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cf_vasicek1d_zbcalleuro

Output parameters:

- Price

The stochastic differential equation representing the the shor rate is given by

$$dr_t = k(\theta - r_t)dt + \sigma\, dW(t)$$

The price of the zero-coupon bond is given by

$$P(t,T) = A(t,T)e^{-B(t,T)\,r(t)}.$$

where

$$A(t,T) = e^{(\theta - \frac{\sigma^2}{2k^2})(B(t,T)-T+t) - \frac{\sigma^2}{4k}B(t,T)^2}$$

and

$$B(t,T) = \frac{1}{k}(1 - e^{-k(T-t)})$$

The price of the European Call with maturity T on Zero-Coupon Bond with maturity $(S > T)$is given by

$$P(t,S)N(h) - KP(t,T)N(h - \sigma_p)$$

Where N is the cumulative function of the normal law and

$$\sigma_p = \sigma\sqrt{\frac{1 - e^{2k(T-t)}}{2k}}B(T,S)$$

and

$$h = \frac{1}{\sigma_p}log(\frac{P(t,S)}{P(t,T)k}) + \frac{\sigma_p}{2}$$

References