

Module 2: How to Value an Option



Module overview

- Understanding option quotes
- Valuing options
- Using pricing models to trade options

Options: a quick summary

- An option contract provides the buyer with the right to buy or sell a stock or ETF at a predetermined price for a specific period of time
 - Option buyers have the right to buy or sell a stock but are under no obligation to do so
 - Option buyers always have a predetermined amount of risk in dollar terms
- Calls provide buyers with the right to buy stock
- Puts are the right to sell stock

Options quote:

AAPL160520C001150000

AAPL May 2016 115.000 call (AAPL160520C00115000) - OPR

2.14 ↓ 0.13 (5.73%) 12:02PM EDT

Prev Close:	2.27	Day's Range:	2.03 - 2.33
Open:	2.25	Contract Range:	N/A - N/A
Bid:	2.12	Volume:	2,470
Ask:	2.14	Open Interest:	65,948
Strike:	115.00		
Expire Date:	20-May-16		

Symbol: AAPL160520C001150000

Underlying symbol: AAPL

Expiration date: 160520 (May 20, 2016 in YYMMDD format)

C = Call, this would be P for a put

001150000 is the strike price of \$115 the format is \$XXXXXX.XXX which provides for strike prices as high as \$99,999.999 with three decimal place

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Quotes

- Include the price of the last trade (\$2.14) and the change from the previous close
- Bid prices are what you can sell at (\$2.12)
- Ask prices are what you can buy at (\$2.14)
- Volume shows today's trading activity
- Open interest shows total number of contracts open in that specific option

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Bid and ask prices are important

- These are the prices a market order should be executed at
- You could set a limit price using the bid and ask to ensure you get a fair price on your trade
- The spread is the difference between the bid and ask
 - You could set a limit order between the bid and ask to get a better price
- Bid \$2.12/Ask \$2.14: expect to sell at \$2.12, buy at \$2.14 or use a limit order of \$2.13

Volume and open interest

- Volume shows the trading activity for that day
- Open interest shows the trading activity over the life of the contract
- Due to high frequency trading, these are no longer as important as they were – you can trade any option in any liquid stock no matter the volume and OI are

Complex concept: Option liquidity exists because of put-call parity

$$P + S = C + PV(A)$$

with

P = price of put with strike price A

S = price of stock

C = price of call with strike price A

PV(A) = net present value of the option's strike price

Simplified version: a put and the stock = a call and cash

So what?

- This means option with low open interest (OI) would be tradable if the stock is liquid
- In this case, the model depends on:
 - Are the assumptions behind the model generally true?
 - Do market participants follow the model?
- You don't need to know why put-call parity holds to benefit from it but this section shows the why so you'll be able to trade confidently

Assumptions underlying options pricing model

1. Traders have unlimited liquidity
 - Bank for International Settlements (BIS) says worldwide derivatives have a market value of \$18.7 trillion and exposure of \$710 trillion
2. Borrowing costs and commissions are insignificant
 - Interest rates close to 0%
 - HFT firms make money trading with an average profit of \$0.002 per share (indicates low trading costs)
3. Markets are efficient
 - They are close enough to efficient to provide liquidity

Why would markets be efficient?

- Pricing models for stocks and options assume prices are efficient
- Efficiency means the prices reflect all known information and do not offer a price advantage to any individual trade
 - Efficiency is enforced by threat of arbitrage
- Arbitrage is the ability to capture a riskless profit
 - For example, buying all of individual stocks in the S&P 500 for a value that is 5% less than the price of the futures contract isn't possible
 - You would buy the stocks, sell the futures and gain 5% and market makers won't allow that

Arbitrage is a threat

- Because arbitrage is possible, financial and consumer market prices have to be efficient
 - Exists in retail stores as well, for example in Wal-Mart's price match policy
- Some small discrepancies (of a penny per share or less) can develop in financial markets
 - High frequency traders profit from this and prevent prices from moving a great deal from fair value

An example

Data from April 15, 2016:

Intel (INTC) trading @ \$31.86

April 29 \$32 call @ \$0.70

April 29 \$32 put @ \$0.87

INTC is expected to pay a dividend in early May.

Because the dividend will be paid after the option expires we can ignore it.

The problem to solve is

$$P + S = C + PV(A)$$

$$\text{or } P + S = C + (A / ((1 + R)^T))$$

where R is the interest rate a broker charges on a margin loan and T is the length of the loan in years

For this example, the variables are

$$P = \$0.84$$

$$S = \$31.86$$

$$C = \$0.73$$

$$A = \$32$$

$$R = 1.6\% \text{ or } 0.016 \text{ in the formula (margin rate from Interactive Brokers)}$$

$$T = 1/12 \text{ since the option expires in one month}$$

$$P + S = C + (A / ((1 + R)^T))$$

- $\$0.84 + \$31.86 = \$0.73 + (\$32 / ((1 + 0.016)^{1/12}))$
- $\$32.70 = \$0.73 + (\$32 / \$1.001)$
- $\$32.70 = \$0.73 + \$31.97$
- $\$32.70 = \$32.70$

In a real-world example, using closing data, put-call parity holds precisely. Intraday, expect some deviation. But the model still applies and is useful.

Based on put-call parity

- Options on liquid stocks can be traded even when open interest on a contract is low
 - Market makers and HFT firms will take the trades to benefit from the bid or offer on the seemingly illiquid option

Next question: where do the options prices come from?

- Pricing models have been developed by traders and researchers
 - Models are a way to express the real world with math and are widely used in the markets
 - For example, find a stock's estimated fair value with a model based on the P/E ratio by using the average P/E ratio for the past five years
- The most popular options pricing model is the Black-Scholes pricing model
 - Developers were awarded a Nobel Prize in Economics
- Models include a number of factors
 - Additional factors not included in the models are also at work

Factors determining options pricing

- Stock price
 - Important because the pricing models assume the stock is actually bought. Therefore, high-priced stocks have high carrying costs and will have higher premiums than low-priced stocks
 - All things being equal, a call or put option on a \$100 stock will be more expensive than a \$10 stock
- Interest rates
 - Important because models assume traders borrow money to fund their stock purchase

Factors determining options pricing

- Dividends (if any)
 - Important because the models assume the stock is bought so dividends would be received if you own the stock and add to the total return of the trade
- Time to expiration
 - Important because (1) it costs more to borrow money for a longer period of time and models assume the stock is bought and (2) there is a greater probability the option will have value when the timeframe is longer

Factors determining options pricing

- Volatility
 - Important because greater volatility means there is a greater likelihood of profitability on the trade
 - Volatility cannot be directly measured
 - It is found by inserting known values into the model and solving for the variable that represents volatility

Factors interact with each other

- Each factor changes frequently
 - Time changes daily
 - Interest rates usually change slightly each day
 - Prices change throughout the day
 - Volatility changes with each market tick
- To see the current value of an option, based on the Black-Scholes model use a calculator such as the one at the CBOE web site

<http://goo.gl/0WThht>

Why use a calculator?

- Can find updated data through the day
 - Allows you to trade at the best price
- Limits trading costs
 - Knowing the fair value helps you place limit orders that are likely to be filled
 - Spreads on options (the difference between the bid and ask) can reduce profits on a trade by 20% or more

Options pricing data

- When checking for the current price of an option, note the spread (difference between the bid and ask)
 - Bid and ask are updated in real time
 - Last or closing price is only updated when trades occur
 - Last or close could be old or stale
- The midpoint of the spread is an ideal liquidity point for placing orders

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Options Calculator


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The IVolatility.com Options Calculator is an educational tool intended to assist individuals in learning how options work. It is not intended to provide investment advice, and users of the Options Calculator should not make investment decisions based upon values generated by it.

Symbol:
☒ Stock or Index Symbol
 ☐ Option symbol

SPY: NYSEArca - SPDR S&P 500 ETF Trust
 Closing prices as of: 04/14/2016
 Today's date: 04/15/2016

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Style:

 Price:

 Strike:

 Expiration Date:

 Days to Expiration:

 Volatility %:

 Interest Rate%:

 Dividends Date (mm/dd/yy):

 Dividends Amount:

 Dividends Frequency:

	Call	Put
Symbol:	SPY 160520C	SPY 160520P
Option Value:	0.6868	7.6021
Delta: ?	0.1784	-0.8249
Gamma: ?	0.0361	0.0366
Theta: ?	-0.0274	-0.0250
Vega: ?	0.1681	0.1728
Rho: ?	0.0349	-0.1132

Implied Volatility

	Option Price	Volatility %
Call ▾		0.00

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Implied Volatility

Option Price Volatility %

Call

Trading example

- SPY \$215 call with 35 day to expiration is worth \$0.69
 - Bid = \$0.65
 - Ask = \$0.75
- A buy order at \$0.70 is likely to be filled
 - Lowers trading cost by 6.7%, or almost 14% on a round turn
 - Lower trading costs are achieved by using orders inside the spread and paying \$0.70 with a limit order instead of \$0.75 with a market order

Calculator also provides the Greeks

- The Greeks are values of the risk factors that affect an options contract
 - They are calculated from models
- There are five Greeks - delta, gamma, theta, rho and vega
 - Each defines the amount an option price should move if only one factor changes and everything else remains unchanged
- Delta is the most important one for traders to follow
 - You can trade options profitably using the strategies in this course without knowing the Greeks but delta can help you increase your profits

Delta

- Delta measures how much an option's price should change if the value of the underlying security changes by \$1.00
- The values of delta range from 0 to 1 for calls and 0 to -1 for puts
- As an example, if a trader holds an out-of-the-money call option on GOOGL with a delta of 0.25, they should to see the price of the option increase by \$0.25 if GOOGL goes up by \$1
- The call should gain about \$0.125 if GOOGL increases in value by \$0.50.
- If GOOGL falls by \$1, the value of the option should fall by \$0.25
- For puts, the delta might be -0.25 and the put option would be expected to fall by \$0.25 if GOOGL rose by \$1
- If GOOGL fell by \$1, the put option should increase by \$0.25

Delta's usefulness for traders

- Delta can be used to find the probability an option will be in-the-money at expiration
 - This is technique is explained in Module 3
- Delta can help you determine if a trade has too much risk

Gamma and theta

- Gamma is used to estimate how much delta will change when the underlying security moves by \$1.00
 - A small gamma indicates that the delta should be relatively stable and a large gamma shows that the delta is likely to change significantly even when the underlying makes a small price move. Large gamma options will be more volatile than low gamma options.
 - For example, a \$1 move in a stock with a gamma of 0.5 could move delta 0.25 to 0.125
- Theta describes the time decay of an option
 - Every day that you hold an option, if the underlying security is unchanged then the value of the right to exercise the option at a profit should decrease
 - This is called time decay since the value of an option on an unchanged security will decay to zero over time
 - Theta is an estimate of how much the value of an option will change every day based solely on the time to expiration

Vega and rho

- Vega measures how much the price of the option should change for every 1% change in the volatility of the underlying security
 - Increases in volatility generally make an option more expensive
- Rho measures the sensitivity of an option's price to moves in interest rates. Rho is the estimated change in the value of an option when interest rates change by 1%. It is usually fairly low, often under 0.05

What's next?

- Trading strategy #1: Double, triple or even quadruple the return of your portfolio