

Single Pin At Expiry Barrier Option

Vector Risk Pty Ltd

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1 Inputs to Function

<i>Description</i>	<i>Symbol</i>	<i>min</i>	<i>max</i>	<i>Reasonable range</i>
Underlying	S	0^+	$+\infty$	
Strike	X	0^+	$+\infty$	
Barrier	H	0^+	$+\infty$	
Continuous risk-free interest rate	r	0^+	$+\infty$	
Continuous secondary rate	q	0^+	$+\infty$	
Volatility	σ	0^+	$+\infty$	
Time to maturity	T	0^+	$+\infty$	
Put or Call		–	–	“P” or “C”
Up or Down	<i>indicator</i>	–	–	“U” or “D”
In or Out		–	–	“I” or “O”

Table 1: Inputs for Single Pin At Expiry Barrier Option pricing function

2 Formula

The value of a *call* type single pin at expiry barrier option is given by Table 2 whereas the value of a *put* type single pin at expiry barrier option is given by Table 3. We use S_T to denote the underlying price at maturity time T .

I / O	U / D	Barrier	Limits	Payoff	Value
I	U	$X < H$	$S_T < X < H$	–	$\text{BSG}(S, H, r, q, \sigma, T, \text{indicator})$
			$X < S_T < H$	–	$+\text{BinaryCash}(S, H, H - X, r, q, \sigma, T, \text{indicator})$
			$X < H < S_T$	$S_T - X$	
		$H < X$	$S_T < H < X$	–	
			$H < S_T < X$	0	$\text{BSG}(S, X, r, q, \sigma, T, \text{indicator})$
			$H < X < S_T$	$S_T - X$	
	D	$X < H$	$S_T < X < H$	0	$\text{BSG}(S, X, r, q, \sigma, T, \text{indicator})$
			$X < S_T < H$	$S_T - X$	$-\text{BSG}(S, H, r, q, \sigma, T, \text{indicator})$
			$X < H < S_T$	–	$-\text{BinaryCash}(S, H, H - X, r, q, \sigma, T, \text{indicator})$
		$H < X$	$S_T < H < X$	0	
			$H < S_T < X$	–	0
			$H < X < S_T$	–	
O	U	$X < H$	$S_T < X < H$	0	$\text{BSG}(S, X, r, q, \sigma, T, \text{indicator})$
			$X < S_T < H$	$S_T - X$	$-\text{BSG}(S, H, r, q, \sigma, T, \text{indicator})$
			$X < H < S_T$	–	$-\text{BinaryCash}(S, H, H - X, r, q, \sigma, T, \text{indicator})$
		$H < X$	$S_T < H < X$	0	
			$H < S_T < X$	–	0
			$H < X < S_T$	–	
	D	$X < H$	$S_T < X < H$	–	$\text{BSG}(S, H, r, q, \sigma, T, \text{indicator})$
			$X < S_T < H$	–	$-\text{BinaryCash}(S, H, H - X, r, q, \sigma, T, \text{indicator})$
			$X < H < S_T$	$S_T - X$	
		$H < X$	$S_T < H < X$	–	
			$H < S_T < X$	0	$\text{BSG}(S, X, r, q, \sigma, T, \text{indicator})$
			$H < X < S_T$	$S_T - X$	

Table 2: Payoff and value for call type single pin at expiry barrier options.

I / O	U / D	Barrier	Limits	Payoff	Value
I	U	$X < H$	$S_T < X < H$	–	0
			$X < S_T < H$	–	
			$X < H < S_T$	0	
	$H < X$	$H < X$	$S_T < H < X$	–	$\text{BSG}(S, X, r, q, \sigma, T, \text{indicator})$
			$H < S_T < X$	$X - S_T$	$-\text{BSG}(S, H, r, q, \sigma, T, \text{indicator})$
			$H < X < S_T$	0	$-\text{BinaryCash}(S, H, H - X, r, q, \sigma, T, \text{indicator})$
	D	$X < H$	$S_T < X < H$	$X - S_T$	$\text{BSG}(S, H, r, q, \sigma, T, \text{indicator})$
			$X < S_T < H$	0	
			$X < H < S_T$	–	
	$H < X$	$H < X$	$S_T < H < X$	$X - S_T$	$\text{BSG}(S, H, r, q, \sigma, T, \text{indicator})$
			$H < S_T < X$	–	$+\text{BinaryCash}(S, H, H - X, r, q, \sigma, T, \text{indicator})$
			$H < X < S_T$	–	
O	U	$X < H$	$S_T < X < H$	$X - S_T$	$\text{BSG}(S, H, r, q, \sigma, T, \text{indicator})$
			$X < S_T < H$	0	
			$X < H < S_T$	–	
	$H < X$	$H < X$	$S_T < H < X$	$X - S_T$	$\text{BSG}(S, H, r, q, \sigma, T, \text{indicator})$
			$H < S_T < X$	–	$+\text{BinaryCash}(S, H, H - X, r, q, \sigma, T, \text{indicator})$
			$H < X < S_T$	–	
	D	$X < H$	$S_T < X < H$	–	0
			$X < S_T < H$	–	
			$X < H < S_T$	0	
	$H < X$	$H < X$	$S_T < H < X$	–	$\text{BSG}(S, X, r, q, \sigma, T, \text{indicator})$
			$H < S_T < X$	$X - S_T$	$-\text{BSG}(S, H, r, q, \sigma, T, \text{indicator})$
			$H < X < S_T$	0	$-\text{BinaryCash}(S, H, H - X, r, q, \sigma, T, \text{indicator})$

Table 3: Payoff and value for put type single pin at expiry barrier options.

3 Properties of Instrument

An single pin at expiry barrier option is a plain vanilla single barrier option with a barrier applicable *only* at expiry.