Simple Chooser Option

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1 Inputs to Function

Description	*Symbol*	*min*	*max*	*Reasonable range*
Underlying	S	0^+	$+\infty$	
Strike price	X	0^+	$+\infty$	
Volatility until t_1	σ_1	0^+	$+\infty$	
Time to decision date	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 until T_2	σ_2	0^+	$+\infty$	
Time to maturity	T_2	$> t_1$	$+\infty$	

Table 1: Inputs for Simple Chooser Option pricing function

2 Formula

The value of a *simple chooser* option is

$$Se^{-q_2 T_2}\left[N\left(d\right)-N\left(-y\right)\right]-Xe^{-r_2 T_2}\left[N\left(d-\sigma_2\sqrt{T_2}\right)-N\left(-y+\sigma_1\sqrt{t_1}\right)\right],$$

where

$$d=\frac{\ln\frac{S}{X}+\left(r_2-q_2+\frac{\sigma_2^2}{2}\right)T_2}{\sigma_2\sqrt{T_2}} \qquad y=\frac{\ln\frac{S}{X}+\left(r_2-q_2\right)T_2+\frac{\sigma_1^2}{2}t_1}{\sigma_1\sqrt{t_1}}.$$

3 Properties of Instrument

Rubinstein (1991) introduced chooser options which allow the holder to choose whether the option 'becomes' a standard call or put after a given time t_1. A simple chooser option has constant strike X and time to maturity T_2 for both call and put options.[1]

The payoff of a simple chooser option at time t_1, $(t_1 < T_2)$ is thus

$$\max\left\{\mathrm{C}\left(S_{t_1},X,T_2-t_1\right),\mathrm{P}\left(S_{t_1},X,T_2-t_1\right)\right\}$$

where C() and P() are the values of a Generalised Black-Scholes call and put option respectively, with uncertain underlying S_{t_1} (the value of the underlying at time t_1), strike X and time to maturity (T_2-t_1).

[1] Haug (2007), p.128, 4.12.1 *Simple Chooser Options*

Bibliography

Espen Gaarder Haug. *The Complete Guide To Option Pricing Formulas*. McGraw Hill, New York, 2nd edition, 2007.

Mark Rubinstein. Options for the undecided. *Risk*, 4(4):43, April 1991.