tr_euler

Input parameters:

- StepNumber N

Output parameters:

- Price
- Delta

This is a binomial tree where the driving Brownian motion of the model is replaced by the symmetric random walk in a natural manner. In particular the weight of the two sons nodes are $\frac{1}{2}$. This is certainly the first scheme a probabilist would design. We give [1] as a reference. It is not a flat tree (ie $u * d = 1$ does not hold), therefore for american options the intrinsic value has to be recomputed at each node of the tree. On the positive side, the scheme works whatever the value of σ in the sense that the probabilities remain positive (since they are constant!).
As it is shown in Convergence result for Tree methods in finance for this scheme many mathematical results are available since the exemple of the approximation of Brownian motion by the standard random walk is the archetype of a Markov chain approximation scheme.

/*Price array*/

/*Up and Down factors*/
Here $u = e^{\left(r-diviv-\frac{\sigma^2}{2}\right)h+\sigma\sqrt{h}}$, $d = e^{\left(r-diviv-\frac{\sigma^2}{2}\right)h-\sigma\sqrt{h}}$.

/*Discounted Probability*/
Plainly $e^{-rh} * \frac{1}{2}$.

/*Terminal values*/

/*Backward Resolution*/
Notice that the indexing of the price array P is relative to the lower of the underlying values at a fixed time.

/*Delta*/
We keep the formula of the CRR delta. The convergence can be proved in the same manner as for the CRR delta (cf there)

/*First Time Step*/

/*Price*/

/*Memory desallocation*/

References

[1] H.KUSHNER P.G.DUPUIS. *Numerical Methods for Stochastic Control Problems in Continous Time*. Springer-Verlag, 1992. 1