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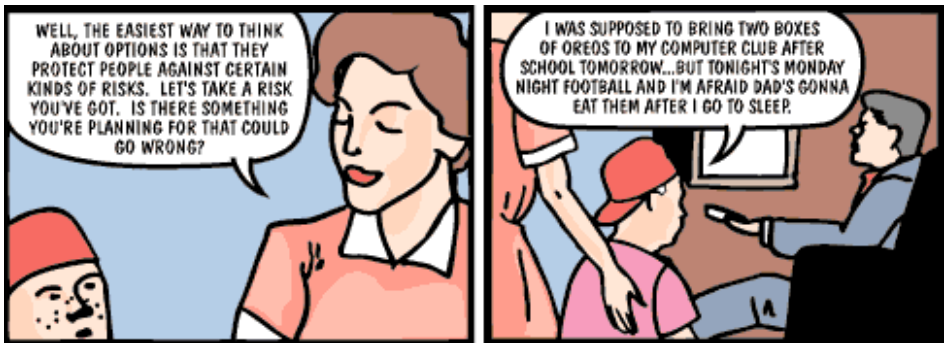
Mechanics of options markets



Security is mostly a superstition. It does not exist in nature, nor do the children of men as a whole experience it. Avoiding danger is no safer in the long run than outright exposure. Life is either a daring adventure or nothing.

—Helen Keller

Overview

- Types of options
- Option positions
- Underlying assets
- Specification of stock options
- Newspaper quotes

- Trading
- Commissions
- Margins
- The options clearing corporation
- Regulation
- Taxation
- Warrants, executive stock options, and convertibles
- Over-the-counter markets

Introduction

- Focus on exchange traded options
- Also OTC options, tailored to the requirements of a particular company

Types of options

Call vs. put

- A call is an option to buy
- A put is an option to sell

Definition

Definition 8.1. A *call* (*put*) option is the right but not the obligation to buy (sell) a certain asset by a certain date for a certain price (the strike price).

European vs. American

- Options are exercised
  - only at the end of its life – European □ American □
  - at any time – European □ American □
- Which can be priced in closed-form? European □ American □
- The one that cannot can be priced numerically □ semi-analytically (approximate expansion) □
- Exchange traded options generally European □ American □

Specification

- The four parameters for exchange traded options are
  - _____
  - _____
  - _____
  - _____

Option positions

- Long call
- Long put
- Short call
- Short put

Example

Example 8.1. Sketch the functions
- $\max(x, 0)$, $\min(x, 0)$,
- $\max(x, a)$, $\min(x, a)$,
- $\max(x - a, 0)$, $\min(x - a, 0)$,
- $\max(a - x, 0)$, $\min(a - x, 0)$,
- $-\max(a - x, 0)$, $-\min(a - x, 0)$

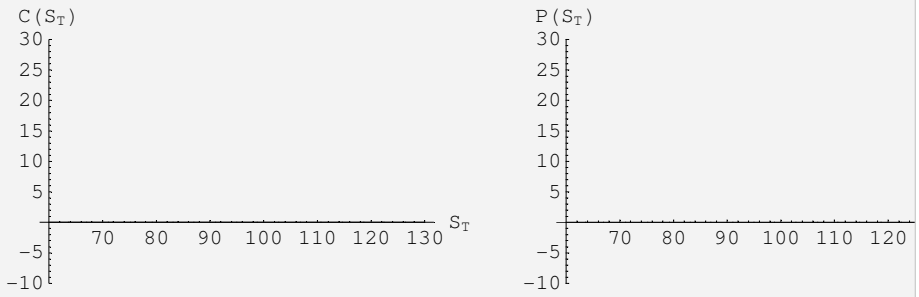
against x, where a is a positive constant.

Example

Example 8.2. Sketch the profit from buying a European call (left figure) and buying a European put (right figure) on one eBay share if the call price is \$5 for an option with a strike price of \$100; and the put price is \$7 for an option with a strike price of \$70.

Give the expression for the payoff in terms of the parameters of the option in each case.

From the definition of a call (put) option as the right, but not the obligation, to buy (sell) the underlying, motivate the payoff expression that you have given.



Payoff functions

• Long call: $\max(S_T - K, 0) - C$

• Long put: $\max(K - S_T, 0) - P$

where S_T, K, C are respectively, …

Motivation for call expression

When option expires

• in the money $S_T > K$, holder can buy stocks in the market for K, instead of prevailing market price of S_T. This benefit is worth the difference, $S_T - K$.

• out of the money $S_T < K$, the right to buy the underlying at K is worthless

$$\begin{cases} S_T - K & S_T > K \\ 0 & S_T < K \end{cases} \equiv \max(S_T - K, 0)$$

Code to plot axes

Underlying assets

Stocks

- In US, options on > 500 companies
- To buy/sell _____ shares
- Mainly _____ style

Foreign Currency

- Main exchange is Philidelphia
- Size of contract depends on currency
- Contract sizes for US investor: GBP $\frac{1}{32} \times 10^6$, JPY $\frac{1}{16} \times 100 \times 10^6$

Index

- Most popular: S&P500, S&P100, Nasdaq 100, Dow Jones Industrial
- S&P 500 is European, S&P 100 is American
- Contract is for 100 points

- All settlement in cash

Futures

- Option on a Futures contract
- Future expires just after option
- When exercised, holder receives
  - call – long future plus excess in cash of the future's price − strike price
  - put – short future plus excess strike − futures price
- Most futures now have options
- Most traded:
  - Treasury bond futures on CBOT
  - Eurodollar futures on CME

Specification of stock options

- Basically an American style option on 100 shares
- Variations in expiration, strike, dividends, holding limits are specified by the exchange

Expiration Dates

- Refer to option by month of expiration
- Deadlines
  - Last trading day – 3rd Friday in month
  - Last chance to exercise – 4:30pm on Friday
  - Broker notify exchange – 10:59pm Saturday
- January, February or March cycles:
  - Jan, Apr, Jul, Oct;
  - Feb, May, Aug, Nov
  - Mar, Jun, Sep, Dec
- Options trade for
  - current month
  - next month
  - next two cycle months
- e.g. IBM on Jan cycle
  - early Jan – Jan, Feb, April, July
  - late Jan – Feb, Mar, April, July
  - early May – May, June, July, October

J	F	M	A	M	J	J	A	S	O	N	D
J	F	M	A	M	J	J	A	S	O	N	D
J	F	M	A	M	J	J	A	S	O	N	D

- Long Term Equity Anticipation Securities (LEAPS)

- January expiration
- Up to 3 years

Strike Prices

- Exchanges set intervals for strike prices dependent on current price

Range	Spacing
$5 < S < $25	$2 .50
$25 < S < $200	$5
$200 < S	$10

- Options ± one interval are offered when trading opens,
- As stock moves up or down, options offered above / below initial limits

Terminology

- Variety of options (put/call, strikes, expiries) traded at any one time
- All options of the same type (put/call) are referred to as an *option class* – e.g. IBM calls
- An *option series* is all options of the same class, expiration and strike – e.g. IBM 50 Oct calls
- Moneyness
  - *In the money* – positive cash flow if exercised immediately
  - *At the money* – price = strike
  - *Out of the money* – negative cash flow if exercised immediately
- *Intrinsic value* – max $(S - K, 0)$ for a call or max $(K - S, 0)$ for a put
- Time value – total option price = intrinsic value + time value

Flex Options

- Traders on exchange floor agree to non-standard terms
- An attempt by exchanges to regain business from OTC market

Dividends and Stock Splits

- Options cash dividend protected?
  - Before – yes: for OTC, on ex-dividend day strike reduced by dividend
  - Now – not for Exchange traded
- Stock splits
  - Exchange traded options adjusted for
  - Not affect shareholder's wealth
- Stock dividends
  - Stock options adjusted for
  - Share price expected to go down after a stock dividend declared
- Rights issues
  - Adjustments made for

- Calculate theoretical value of rights and reduce strike accordingly

Calculation

- Suppose you own N options with a strike price of K :
- No adjustments are made to the option terms for cash dividends
- When there is an n-for-m stock split,
  - strike price is reduced to mK/n
  - no. of options is increased to nN/m
- Stock dividends handled in a manner similar to stock splits
- Consider call option to buy 100 shares for \$20/share
- How should terms be adjusted for:
  - 2-for-1 stock split?
  - 5% stock dividend?

Position Limits and Exercise Limits

- *Position limit* – max number of option contracts that a trader can hold
- Long calls and short puts counted together
- *Exercise limit* – max number of option contracts that a trader can exercise at any time
- Often equal

Newspaper quotes

- A contract costs 100 × price shown
- *Open interest* is the number of _____
- Note that a newspaper quote may imply an arbitrage possibility
- E.g. $S = 69\frac{5}{8}$, $K = 75$ $P = 5\frac{1}{4}$
  buy put, exercise immediately → profit of 1/8
- In reality arb opps probably do not exist

Trading

Market Makers

- Will quote both bid and ask prices for specified option
- Not know if trader wants to buy or sell
- Makes a profit on the bid-ask price (limited by exchange)
- Ensure that orders can be executed at some price without delay

Floor Brokers

- Execute trades for the general public
- Trade via another broker or with a market maker

Order Book Official

- Many orders are limit orders
- Can only be executed at a specified or more favourable price
- A limit order cannot usually be executed immediately by the floor broker who receives it, so they pass it on to an *order book official / board broker*
- OBO enters it into computer that ensures when limit price is reached, order is executed
- Information on outstanding orders is available to all traders
- This approach is to be compared with the Specialist System
- A specialist acts as the market maker and keeps the order book
- A specialist does not make information on their order book public

Offsetting Orders

- Trader can close a position by issuing an offsetting order

Commissions

- Vary greatly

Margins

- Not allowed to buy options on margin account; must be paid for in full. Why? L_____.
- Traders who write options must maintain a margin account as security against default if the option is exercised

Writing Naked Options

- Option position not covered by offsetting position in stock
- The initial margin in the US is the greater of these two:
  - 100% of the proceeds of the sale + 20% of share price − amount option is out of the money
  - 100% of the proceeds of the sale + 10% of share price
- For index options – 20% is replaced by 15% to reflect lower volatility of index

Example

Example 8.3. A trader writes 4 naked call options on a stock. $C = 5$, $K = 40$ and $S = 38$. What is the margin?

$(5 + (0.2 \times 38 - 2)) \times 4 \times 100 = 4240$
$(5 + (0.1 \times 38)) \times 4 \times 100 = 3520$
The margin will be $4,240

Covered Calls

- Call is written when shares that may need to be delivered are owned
- Worse case – have to sell shares
- No margin is required but trader's position reduced by amount OTM

The options clearing corporation

- Performs a similar role as a Clearinghouse
- Guarantees option writers will fulfil their contractual obligations
- All option trades must be cleared through a member
- Members must have a certain amount of capital and contribute to an insurance fund

Taxation

- Tax implications of options are complex
- Generally profits from options trading are a capital gain
- Gains / losses recognised when option expires or sold

Wash Sale Rule

- Prevent sale of loss making assets to generate a tax loss
- Restrictions on non-traders selling a stock and buying a call within 30 days
- Constructive sales – prevent delaying a capital gain to avoid tax

Warrants, executive stock options, and convertibles

- Warrants and executive share options are special – company will issue new stock to cover
- → dilution of value of equity

Warrants

- Often come about as result of bond issue
- Added to bond at issue to make more attractive
- Can be stripped from bond and traded separately

Executive Share Options

- Cannot be traded
- Can last 10-15 years

Convertible bond

- Issued by company
- Can be converted into equity under predefined terms

Over-the-counter markets

- Now bigger than exchange market
- Can post collateral to reduce credit risk
- Exotic options possible

Summary

- Two types of options: _____ and _____
- These give the right to _____ and _____ the underlying for a _____ _____ at a _____ _____
- Four possible positions
- Writing an option is taking a _____ position
- Underlyings for options include _____, _____, _____, _____
- For contract, exchange specifies _____, _____, _____, _____
- US, one stock option ≡ right to buy/sell _____ shares
- Strike prices at $\$2\frac{1}{2}$, \$5 or \$10 intervals
- Adjustments:
  - No: _____
  - Yes: _____, _____, & _____
- The aim is _____
- Market makers
  - quote bid and ask at which prepared to buy and sell, resp.
  - improve _____ of the market and reduce _____
  - profit from _____