Resetting Strike Option

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1 Inputs to Function

Description	Symbol	min	max	Reasonable range
Underlying	S	0^+	$+\eta\infty$	
Strike	X	0^+	$+\eta\infty$	
Continuous risk-free interest rate up to t_1	r_1	0^+	$+\infty$	
Continuous secondary rate up to t_1	q_1	0^+	$+\infty$	
Volatility up to t_1	σ_1	0^+	$+\infty$	
Time to decision	t_1	0^+	$< T_2$	
Continuous risk-free interest rate up to T_2	r_2	0^+	$+\infty$	
Continuous secondary rate up to T_2	q_2	0^+	$+\infty$	
Volatility up to T_2	σ_2	0^+	$+\infty$	
Time to maturity	T_2	$> t_1$	$+\infty$	
Put or Call	$indicator$	–	–	"P", "C"

Table 1: Inputs for Resetting Strike Option pricing function

2 Formula

The value of a resetting strike option is given by

$$\phi S e^{-q_2 T_2} N\left(-\phi d_1\right) N\left(\phi e_1\right) - \phi S e^{-q_1 t_1 - r_{12}(T_2 - t_1)} N\left(-\phi d_1\right) N\left(\phi e_2\right)$$
$$+ \phi S e^{-q_2 T_2} N_2\left(\phi d_1, \phi y_1; \rho\right) - \phi X e^{-r_2 T_2} N_2\left(\phi d_2, \phi y_2; \rho\right)$$

where

$$d_1 = \frac{\ln\frac{S}{X} + \left(r_1 - q_1 + \frac{\sigma_1^2}{2}\right) t_1}{\sigma_1 \sqrt{t_1}} \qquad d_2 = d_1 - \sigma_1 \sqrt{t_1}$$

$$e_1 = \frac{\left(r_{12} - q_{12} + \frac{\sigma_{12}^2}{2}\right)(T_2 - t_1)}{\sigma_{12} \sqrt{T_2 - t_1}} \qquad e_2 = e_1 - \sigma_{12}\sqrt{T_2 - t_1}$$

$$y_1 = \frac{\ln\frac{S}{X} + \left(r_2 - q_2 + \frac{\sigma_2^2}{2}\right) T_2}{\sigma_2 \sqrt{T_2}} \qquad y_2 = y_1 - \sigma_2 \sqrt{T_2}$$

$$\rho = \frac{\sigma_1 \sqrt{t_1}}{\sigma_2 \sqrt{T_2}}$$

ϕ	Option Type
-1	Put
1	Call

and r_{12}, q_{12} and σ_{12} denote the forward continuous, secondary and volatility rates between time t_1 and T_2.

3 Properties of Instrument

Resetting strike options behave in a similar manner to normal vanilla options, with maturity at time T_2 and an additional check at time t_1. At t_1, if the underlying price S_{t_1} is less (greater) than the initial strike value X, the strike is reset to be S_{t_1}.