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cf_floating_putlookback

Let

- T = maturity date $(T > t)$
- x = spot price
- M = current maximum $\mathrm{M}_{0,\mathrm{t}}$
- 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

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

Floating Lookback Put Option

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

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

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

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

$$-e^{-r\theta}(\frac{x}{M_{0,t}})\frac{n(b_1)}{\sigma\sqrt{\theta}} - 1) + e^{-\delta\theta}\frac{n(b_1)}{\sigma\sqrt{\theta}} - 1)$$

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