

Option trading

Goals:

- Classical option trading strategies
- SIGTech platform

Relevant literature:

- Hull Chap. 12

Principal-protected note

- Continuous compounding annual rate 6%
- Price of a 3 years zero-coupon bond with a principal of \$1,000:
 $1,000e^{-0.06 \times 3} = \835.27
- A stock portfolio is worth \$1,000 and provides a dividend yield of 1.5% per annum
- A 3-year at-the-money European call option on this stock portfolio is priced less than \$164.73

The bank can offer

- A 3-year zero-coupon bond with a principal of \$1,000
- A 3-year at-the-money European call option on the stock portfolio

If the value of the portfolio increases: the investor gets whatever \$1,000 would have grown to. (zero-coupon bond pays off \$1,000 and equals to the strike)

If the value of the portfolio goes down, the investor receives the original \$1,000 principal invested.

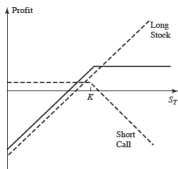
The worst that can happen is that the investor loses the chance to earn interest.

Trading an option and the underlying asset

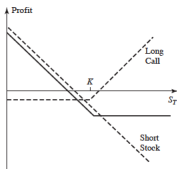
dashed line shows the relationship between profit for individual securities

solid line shows the profit for the whole portfolio

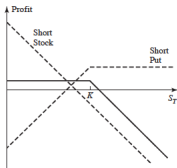
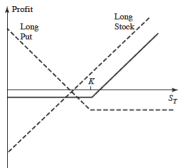
- covered call: top left, long position in a stock, a short position in a European call
- reverse of a covered call: top right
- protective put: bottom left, a long position of a European put, a long position in a stock
- reverse of a protective put: bottom right.



(a)



(b)



The previous four plots look like short put, long put, long call, short call

This is because put-call parity

$$p + S_0 = c + ke^{-rT}.$$

Long position in a European put and a stock is the same as a long position in a call plus some cash (Ke^{-rT})

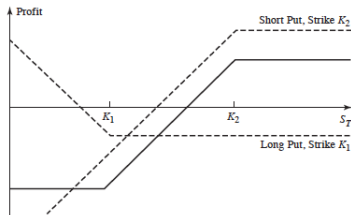
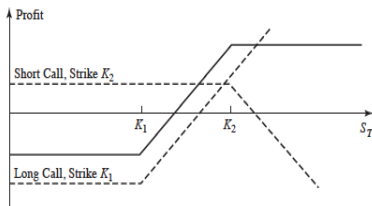
Bull spreads

A **spread** trading strategy involves taking position in two or more options

Bull spread: buy a European call with a certain strike and sell a European call on the same stock with a higher strike. Both options have the same expiration date

Call price always decreases as the strike price increases, the value of option sold is always less than the value of the option bought. A bull spread requires an initial investment

A bull spread strategy limits the investor's upside as well as downside. In return for giving up the upside potential, the investor gets the price of the option with strike price K_2

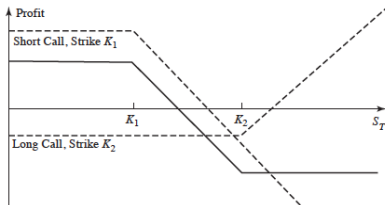
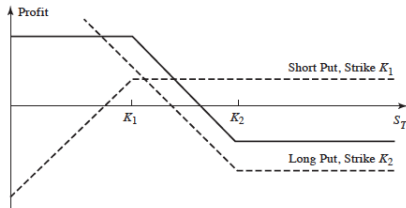


Bear spreads

A **bear spread** can be created by buying a European put with one strike price and selling a European put with another strike price.

A bear spread involves an initial cash outflow because the price of the put sold is less than the price of the put purchased

Bear spreads limit both the upside profit potential and the downside risk



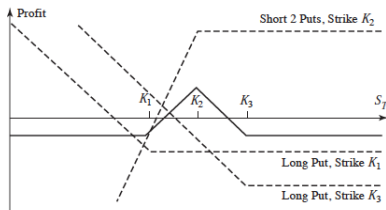
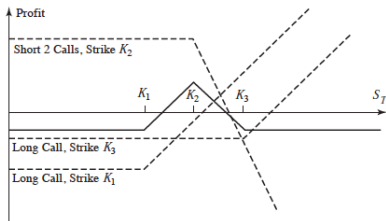
Butterfly Spreads

A **butterfly spread** involves

- buy a European call option with a low strike K_1
- buy a European call option with a high strike K_3
- sell two European call options with a strike $K_2 = \frac{1}{2}(K_1 + K_3)$

A butterfly spread leads to profit if the stock price stay close to K_2 , but give rise to a small loss if there is a significant stock price move in either direction.

A strategy if an investor feels that large stock price moves are unlikely



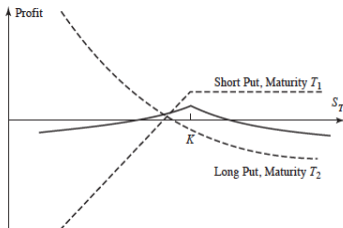
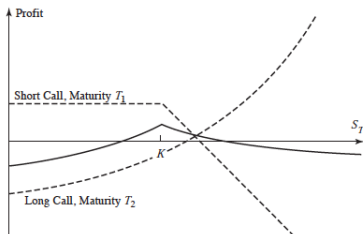
Calendar spreads

Calendar spreads consist of options with the same strike price and different expiration dates

A calendar spread can be created by

- Sell a European call option with a certain strike
- Buy a longer maturity European call option with the same strike

Investor makes a profit if the stock price at expiration for the short-maturity option is close to the strike price of the short-maturity option. However, a loss is incurred when the stock price is significantly above or significantly below this strike price

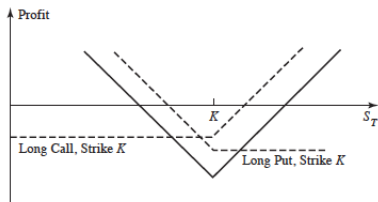


Straddle

A **straddle** involves buying a European call and put with the same strike price and expiration date

A straddle is appropriate when an investor is expecting a large move in a stock price but does not know in which direction the move will be

The following figure is a **bottom straddle** or **straddle purchase**. A **top straddle** or **straddle write** is the reverse position

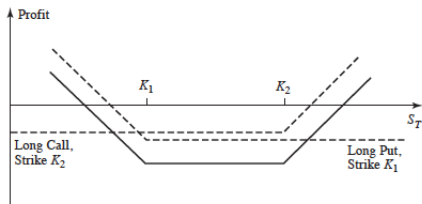


Strangle

A **strangle** consists of a buying a European put and a European call with the same expiration date and different strike prices.

A strangle is similar to a straddle.

The profit pattern depends on how close together the strike prices are. The further they are apart, the less the downside risk (the stock price ends up between two strikes, but out-of-the-money options are cheaper) and the farther the stock price has to move for a profit to be realized

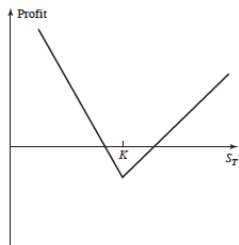


Strips and straps

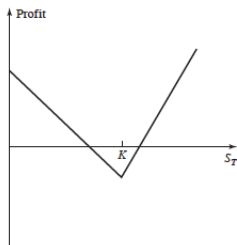
A **strip** consists of a long position in one European call and two European puts with the same strike and expiration date

A **strap** consists of a long position in two European calls and one European put with the same strike and expiration date

Strip: the investor is betting that there will be a big stock price move and considers a decrease in the stock price to be more likely than an increase



Strip (one call + two puts)



Strap (two calls + one put)