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## ap\_fixedasian\_turnbullwakeman

Output parameters:

- Price
- Delta

**Description:** Fixed Asian options are priced with Turnbull-Wakeman method that gives the Edgeworth expansion around a lognormal distribution using the first four moments of the logarithm of the arithmetic average[2]

/\*Scaling of parameters \*/

/\*Computation of the first four moments \*/

/\*Computation of cumulants of the arithmetic average\*/

/\*Computation of lognormal density and its derivatives\*/

/\* Fit the parameters meanlog,v of lognormal distribution \*/

/\*Levy Formula\*/

Fixed Asian options are priced with Levy method[1]. /\*Edgeworth Adjust-

ment : Computation of theoretical moments of the lognormal density\*/

/\*Edgeworth Adjustment : Computation of theoretical cumulants of the

lognormal density\*/

/\* Call Price \*/

Taking the Call price formula from [2]

. /\* Put Price from Parity\*/

Simple calculus give the call-put parity relationship

$$P_{T,t}(K) = C_{T,t}(K) + K * \exp(-r * (T - t)) - S(t) * \exp(-r * (T - t)) * (\exp(-(r - \text{divid}) * (T - t)) - 1) * \frac{1}{(T-t)*(r-\text{divid})}$$

/\*Delta for call option\*/

Here we derive the formula from [1] with respect to the variable  $S(t)$

/\*Delta for put option\*/

We use again the call-put parity relation

$$\Delta_P = \Delta_C - \exp(-r * (T - t)) * (\exp(-(r - \text{divid}) * (T - t)) - 1) * \frac{1}{(T-t)*(r-\text{divid})}$$

/\*Price\*/  
/\*Delta \*/

## References

- [1] E.LEVY. Pricing european average rate currency options. *J.Of International Money and Finance*, 11:474–491, 1992. 1, 2
- [2] S.TURNBULL WAKEMAN L. A quick algorithm for pricing european average options. *J.Of Financial and Quantitative Analysis*, 26:377–389, 1991. 1