

Options Valuation

http://spreadsheetml.com/finance/optionsvaluation_putcallparity_binomialoptionpricing_blacksholesmodel.shtml

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ConnectCode's Financial Modelling Templates

Have you thought about how many times you use or reuse your financial models? Everyday, day after day, model after model and project after project. We definitely have. That is why we build all our financial templates to be reusable, customizable and easy to understand. We also test our templates with different scenarios vigorously, so that you know you can be assured of their accuracy and quality and that you can save significant amount of time by reusing them. We have also provided comprehensive documentation on the templates so that you do not need to guess or figure out how we implemented the models.

All our template models are only in black and white color. We believe this is how a professional financial template should look like and also that this is the easiest way for you to understand and use the templates. All the input fields are marked with the '' symbol for you to identify them easily.*

Whether you are a financial analyst, investment banker or accounting personnel. Or whether you are a student aspiring to join the finance world or an entrepreneur needing to understand finance, we hope that you will find this package useful as we have spent our best effort and a lot of time in developing them.

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1. Options Valuation

1.1 Options

An option is a contract that gives a person or institution the right to buy or sell an asset at a specified price. A call option is a contract to buy an asset at a fixed price while a put option is a contract to sell an asset at a fixed price. The specified price is known as the option's strike price or exercise price. Options come with an expiration date where it can no longer be exercised. This date is also known as the maturity date. There are two important types of options, the American type and the European type. The American type option can be exercised any time up to the expiration date whereas the European type of option can only be exercised on the expiration date. One important usage of option is to adjust the risk exposure an investor has to the underlying assets.

1.2 Option Valuation spreadsheet

This spreadsheet uses the Put Call Parity relation, Binomial Option Pricing and Black Scholes model to value options.

1.2.1 Put Call Parity

The Put Call Parity assumes that options are not exercised before expiration day which is a necessity in European options. It defines a relationship between the price of a call option and a put option with the same strike price and expiry date, the stock price and the risk free rate.

	A	B	C	D	E	F
1	Put-Call Parity (PCP)					
2						
3						
4	Inputs					
5	Number of Periods to Expiration				5.00	
6	Strike or Exercise price				\$80.00	
7	Stock Price				\$60.00	
8	Call Price				\$5.00	
9	Put Price				\$0.00	
10	Interest rate per Period				0.40%	
11	<i>Leave the unknown variable as 0 above for calculation below. Only 1 unknown</i>					
12	<i>variable at one time is supported.</i>					
13						
14	Outputs					
15	<i>Stock Price + Put Price = Present value of Strike price + Call Price</i>					
16	Stock Price				\$60.00	
17	Put Price				\$23.42	
18	Present value of Strike price				78.41902222	
19	Call Price				\$5.00	

The spreadsheet supports the calculation of the Stock Price, Put Price, Present value of Strike Price or Call Price depending on the input values provided. Simply leave the unknown variable as 0 and

it will automatically be calculated by the program. Do note that only one unknown variable is supported at one time.

1.2.2 Binomial Option Pricing

For many years, financial analysts have difficulty in developing a rigorous method for valuing options. This is until Fisher Black and Myron Scholes published the article "The Pricing of Options and Corporate Liabilities" in 1973 to describe a model for valuing options. This model is famously known as the Black Scholes model. The Black Scholes model can be easily understood through a Binomial Option Pricing model. The model has a name "Binomial" because of its assumptions of having two possible states. Basically, the Binomial Option Pricing and Black Scholes models use the simple idea of setting up a replicating portfolio which replicates the payoff of the call or put option. The value of the portfolio is then observed to be the value or cost of the options.

1.2.2.1 Binomial Option Pricing – Call Option

This worksheet sets up a replicating portfolio by borrowing money at the risk free rate and purchasing an amount of the actual stock to replicate the payoff of the Call Option. It then calculates the value (price) of the Call Option through observing the value of the portfolio.

	A	B	C	D	E	F	G
1	Binomial Option Pricing (Call Option)						
2							
3							
4	Inputs						
5	Strike or Exercise price*						\$180.00
6	Current Stock Price*						\$200.00
7	Risk free interest rate*						4.00%
8	Percentage Rise of Stock*						30.00%
9	Percentage Fall of Stock*						-30.00%
10							
11	Outputs						
12	Stock Price at Maturity (Rise)						\$260.00
13	Stock Price at Maturity (Fall)						\$140.00
14	Call Option Price at Maturity (Rise)						\$80.00
15	Call Option Price at Maturity (Fall)						\$0.00
16	Portfolio Replication						
17	No. of Shares of Stock Purchased (Hedge Ratio)						0.67
18	Amount of money borrowed						-\$89.74
19	Call Option Price now						\$43.59

1.2.2.2 Binomial Option Pricing – Put Option

This worksheet sets up a replicating portfolio by lending money at the risk free rate and selling an amount of the actual stock to replicate the payoff of the Put Option. It then calculates the value (price) of the Put Option through observing the value of the portfolio.

	A	B	C	D	E	F	G
1	Binomial Option Pricing (Put Option)						
2							
3							
4	Inputs						
5	Strike or Exercise price*						\$180.00
6	Current Stock Price*						\$200.00
7	Risk free interest rate*						4.00%
8	Percentage Rise of Stock*						30.00%
9	Percentage Fall of Stock*						-30.00%
10							
11	Outputs						
12	Stock Price at Maturity (Rise)						\$260.00
13	Stock Price at Maturity (Fall)						\$140.00
14	Put Option Price at Maturity (Rise)						\$0.00
15	Put Option Price at Maturity (Fall)						\$40.00
16	Portfolio Replication						
17	No. of Shares of Stock Sold (Hedge Ratio)						-0.33
18	Amount of money lent						\$83.33
19	Call Option Price now						\$16.67

1.2.3 Black Scholes Model

The Black Scholes Model is similar to that of the Binomial Option Pricing. The Binomial Option Pricing assumes two possible values of the stock price at the end of the period (maturity). If we initially used 1 year as the end of period and subsequently shorten the period to half a year, the number of possible values at the end of year increases. By further shortening the period, we get an increasing number of possible values at the end of the year. We will reach a stage where we have a continuous range of possible prices at the end of the year. The Black Scholes Model provides a formula for calculating the value of the option (or portfolio) in the situation above and thus allows us to easily value options.

	A	B	C	D	E	F
1	Option Pricing - Black Scholes					
2						
3						
4	Inputs					
5	Number of Periods to Expiration				0.25	
6	Strike or Exercise price				\$60.00	
7	Current Stock Price				\$58.00	
8	Risk free interest rate (Continuously Compounded)				0.80%	
9	Standard Deviation per Period				50.00%	
10						
11	Outputs					
12	d1				-0.0026	
13	d2				-0.2526	
14	N(d1)				0.4990	
15	N(d2)				0.4003	
16	Call Price				\$4.97	
17	Put Price				\$6.85	