

## tr\_bbsr

Input parameters:

- StepNumber  $N$

Output parameters:

- Price
- Delta

This is taken from [2] The ideas of this algorithm is to replace the last time step of the binomial tree by the Black-Scholes formula. This will smooth the terminal payoff so that one may hope an enhanced convergence. This may be called BBS(Binomial Black-Sholes) algorithm. The additional feature of this algorithm is to perform a Richardson extrapolation, whence the name BBSR.

/\*Memory Allocation: Price, Intrinsic Value arrays\*/

/\*Up and Down factors\*/

/\*Risk-Neutral Probability\*/

This is Hull-White binomial probability for which the local consistency condition is easily checked (cf. [1])

/\*Intrinsic Value computation\*/

Storage of the  $2N + 1$  possible values of the intrinsic value.

/\*Backward Resolution\*/

Note that we don't re-compute the intrinsic value.

/\*LastTime Step\*/

The continuation value is done by Black-Scholes formula.

/\*Delta\*/

The delta here is the right hedging delta in the binomial model (cf [The Generalized CRR model](#)). There may be a more clever way to approximate the continuous-time Black&Scholes delta.

/\*First time step\*/

/\*Price\*/

/\*Desallocation\*/

## References

- [1] J.HULL A.WHITE. The use of the control variate technique in option pricing. *J.Of Finance and Quantitative Analysis*, 23:237–251, 1988. [1](#)
- [2] M.BROADIE J.DETEMPLE. American option valuation : new bounds, approximations and a comparison of existing methods. *Review of financial studies*, 9(4), 1995. [1](#)