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cf_floating_putlookback

Let

- T = maturity date ($T > t$)
- x = spot price
- M = current maximum $M_{0,t}$
- 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 $0 \leq u \leq v \leq T$,

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

and

$$\begin{aligned}
 \bullet \quad d_1 &= \frac{\log\left(\frac{x}{K}\right) + \left(b + \frac{\sigma^2}{2}\right)\theta}{\sigma\sqrt{\theta}} & d_2 &= d_1 - \sigma\sqrt{\theta} \\
 \bullet \quad e_1 &= \frac{\log\left(\frac{x}{M_{0,t}}\right) + \left(b + \frac{\sigma^2}{2}\right)\theta}{\sigma\sqrt{\theta}} & e_2 &= e_1 - \sigma\sqrt{\theta} \\
 \bullet \quad f_1 &= \frac{\log\left(\frac{x}{M_{0,t}}\right) + \left(b + \frac{\sigma^2}{2}\right)\theta}{\sigma\sqrt{\theta}} & f_2 &= f_1 - \sigma\sqrt{\theta}
 \end{aligned}$$

Floating Lookback Put Option

PAYOFF $P_T = M_{t,T} - S_T$

PRICE $P(t, x) = M_{0,t} e^{-r\theta} N(-e_2) - x e^{-\delta\theta} N(-e_1)$

$$+ x e^{-r\theta} \frac{\sigma^2}{2b} \left[- \left(\frac{x}{M_{0,t}} \right)^{-\frac{2b}{\sigma^2}} N \left(e_1 - \frac{2b}{\sigma} \sqrt{\theta} \right) + e^{b\theta} N(b_1) \right]$$

DELTA $\frac{\partial P(t,x)}{\partial x} = e^{-\delta\theta} N(e_1) \left(1 + \frac{\sigma^2}{2b} \right) + e^{-r\theta} \left(\frac{x}{M_{0,t}} \right)^{-\frac{2b}{\sigma^2}} N \left(e_1 - \frac{2b}{\sigma} \sqrt{t} \right) \left(1 - \frac{\sigma^2}{2b} \right) - e^{-r\theta} \left(\frac{x}{M_{0,t}} \right)^{\frac{n(b_1)}{\sigma\sqrt{\theta}}} - 1 + e^{-\delta\theta} \frac{n(b_1)}{\sigma\sqrt{\theta}} - 1)$

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