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cf_floating_calllookback

Let

- T = maturity date $(T > t)$
- x = spot price
- m = current minimum $\mathrm{m_{0,t}}$
- t = pricing date
- σ = volatility
- r = interest rate
- δ = dividend yields
- $\theta = T - t$
- $b = r - \delta$

Floating strike lookback options can be priced using Goldman-Sosin-Gatto formula [1] while fixed strike lookback options can be priced using Conze-Viswanathen formula[2].

We set, as $0 \leq u \leq v \leq T$,

$$M_{u,v} = \sup_{u \leq \tau \leq v} S_\tau \qquad \text{and} \qquad m_{u,v} = \inf_{u \leq \tau \leq v} S_\tau$$

and

- $d_1 = \dfrac{\log\left(\frac{x}{K}\right) + \left(b + \frac{\sigma^2}{2}\right)\theta}{\sigma\sqrt{\theta}} \qquad d_2 = d_1 - \sigma\sqrt{\theta}$
- $e_1 = \dfrac{\log\left(\frac{x}{M_{0,t}}\right) + \left(b + \frac{\sigma^2}{2}\right)\theta}{\sigma\sqrt{\theta}} \qquad e_2 = e_1 - \sigma\sqrt{\theta}$
- $f_1 = \dfrac{\log\left(\frac{x}{M_{0,t}}\right) + \left(b + \frac{\sigma^2}{2}\right)\theta}{\sigma\sqrt{\theta}} \qquad f_2 = f_1 - \sigma\sqrt{\theta}$

Floatin Lookback Call Option

PAYOFF $C_T = S_T - m_{t,T}$

PRICE $$C(t,x) = xe^{-\delta\theta}N(f_1) - m_{0,t}e^{-r\theta}N(f_2) + xe^{-r\theta}\frac{\sigma^2}{2b}\left[\left(\frac{x}{m_{0,t}}\right)^{-\frac{2b}{\sigma^2}} N\left(-f_1 + \frac{2b}{\sigma}\sqrt{\theta}\right) - e^{b\theta}N(-f_1)\right]$$

DELTA $$\frac{\partial C(t,x)}{\partial x} = e^{-\delta\theta}N(f_1)\left(1 + \frac{\sigma^2}{2b}\right) + e^{-\delta\theta}\frac{n(a_1)}{\sigma\sqrt{\theta}} - e^{-r\theta}\frac{\sigma^2}{2b} + e^{-r\theta}\left(\frac{x}{m_{0,t}}\right)^{-\frac{2b}{\sigma^2}} N\left(-f_1 + \frac{2b}{\sigma}\sqrt{t}\right)\left(\frac{\sigma^2}{2b} - 1\right)$$

References

[1] B.M.GOLDMAN H.B.SOSIN M.A.GATTO. Path dependent options: buy at low, sell at high. *J. of Finance*, 34:111–127, 1979. 1

[2] A.CONZE R.VISWANATHAN. Path dependent options: the case of lookback options. *J. of Finance*, 46:1893–1907, 1992. 1