tr_lnthirdmoment

Input parameters:

- StepNumber N

Output parameters:

- Price
- Delta

This tree is taken from [1]. This is a trinomial tree in which the local consistency for the approximating chain, with respect to the logarithm of the Black-Scholesmodel, holds up to the fourth moment. This gives an order of accuracy of $o\left(h^2\right)$ and for smooth payoffs $(\dots)$ an order of convergence better than h (cf. there).
The calculations are described there.

/*Price array*/

/*Up and Down factors*/
Here $u = e^{\left(r - diviv - \frac{\sigma^2}{2}\right)h + \sigma\sqrt{3h}}$, $d = e^{\left(r - diviv - \frac{\sigma^2}{2}\right)h - \sigma\sqrt{3h}}$.

/*Discounted Probability*/
Plainly $e^{-rh} * \frac{1}{6}$. This is the discounted probability of the up and down states.

/*Terminal values*/
We start the indexing from below. Clearly the intermediate variable `iv` is useless. For clarity, why not?

/*Backward Resolution*/
Notice that the indexing of the price array P is relative to the lower of the underlying values at a fixed time. We recompute at each time step the lower value of the underlying (`lowerstock`) then at each node the value of the underlying. The number of points at each time step is the previous one (backward) minus 2 since this is a trinomial tree. The coding of the backward conditionnal expectation tries to minimize the number of times operation:
P[j]=proba*(P[j]+4.*P[j+1]+P[j+2])

/*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). Other maybe more clever choices are possible?

/*First Time Step*/

/*Price*/

/*Memory desallocation*/

References

[1] D.LAMBERTON. Random walk approximation and option prices. *Proceedings of the 5th CAP Workshop on Mathematical Finance, Columbia University, November 1998*, page Unknown, 1999. 1