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fd_explicit_cir1d_zcbond

Input parameters:

- Time StepNumber M

Output parameters:

- Price

The stochastic differential equation representing the short rate is given by

$$dr_t = k(\theta - r_t)dt + \sigma\sqrt{r_t}dW(t)$$

The price of the zero-coupon bond is solution of the following PDE

$$u_t + \frac{1}{2}\sigma^2 r u_{rr} + [k(\theta - r)]u_r - ru = 0 u(r, T, T) = 1$$

that we solve using explicit scheme of Hull-White[1]. The pricing procedure is in two steps: in the first step(INITPROBA) we compute probabilities associated to the explicit scheme; this is done simply matching the first and the second moment of the change in r over time step Δt. The branching in the lattice is modified at boundary points $r = r_min$ and $r = r_max$ to ensure that the probabilities associated with all three branches remain positive. For this purpose Hull-White[1] propose alternative branching procedures in the explicit finite difference method.
The second step is standard dynamic programming backward pricing algorithm.

References

[1] J.Hull and A.WHITE. Valuing derivative securities using the explicit finite difference method. *Journal of Financial and Quantitative Analysis*, 25:87–100, 1990. 1