on the same figure, plot a horizontal line with the level of BSM value.
- observe if the CRR curve actually converging to the BSM line?

4. Repeat the above convergence demonstration by replacing the number of steps by

$$N = 10 + 25k.$$

Observe the CRR curve converging to BSM line in the same manner?