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## tr\_hullwhite

Input parameters:

- StepNumber  $N$

Output parameters:

- Price
- Delta

This is taken from [1]. Let  $k = \frac{T}{N}$ ,  $a = e^{(r-\delta)k}$ ,  $b^2 = a^2(e^{\sigma^2 k} - 1)$

$$tmp = a^2 + b^2 + 1, u = \frac{(tmp + \sqrt{tmp^2 - 4a^2})}{2a}, d = \frac{1}{u}$$

Let

$$p = \frac{a - d}{u - d}$$

the probability satisfying the local consistency condition.

/\*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.

/\*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