Mechanics of Options Markets

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Review of Option Types

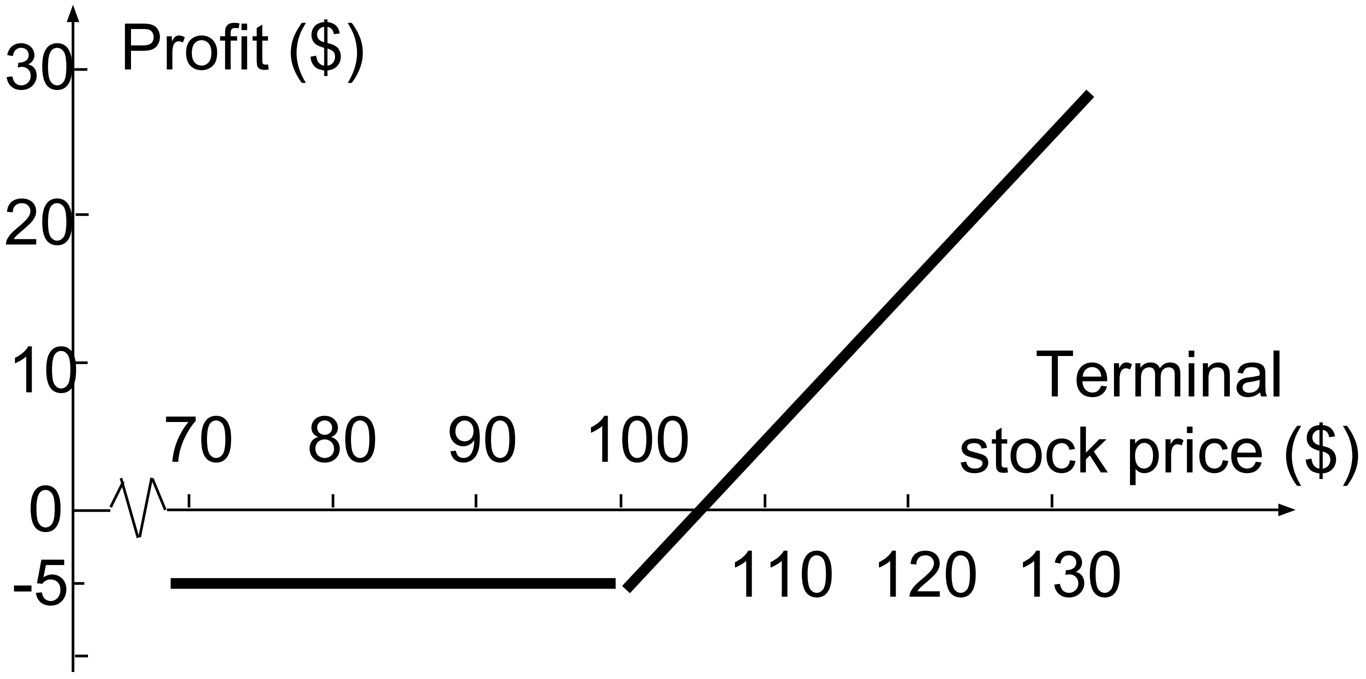
- A call is an option to buy
- A put is an option to sell
- A European option can be exercised only at the end of its life
- An American option can be exercised at any time
- And others: Bermuda, Asian, Rusian, etc

Option Positions

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

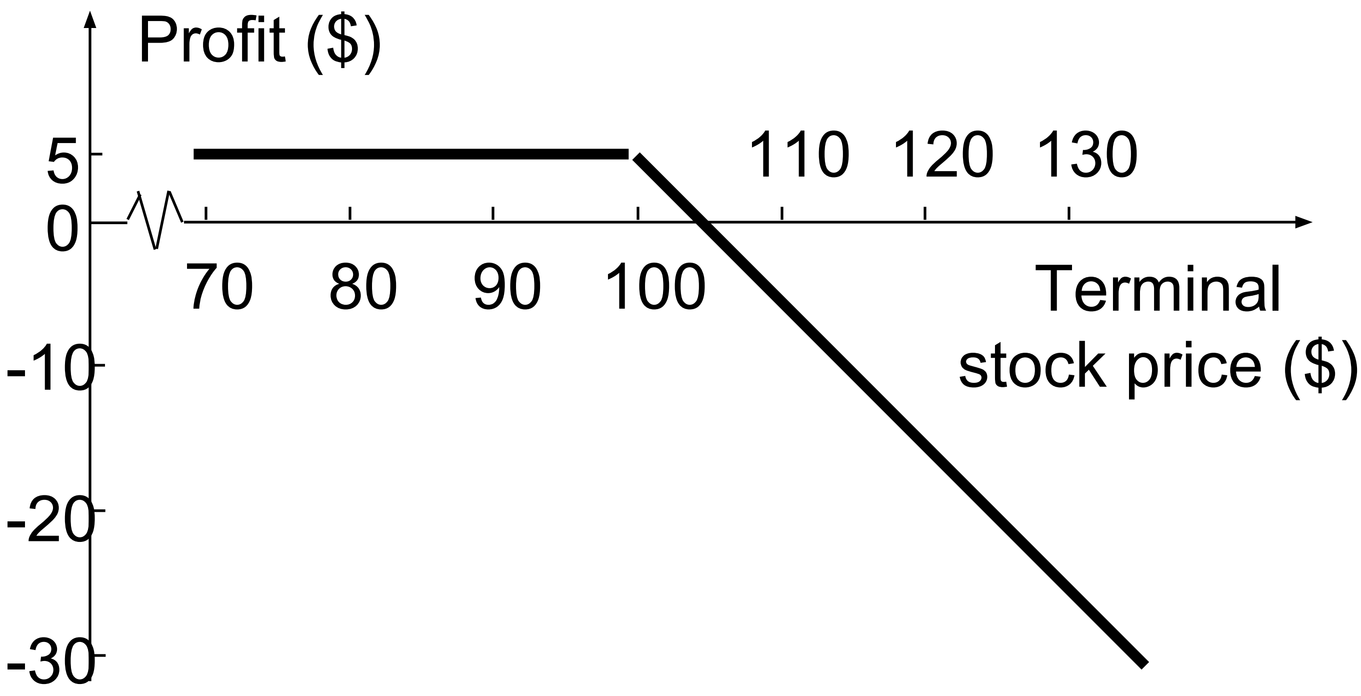
Example: Long Call

Profit from buying one European call option: option price = \$5, strike price = \$100, option life = 2 months



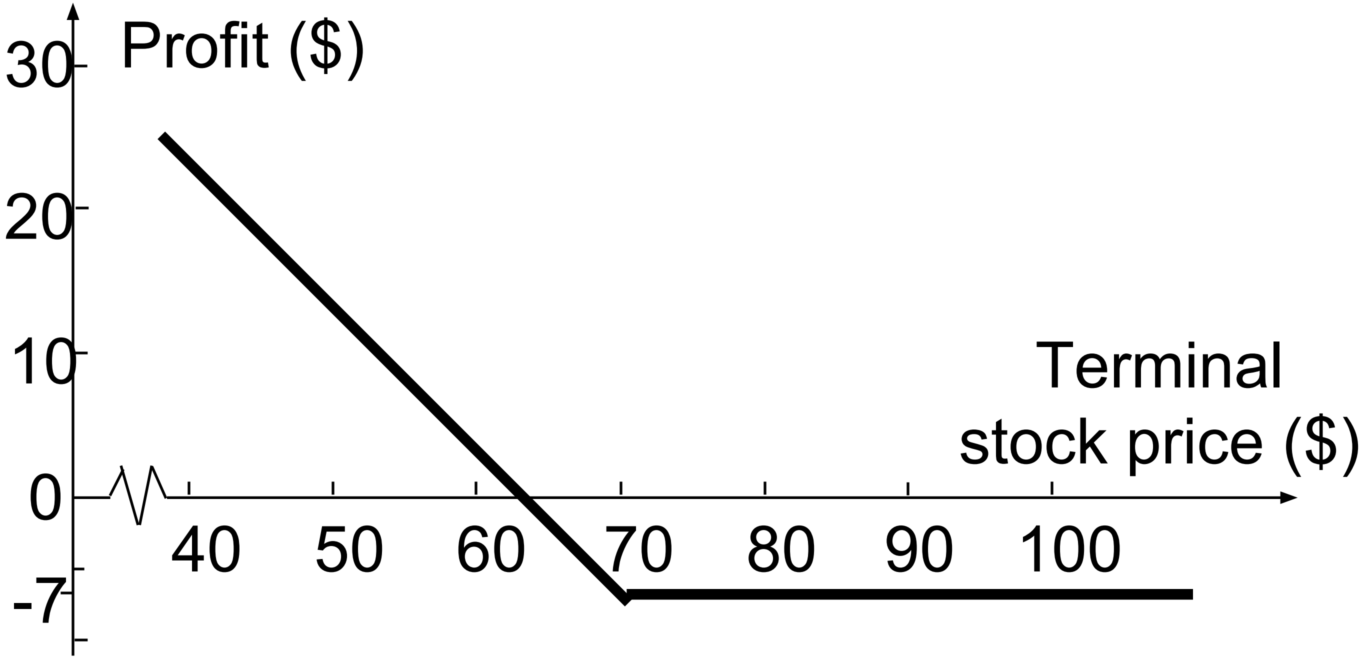
Example: Short Call

Profit from writing one European call option: option price = $5, strike price = $100



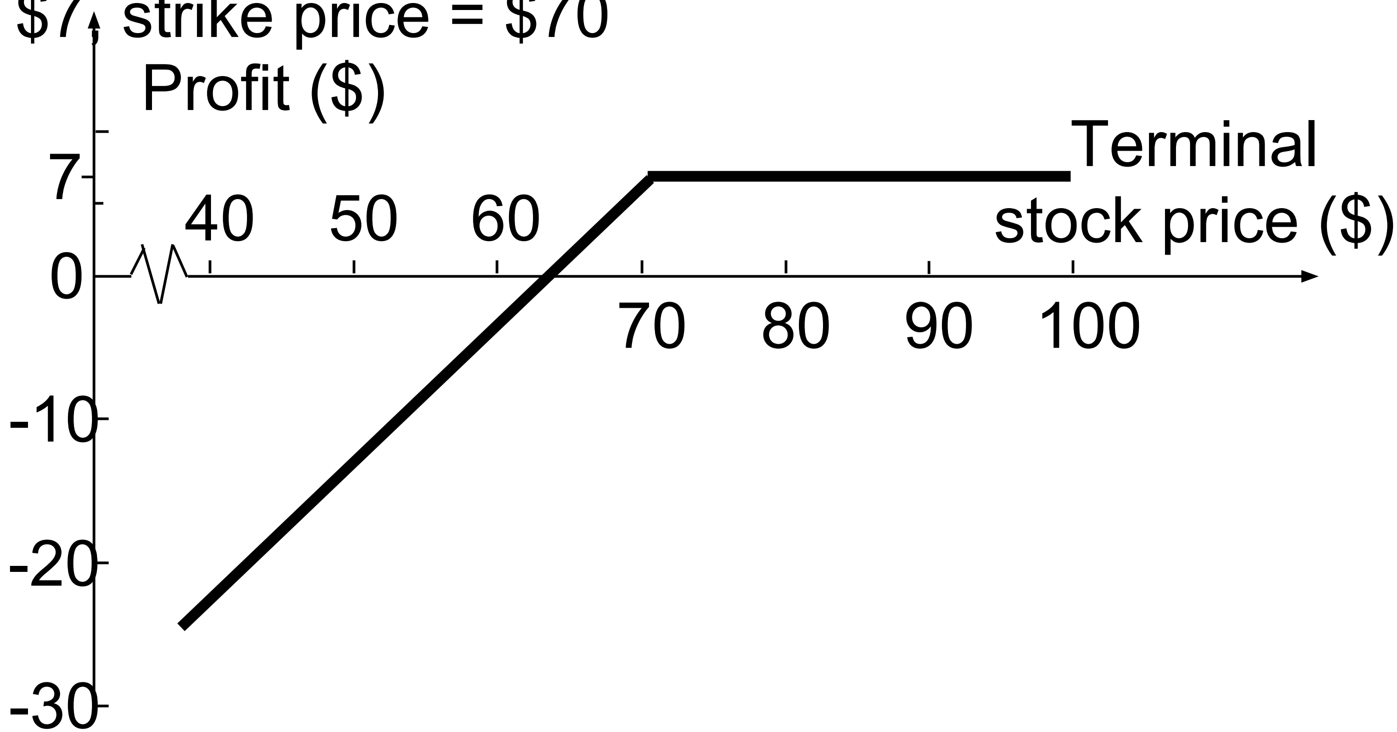
Example: Long Put

Profit from buying a European put option: option price = $7, strike price = $70



Example: Short Put

Profit from writing a European put option: option price = $7, strike price = $70



Assets Underlying Exchange-Traded Options

- Stocks: VALE5,PETR4, GE, IBM
- Foreign Currency
- Stock Indices

SP500(SPX), Ibovespa (IBV),Euro stoxx50 (FESX)

- Futures

Exchange-Traded Options

- FESX: It represents 50 supersector leaders in the 12 euro zone countries Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, Luxemburg, the Netherlands, Portugal and Spain.
- **STOXX Europe 50 options**：OSTX

Exchange-Traded Options

- SPX: The Standard & Poor's 500 Index is a capitalization-weighted index of 500 stocks from a broad range of industries. The component stocks are weighted according to the total market value of their outstanding shares.
- For a list of all 500 component stocks, please click here.

Exchange-Traded Options

- IBV: is an index of about 60-70 stocks that are traded in the São Paulo Stock Exchange.
- The index is composed by a theoretical portfolio with the stocks that accounted for 80% of the volume traded in the last 12 months
- and that were traded at least on 80% of the trading days. It's revised periodically, in order to keep its representativeness of the volume traded
- In average the components of Ibovespa represent 70% of all the stock value traded.

- IBV Option market:

Specification of Exchange-Traded Options

- Expiration date
- Strike price
- European or American
- Call or Put (option class)

Terminology

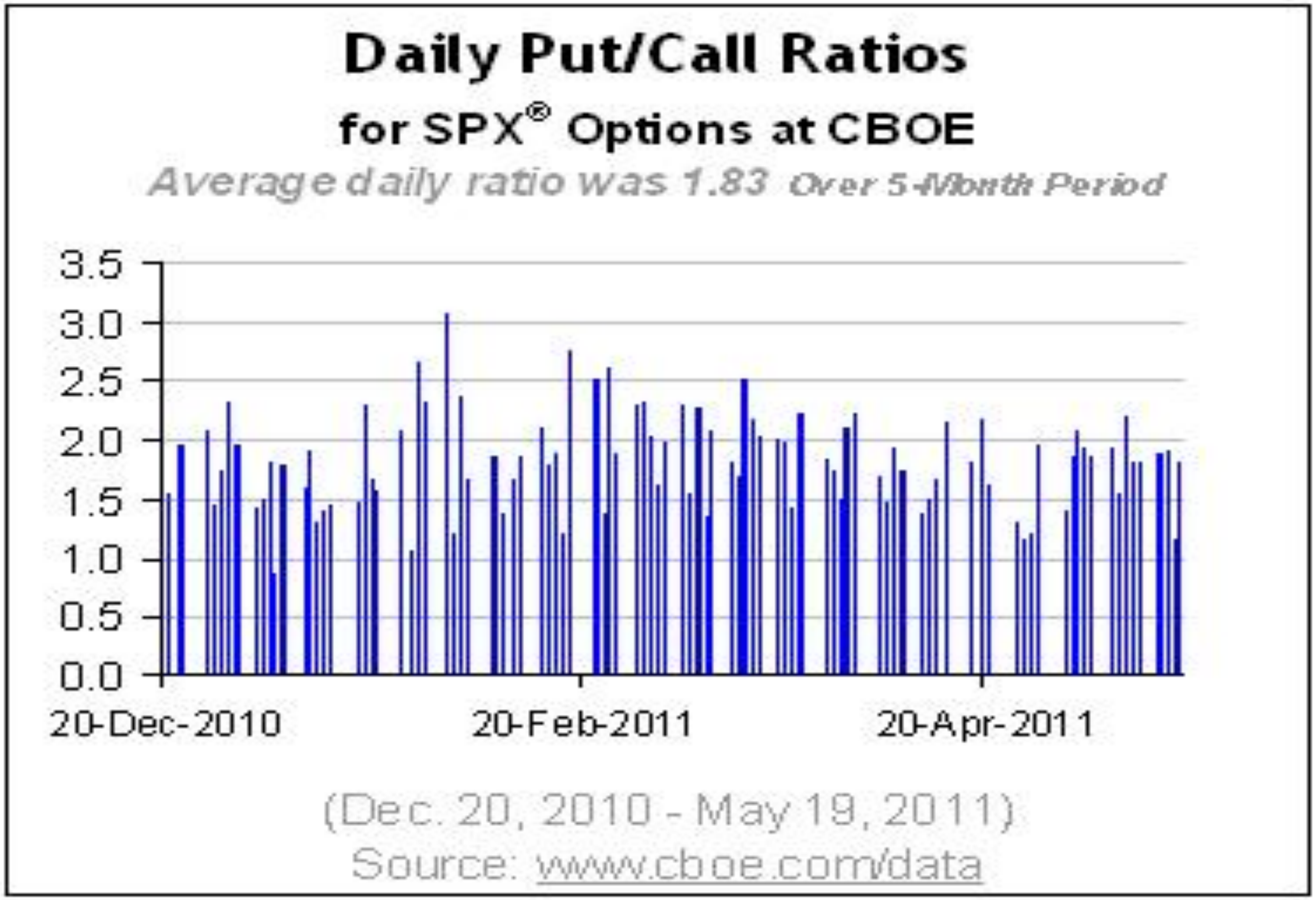
Moneyness :

- At-the-money option
- In-the-money option
- Out-of-the-money option

Market Makers

- Most exchanges use market makers to facilitate options trading
- A market maker quotes both bid and ask prices when requested
- The market maker does not know whether the individual requesting the quotes wants to buy or sell

Puts vs Calls



Trading Strategies Involving Options

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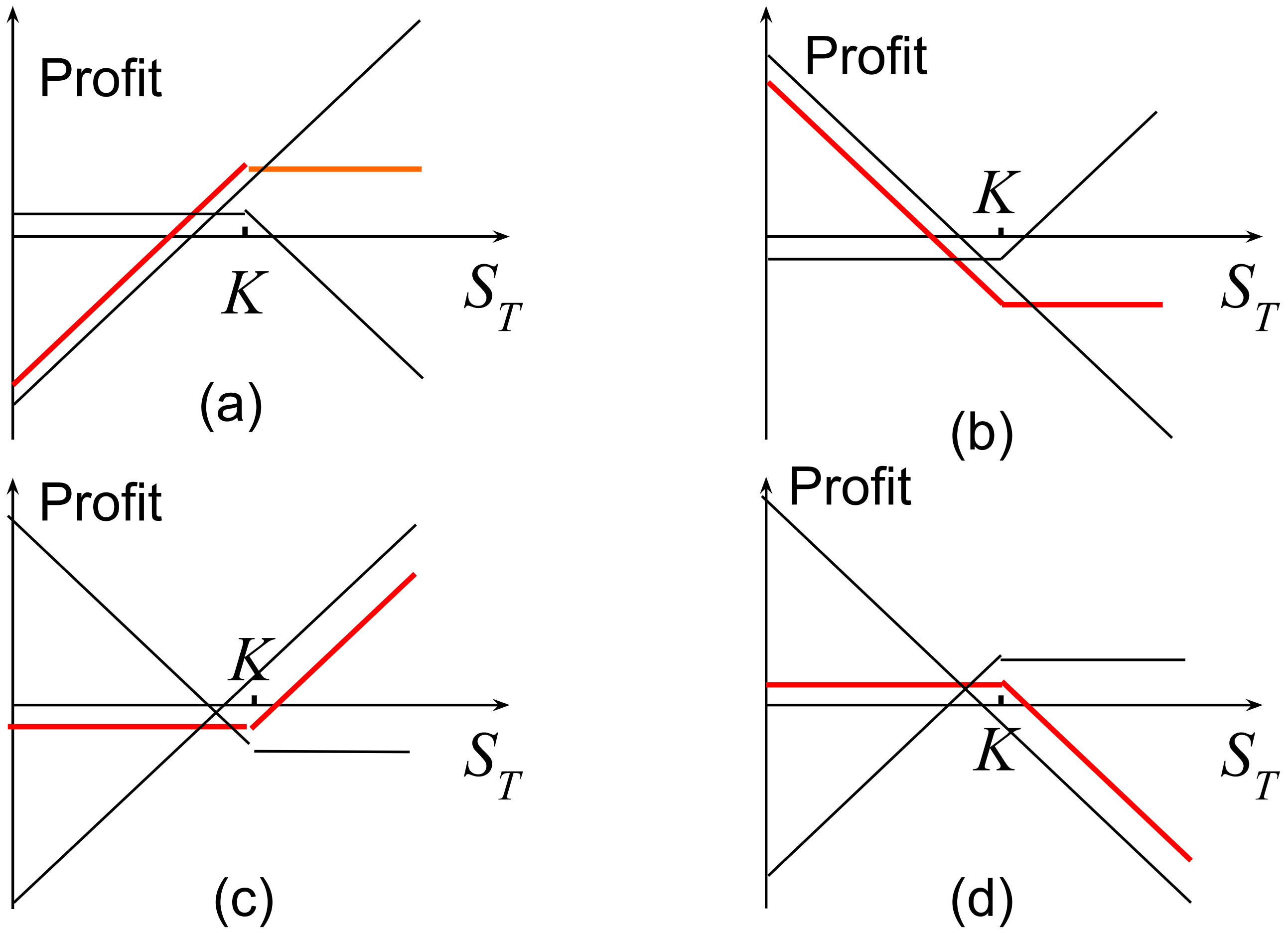
Types of Strategies

- Take a position in the option and the underlying
- Take a position in 2 or more options of the same type (A spread)
- Combination: Take a position in a mixture of calls & puts (A combination)

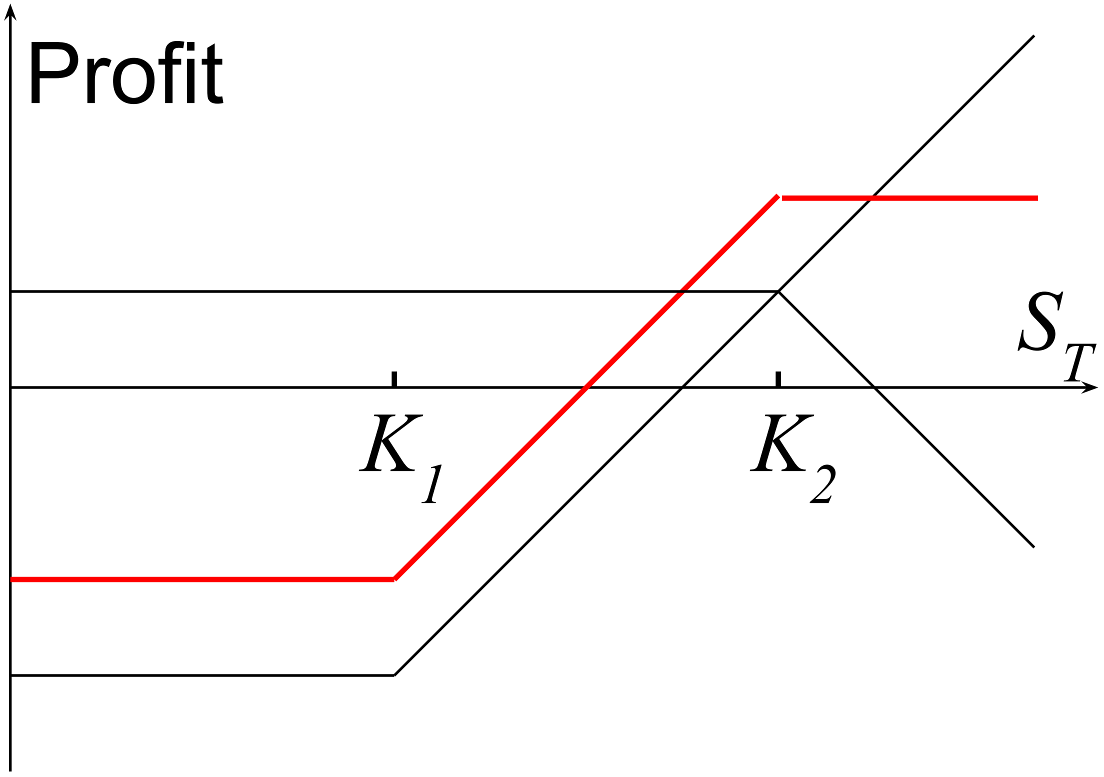
Positions in an Option & the Underlying



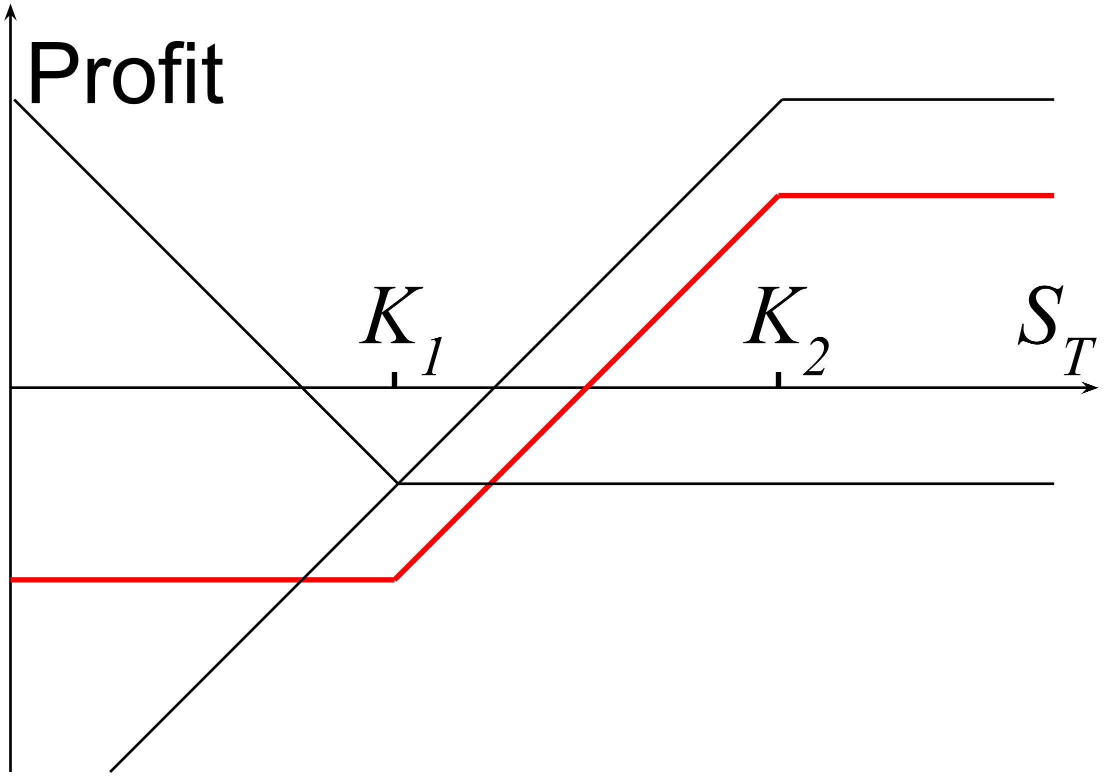
Example

- In 08/03/11 , the share price of TNLP4 was R$ 42.15. The most liquid option with maturity for September and strike of R$ 44.00 has a price of R$ 0.95.
- The investor who bought the stock and sold the option on that date would incur in a final cost of R$ 41.20.
- If the other investor exercise the option the resulting profit would be 6.8% (R$2.8=44-41.2).
- If the share price stays below R$ 44.00, investor will retain the stock and the option premium.

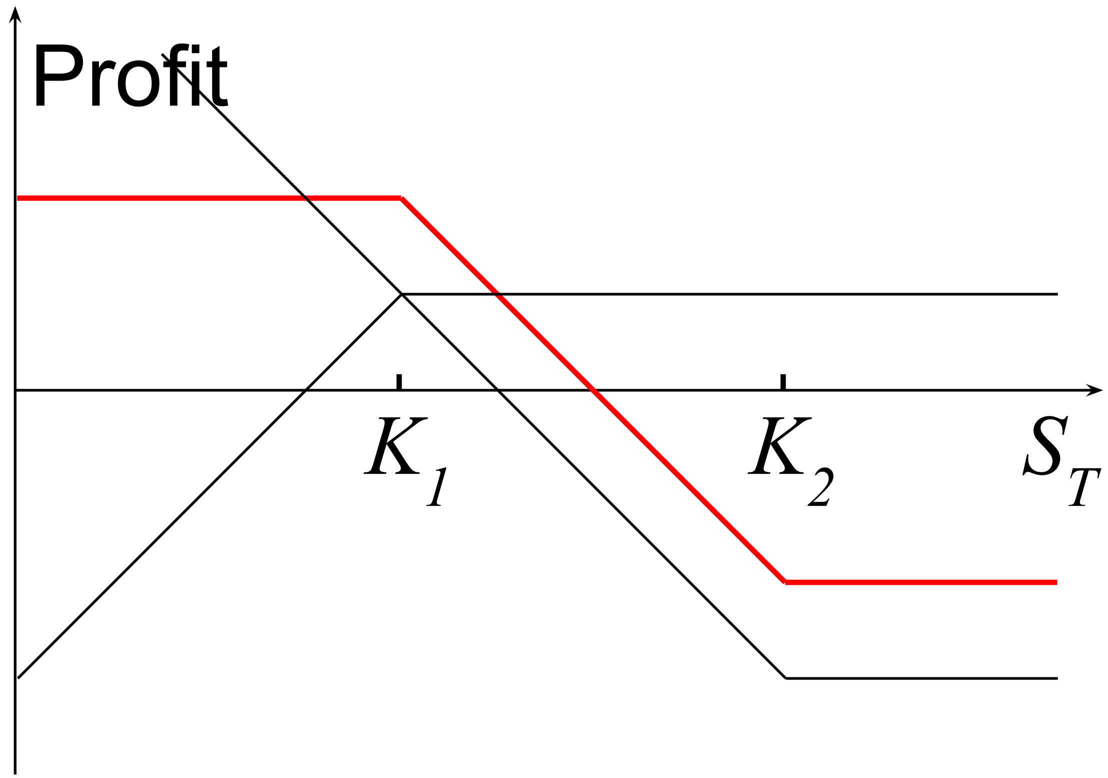
Bull Spread Using Calls



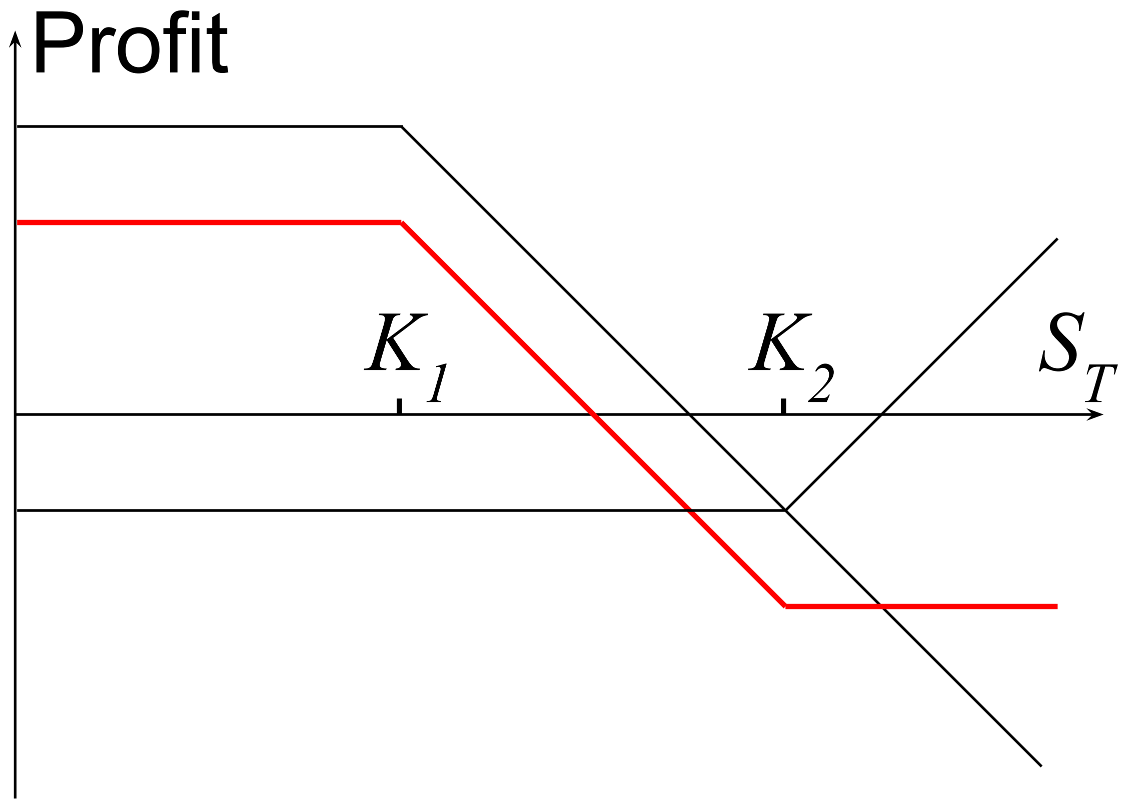
Bull Spread Using Puts



Bear Spread Using Puts



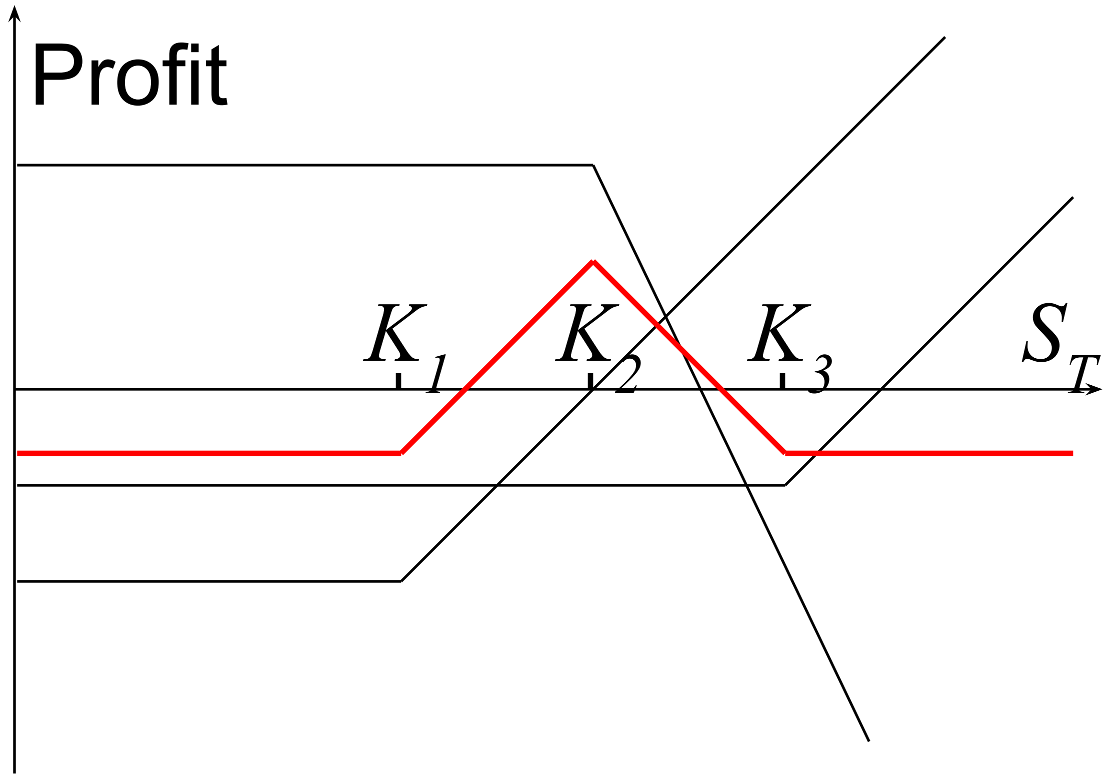
Bear Spread Using Calls



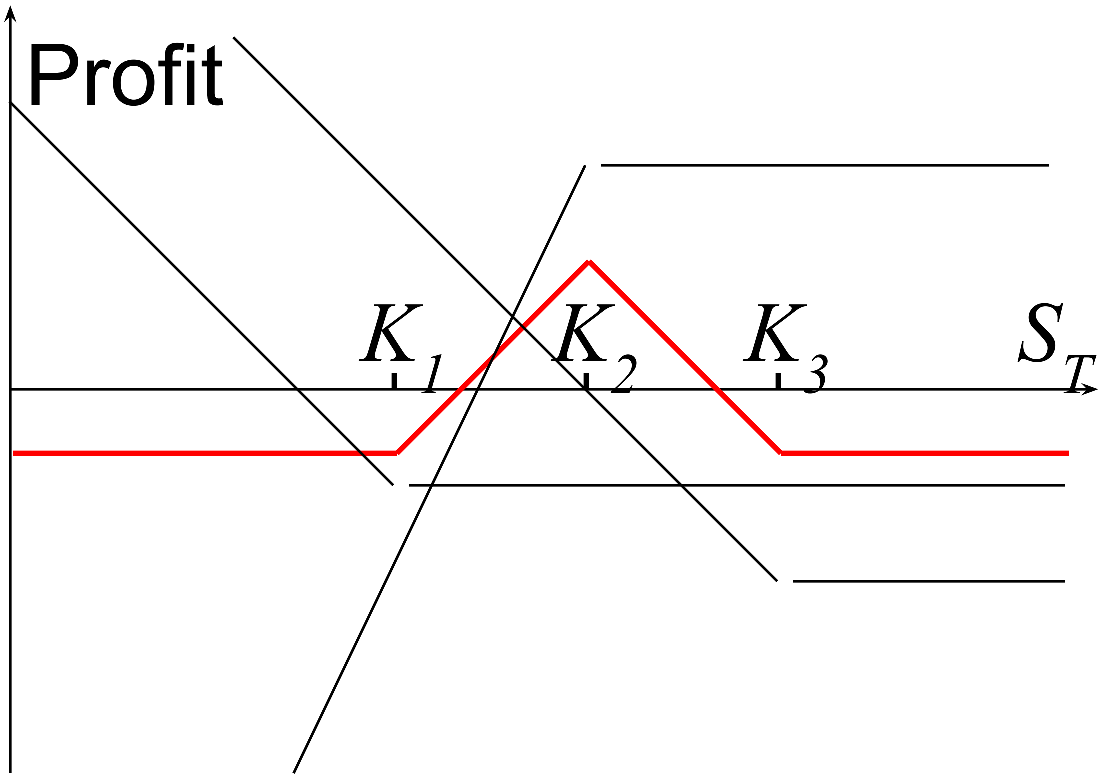
Box Spread

- A combination of a bull call spread and a bear put spread
- If all options are European a box spread is worth the present value of the difference between the strike prices
- If they are American this is not necessarily so.

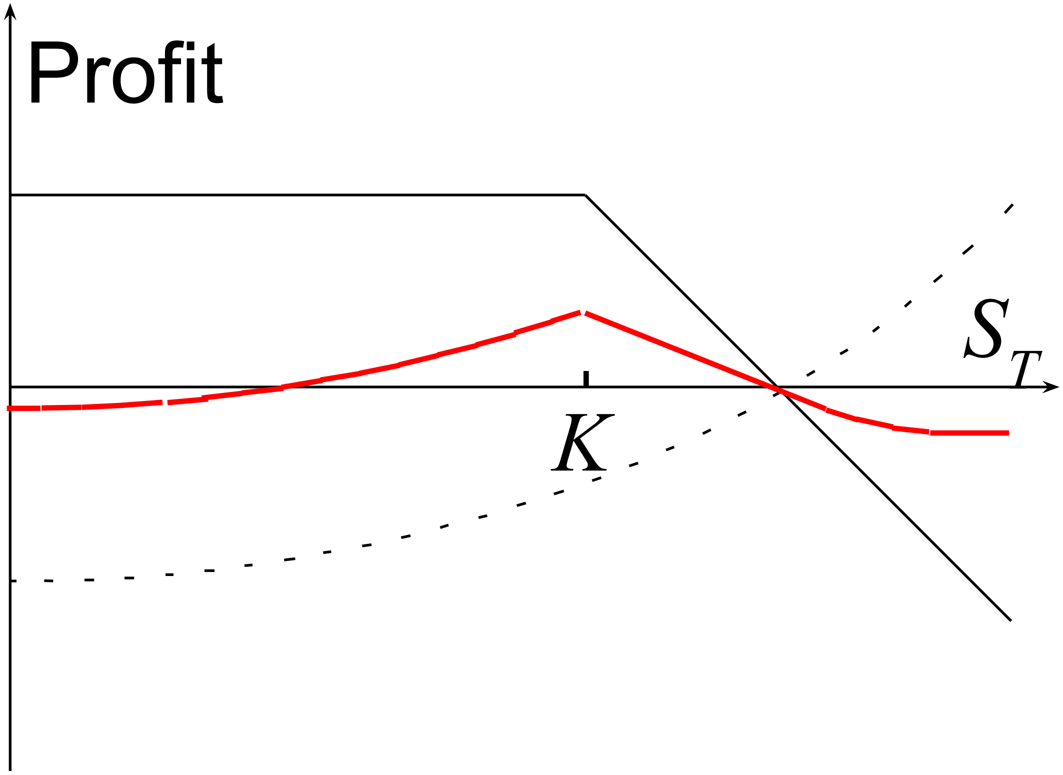
Butterfly Spread Using Calls



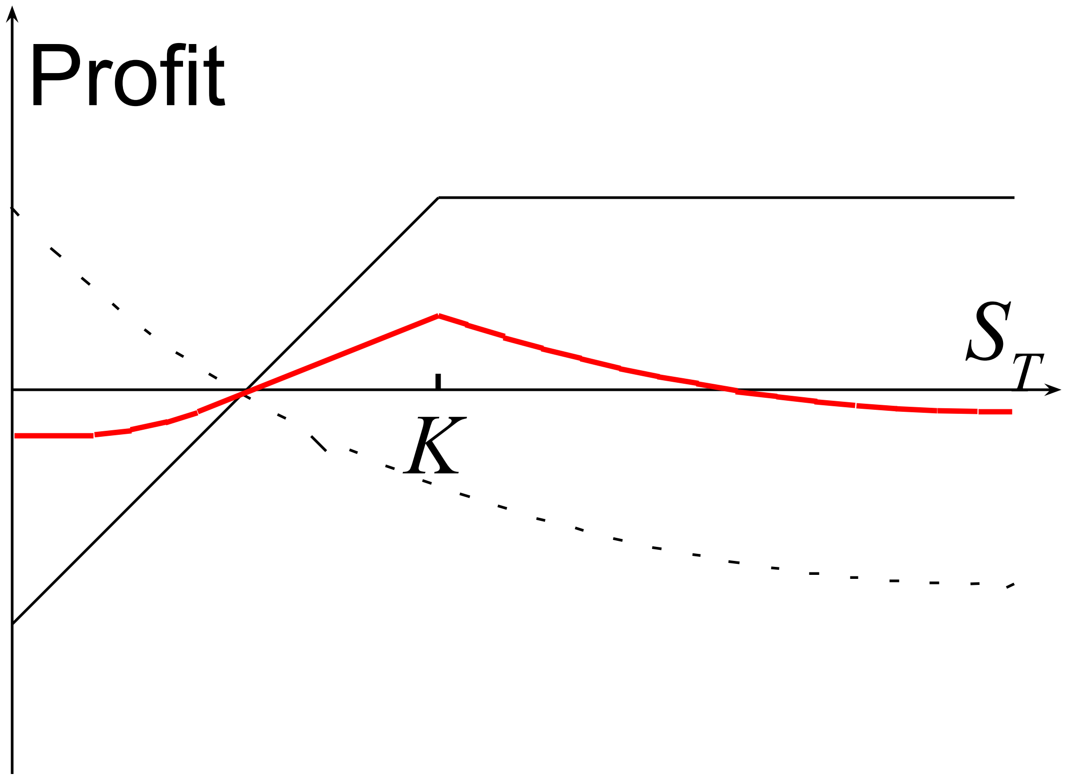
Butterfly Spread Using Puts



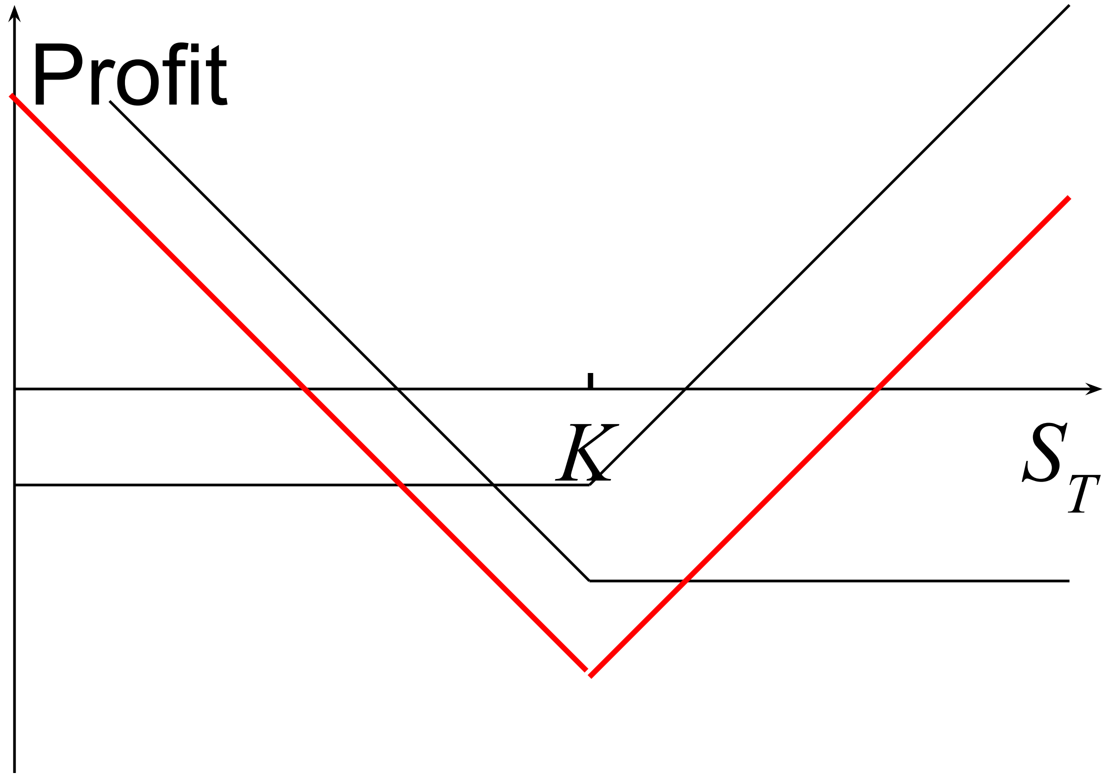
Calendar Spread Using Calls



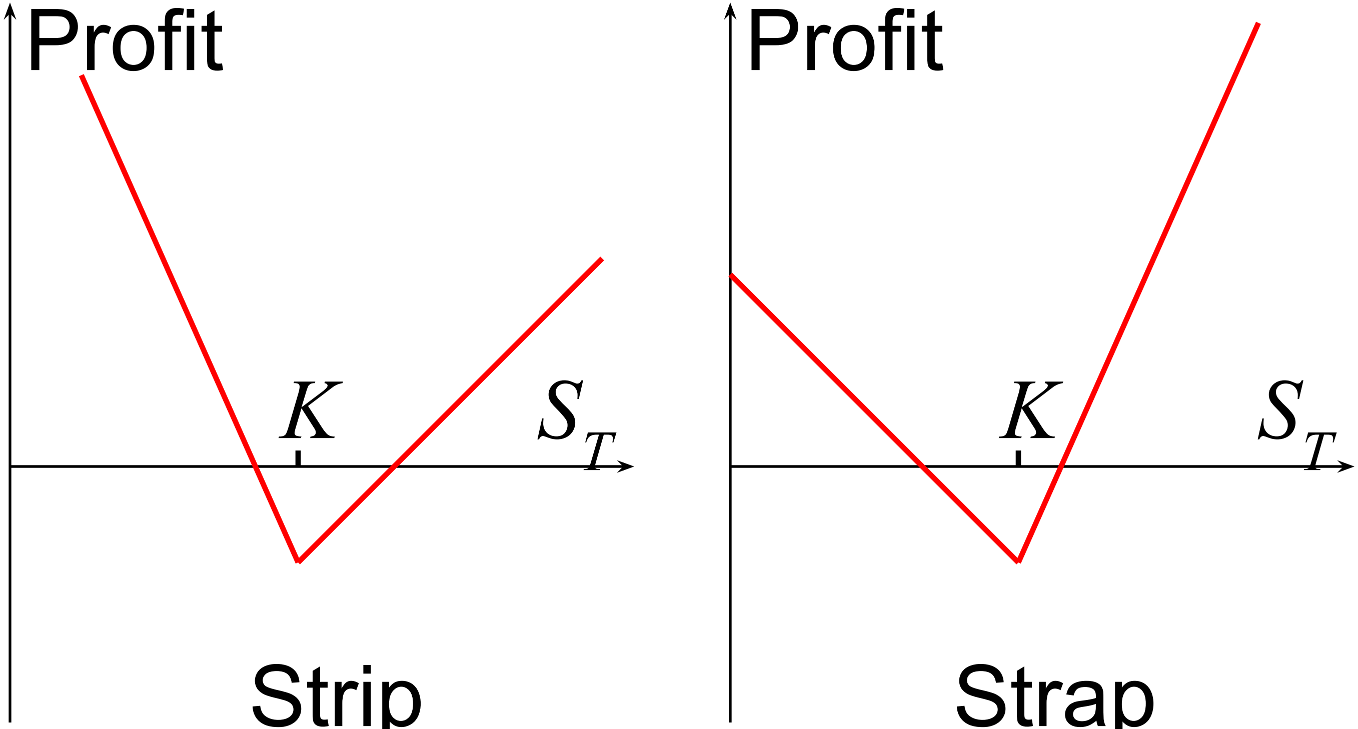
Calendar Spread Using Puts



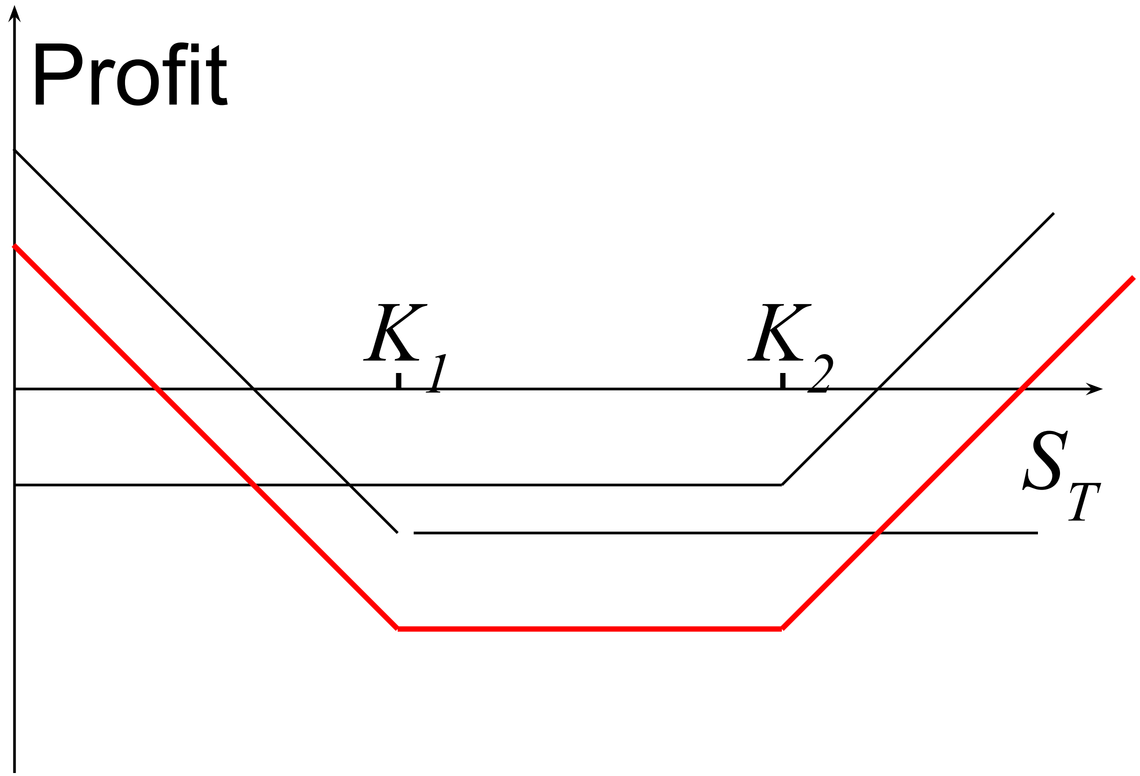
A Straddle Combination



Strip & Strap



A Strangle Combination



Properties of Stock Options

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Notation

- c: European call option price
- p: European put option price
- S_0: Stock price today
- K: Strike price
- T: Life of option
- σ: Volatility of stock price
- C: American call option price
- P: American put option price
- S_T: Stock price at option maturity
- D: PV of dividends paid during life of option
- r Risk-free rate for maturity T with cont. comp.

Effect of Variables on Option Pricing

Variable	c	p	C	P
S_0	+	−	+	−
K	−	+	−	+
T	?	?	+	+
σ	+	+	+	+
r	+	−	+	−
D	−	+	−	+

American vs European Options

An American option is worth at least as much as the corresponding European option

$$C \geq c$$

$$P \geq p$$

Calls: An Arbitrage Opportunity?

- Suppose that

$c = 3$	$S_0 = 20$
$T = 1$	$r = 10\%$
$K = 18$	$D = 0$

- Is there an arbitrage opportunity?

Lower Bound for European Call Option Prices; No Dividends

$$c \geq S_0 - Ke^{-rT}$$

Puts: An Arbitrage Opportunity?

- Suppose that

$p = 1$ $S_0 = 37$

$T = 0.5$ $r = 5\%$

$K = 40$ $D = 0$

- Is there an arbitrage opportunity?

Lower Bound for European Put Prices; No Dividends

$$p \geq Ke^{-rT} - S_0$$

Put-Call Parity: No Dividends

- Consider the following 2 portfolios:
  - Portfolio A: European call on a stock + zero-coupon bond that pays K at time T
  - Portfolio B: European put on the stock + the stock

Values of Portfolios

		$S_T > K$	$S_T < K$
Portfolio A	Call option	$S_T - K$	0
	Zero-coupon bond	K	K
	Total	S_T	K
Portfolio B	Put Option	0	$K - S_T$
	Share	S_T	S_T
	Total	S_T	K

The Put-Call Parity Result

- Both are worth max(S_T , K) at the maturity of the options
- They must therefore be worth the same today. This means that $c + Ke^{-rT} = p + S_0$

Arbitrage Opportunities

- Suppose that

  $c = 3$ $S_0 = 31$

  $T = 0.25$ $r = 10\%$

  $K = 30$ $D = 0$

- What are the arbitrage possibilities when

  $p = 2.25$?

  $p = 1$?

Early Exercise

- Usually there is some chance that an American option will be exercised early
- An exception is an American call on a non-dividend paying stock
- This should never be exercised early

An Extreme Situation

- For an American call option:

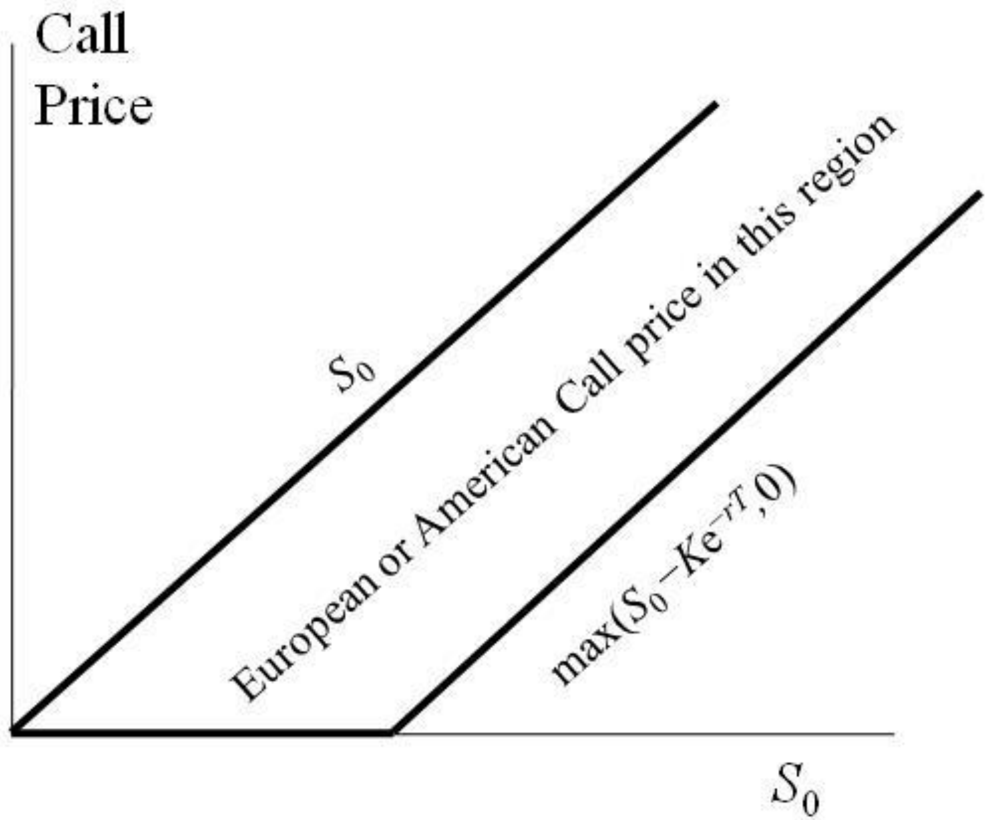
  $$S_0 = 100; T = 0.25; K = 60; D = 0$$

  Should you exercise immediately?
- What should you do if
  - You want to hold the stock for the next 3 months?
  - You do not feel that the stock is worth holding for the next 3 months?

Reasons For Not Exercising a Call Early (No Dividends)

- No income is sacrificed
- You delay paying the strike price
- Holding the call provides insurance against stock price falling below strike price

Bounds for European or American Call Options (No Dividends)



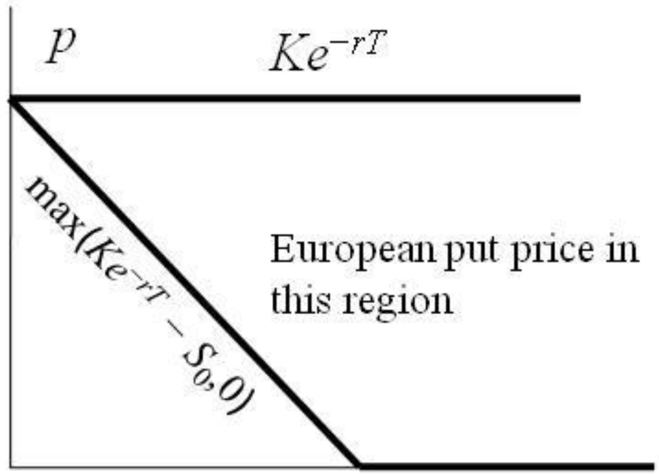
Should Puts Be Exercised Early ?

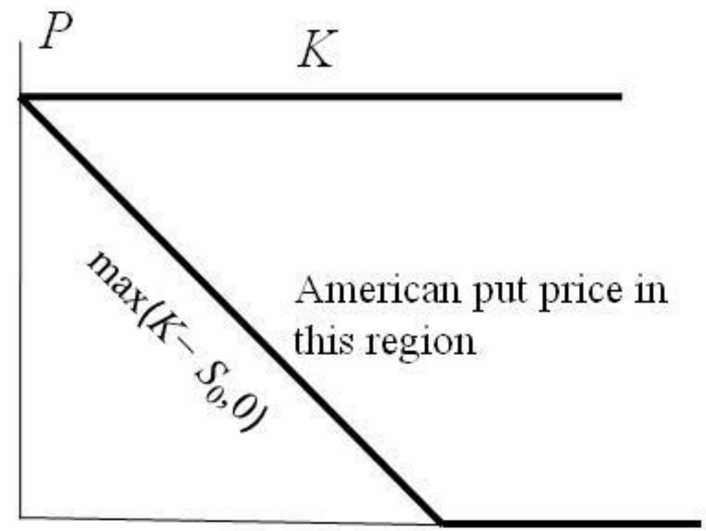
Are there any advantages to exercising an American put when

S_0 = 60; T = 0.25; r=10%

K = 100; D = 0

Bounds for European and American Put Options (No Dividends)





The Impact of Dividends on Lower Bounds to Option Prices

$$c \geq S_0 - D - Ke^{-rT}$$

$$p \geq D + Ke^{-rT} - S_0$$

Extensions of Put-Call Parity

- American options; $D = 0$

$$S_0 - K < C - P < S_0 - Ke^{-rT}$$

- European options; $D > 0$

$$c + D + Ke^{-rT} = p + S_0$$

- American options; $D > 0$

$$S_0 - D - K < C - P < S_0 - Ke^{-rT}$$