
FINA 1082 Financial Management

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Lecture 13

Derivatives II

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Hedging with Derivatives

The Put-Call Parity Formula

Basic Option Strategies

- Synthetic Long Position
- Synthetic Short Position
- Covered Call
- Protective Put
- Options Spreads

The Put-Call Parity Formula

Arbitrage-free (partial equilibrium) relationship between the prices of a put and a call on the same underlying security, if the two options have identical exercise prices and identical times to maturity.

$$C - P = S_0 - \frac{X}{(1 + r_F)^T}$$

Disequilibrium Example

Stock Price = 110
Call Price = 17

Put Price = 5
RF rate = 10.25%

Maturity = 0.5 yrs
Exercise Price = 105

$$17 - 5 = 110 - \frac{105}{(1 + 0.1025)^{0.5}}$$

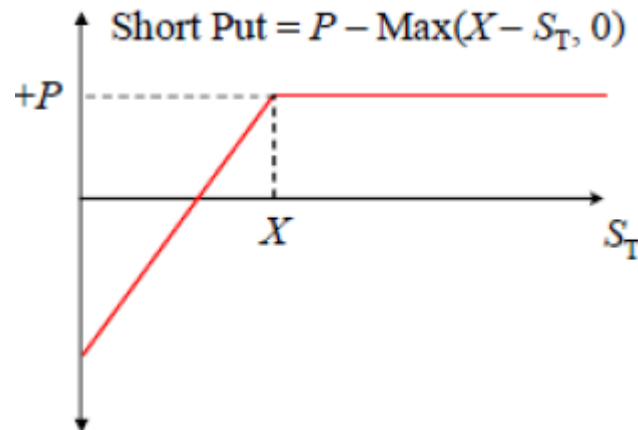
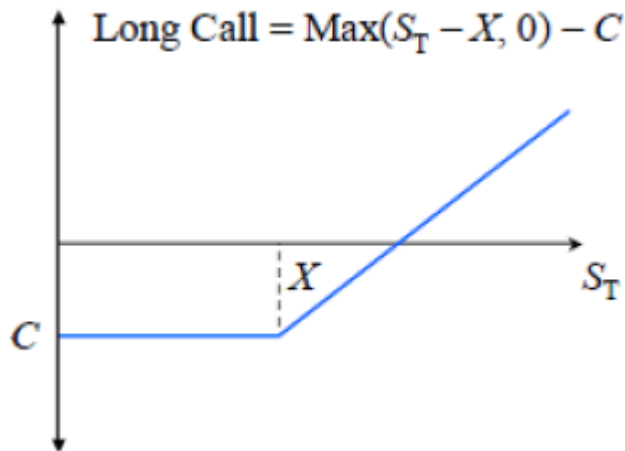
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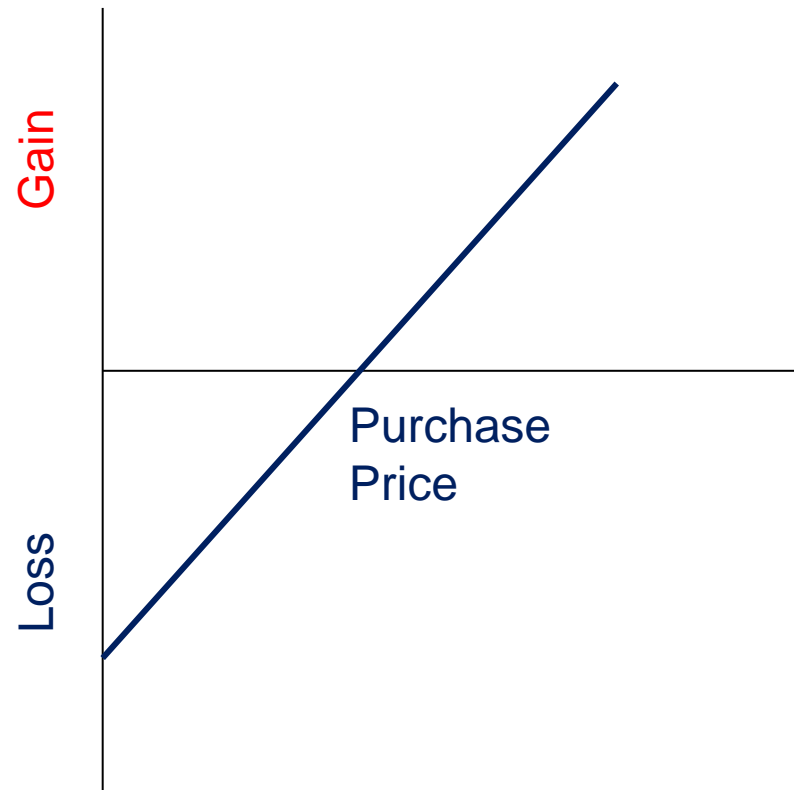
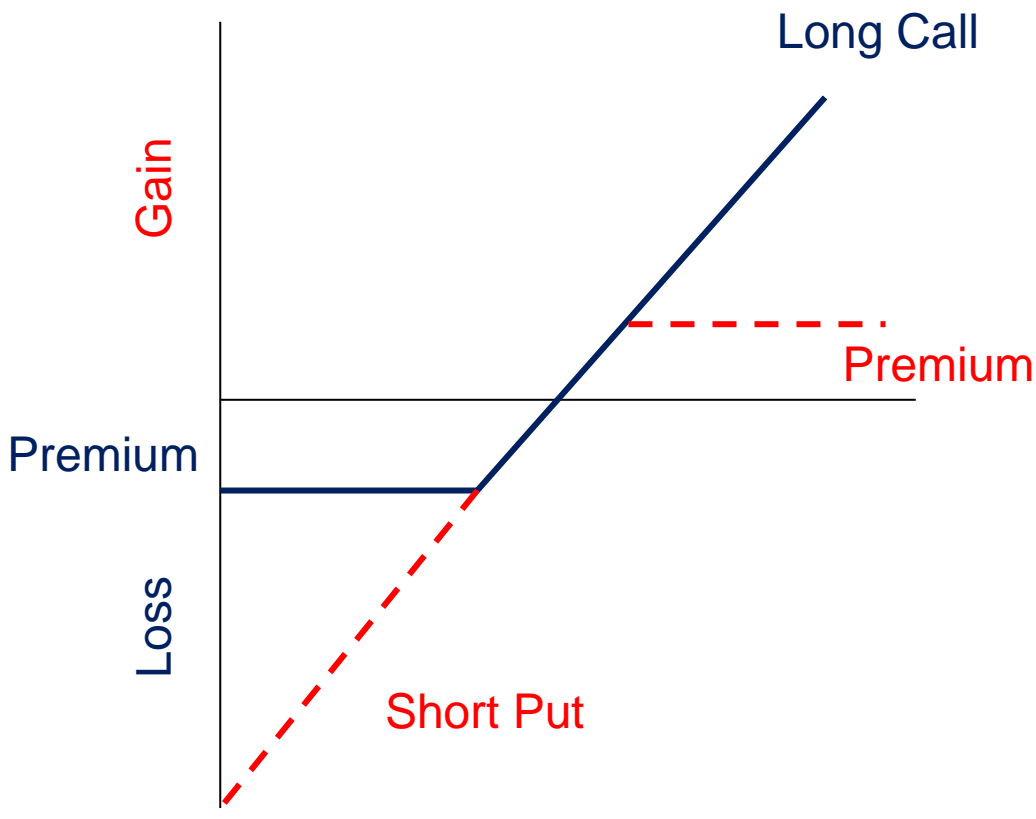
Synthetic Positions

Way to create the **payoff** of a financial instrument **using other financial instruments**.

The Synthetic Long Position

Buying (long) a call and selling (short) a put on the same security creates a *synthetic long position* in the optioned security similar to a **buy-and-hold** position in the security.





A long position can be created via financial engineering. **Purchasing a call and shorting a put** with about the same exercise price on the same underlying stock creates **a synthetic long position in that stock**.

Notes:

If the prices of a put and a call stock **are not equal**, the synthetic long position would not be equivalent to the actual long position.

Put-call parity relationship **shows** that if the exercise prices and maturity dates **are equal**, a put is worth less than a call on the same stock.

To make the put and call prices equal it is necessary to assume different maturities for the call and put.

Some investors would find a **synthetic long position** more desirable than a long position in the stock because the synthetic position requires **less initial cash investment**, and investing less **funds creates more financial leverage**.

The Synthetic Short Position

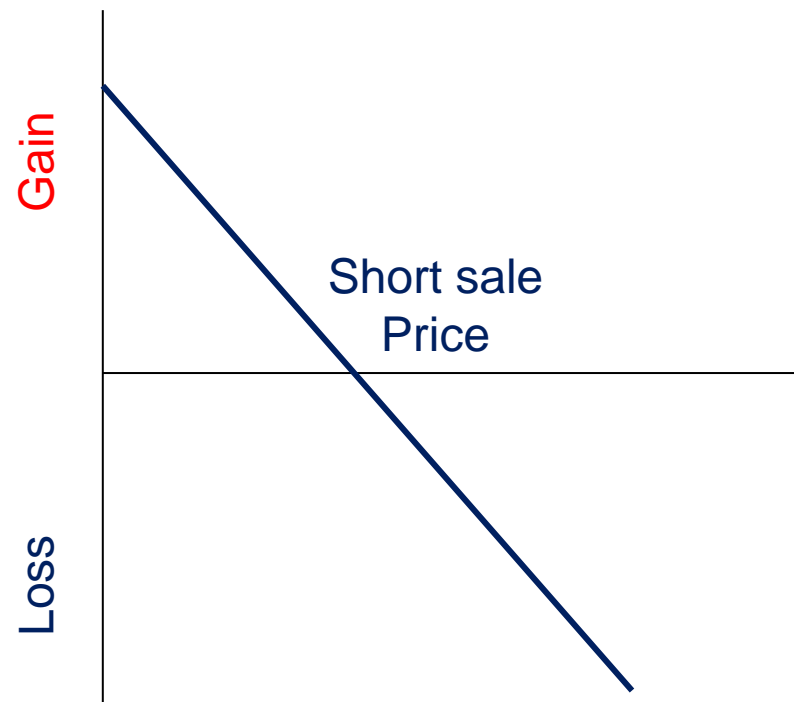
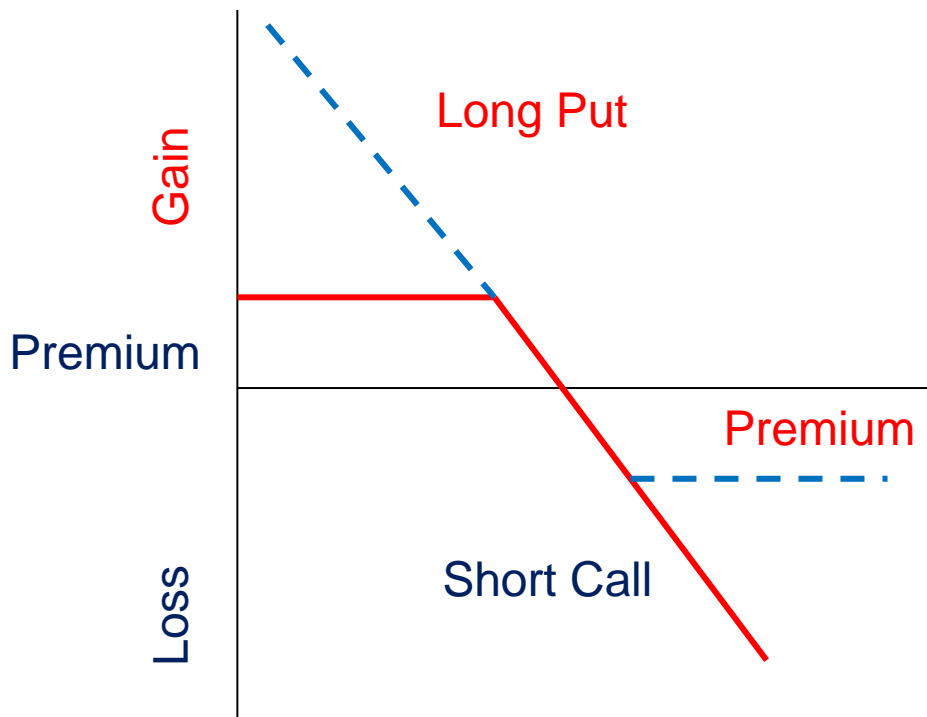
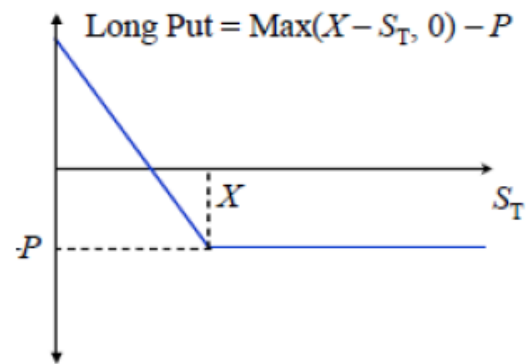
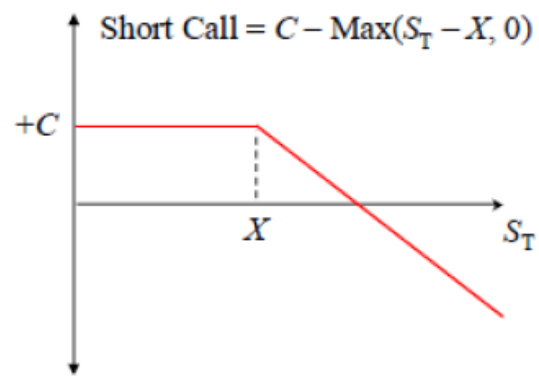
Selling (short) a call and simultaneously buying (long) a put with a similar exercise prices on the same underlying stock creates a Synthetic Short Position.

More desirable than a traditional short position for 3 reasons:

- 1) The option position is superior since the call premium is higher than the put premium.
- 2) Synthetic short position brings more leverage. Short sales require an initial margin and a synthetic shorter position involves a smaller investment.
- 3) Synthetic short seller does not have to pay dividends.

Disadvantages:

- Options expire and more money must be spent to purchase new options to reestablish the position.
- Investor has a short call position that could accumulate unlimited losses if the price of the underlying stock rose high enough.



Covered Call

Sell call on stock you own. (Long stock, short call)

Good:

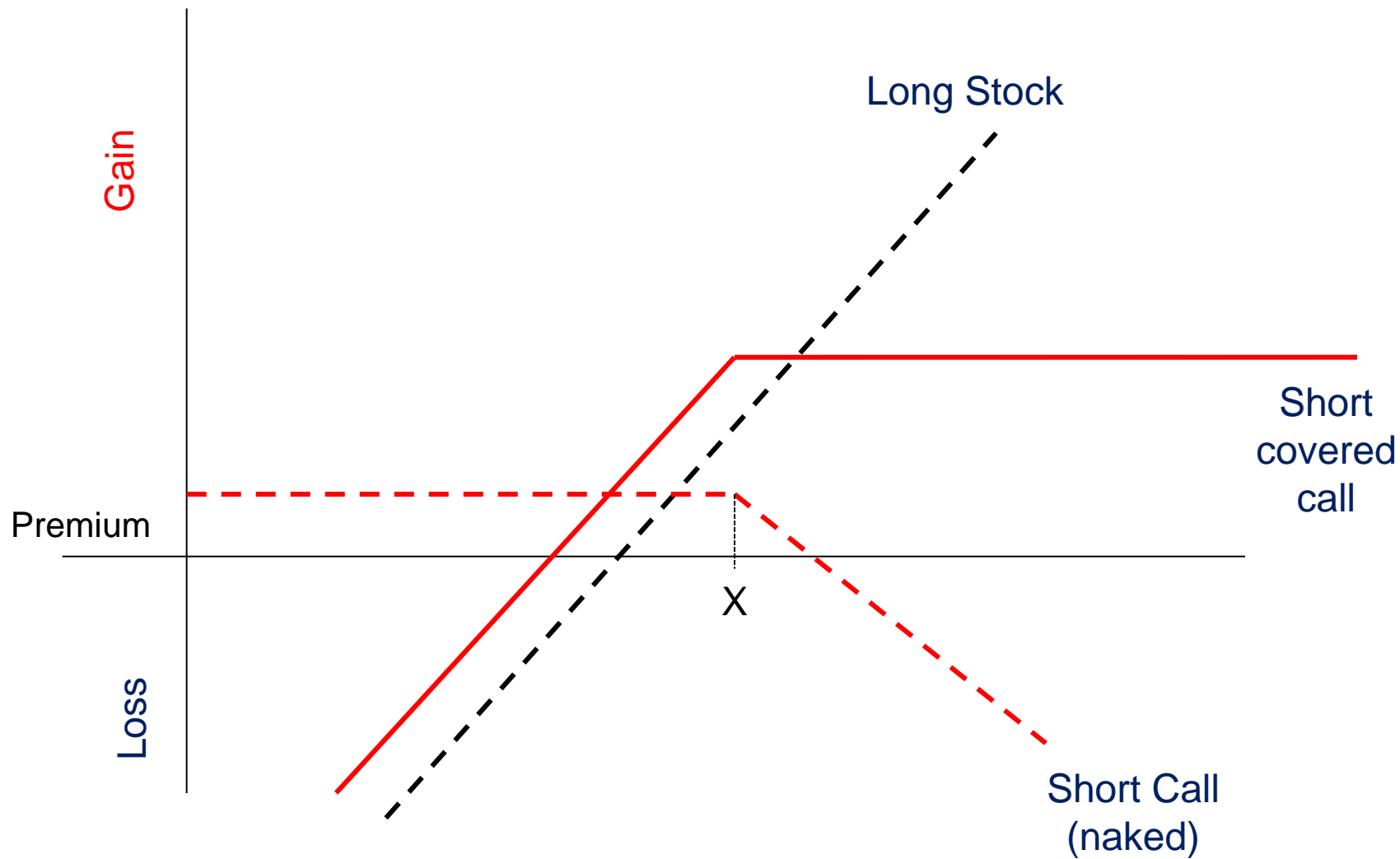
As value of stock falls, loss is partially offset by premium received on calls sold.

Essentially costless since hedge generates a cash inflow

Bad:

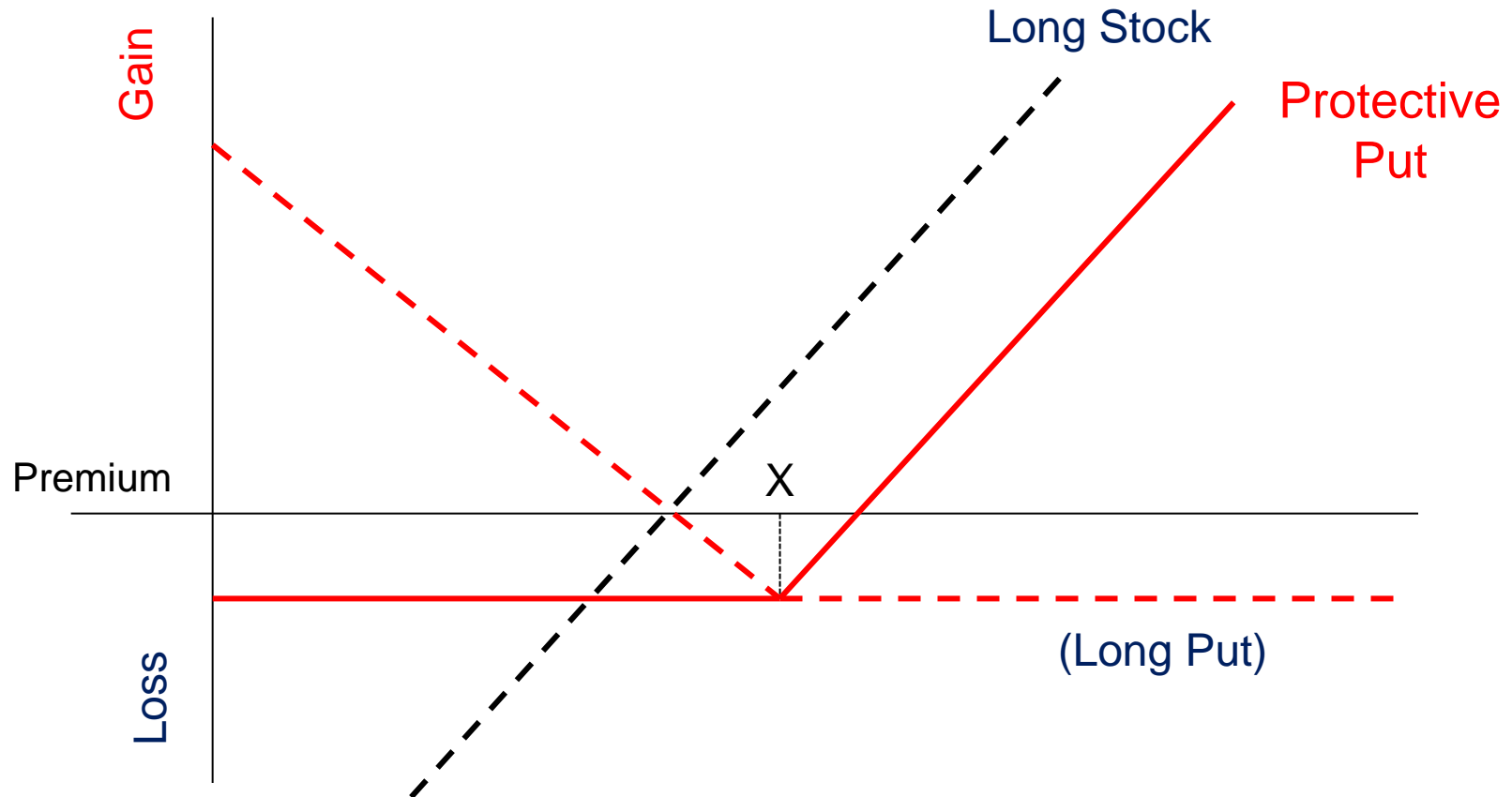
Maximum inflow from call = premium; Hedge is less effective for large drop in stock price

If stock price rises, call will be exercised; Investor transfers gains on stock to holder of call.



Protective Puts

long stock position combined with a long put position



Option Spreads

- ❑ Many other option strategies can be crafted using combinations of option positions
 - ❑ Price spread (vertical spread)
 - Buying and selling options on the same stock with the same expiration, but with different strike prices
 - ❑ Time spread (horizontal or calendar spread)
 - Buying and selling options on the same stock with the same strike price, but with different expirations

Option Spreads (cont.)

❑ Bullish spreads

- Buy a higher priced option and sell a lower priced option on the same stock

❑ Bearish spreads

- Sell a higher priced option and buy a lower priced option on the same stock

❑ Straddle

- Combination of a purchasing (long) or selling (short) a put and a call on the same expiration
- Betting on a large price movement (long straddle) or little price movement (short straddle)

Option Spreads (cont.)

❑ Strangle

- Combination of a call and put with the same expiration but different exercise prices (long or short)
- Similar to straddle strategies

❑ Butterfly spread

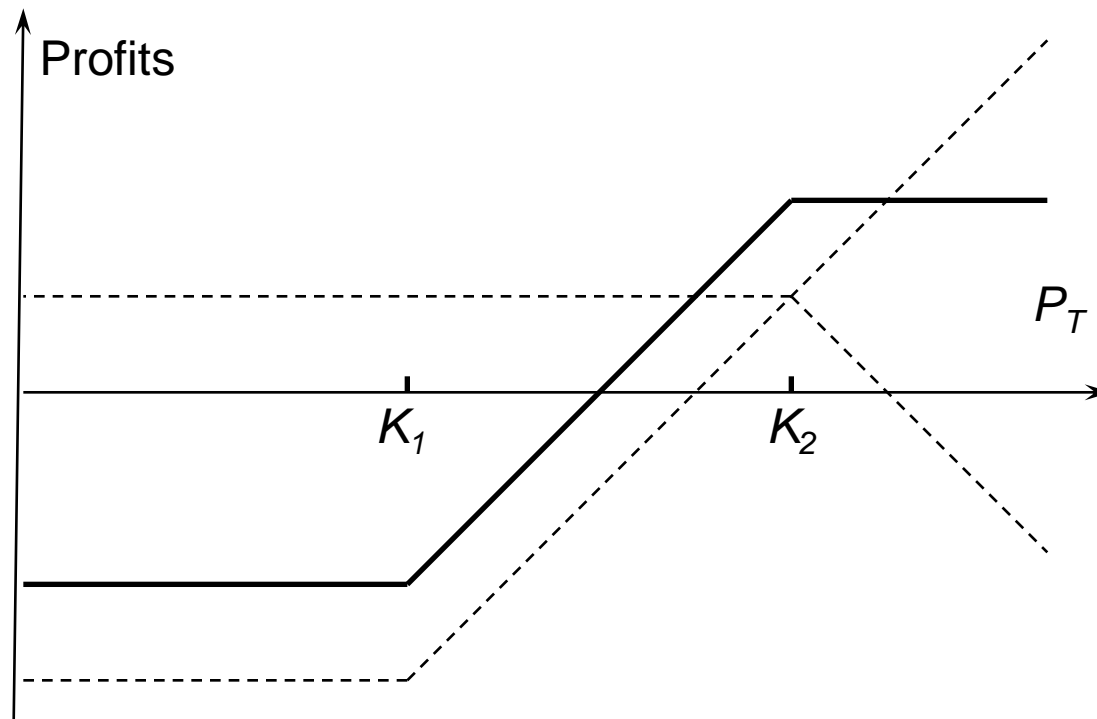
- Combination strategy with 4 options, similar to straddles and strangles, but with less risk of large losses

❑ The number of different strategies is potentially limitless

Bull Spread

Buy a call and sell a call with a higher strike price (on the same stock) or
buy a put with a low strike price and sell a put with a high strike price

Bull Spread with Calls



❑ Dashed lines: Profits from the 2 positions taken separately

❑ Solid line: Profit from the whole strategy

❑ Because a call price always decreases as the strike price increases, the value of the option sold is always less than the value of the option bought. A bull spread, when created from calls, therefore requires an initial investment.

Stock Price range	Payoff from long call option	Payoff from short call option	Total payoff
$ST \geq K_2$	$ST - K_1$	$K_2 - ST$	$K_2 - K_1$
$K_1 < ST < K_2$	$ST - K_1$	0	$ST - K_1$
$ST \leq K_1$	0	0	0

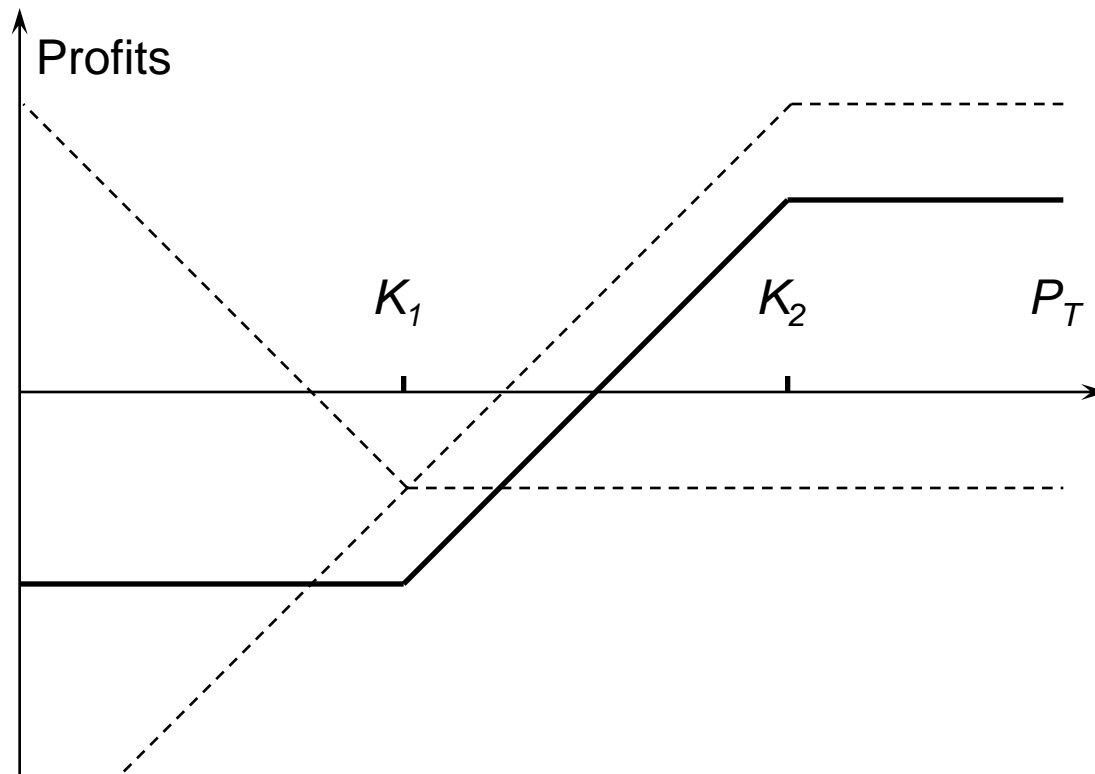
A bull spread strategy limits the investor's upside as well as downside risk

Example:

An investor buys a \$3 call with a strike price of \$30 and sells for \$1 a call with a strike price of \$35.

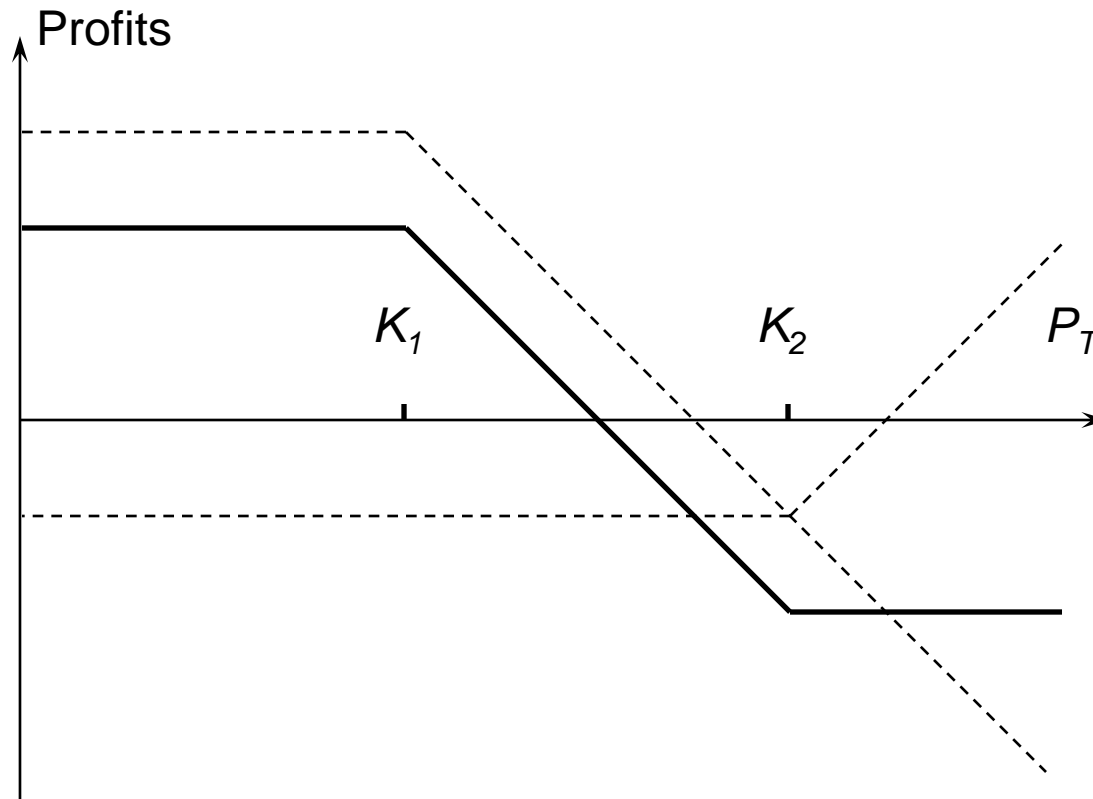
Stock price range	Profit
$ST \leq 30$	-2
$30 < ST < 35$	$ST - 32$
$ST \geq 35$	3

Bull Spread with Puts



Bear Spread with Calls

Buy a call with a higher strike price and sell a call (on the same stock).
Hope that the stock price will decline.



A bear spread can be created by buying a call with one strike price and selling a call with another strike price. The strike price of the option purchased is greater than the strike price of the option sold

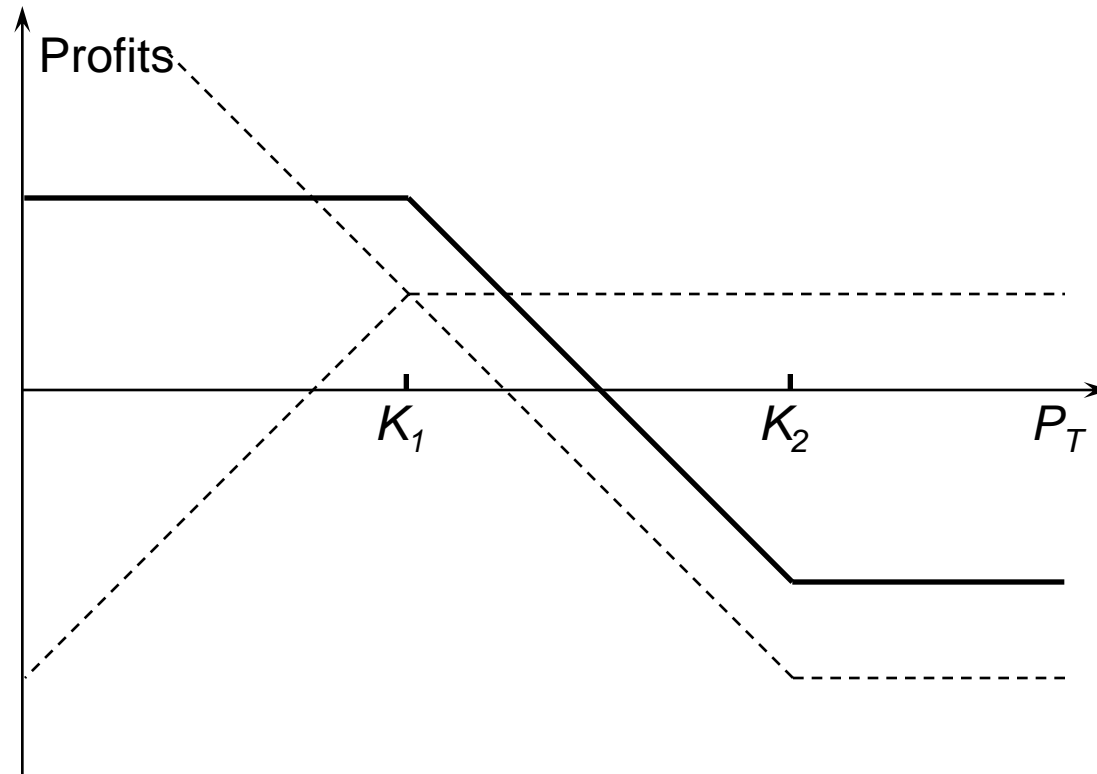
Stock Price range	Payoff from long call option	Payoff from short call option	Total payoff
$S_T \geq K_2$	$S_T - K_2$	$K_1 - S_T$	$-(K_2 - K_1)$
$K_1 < S_T < K_2$	0	$K_1 - S_T$	$-(S_T - K_1)$
$S_T \leq K_1$	0	0	0

Example:

An investor buys a \$1 a call with a strike price of \$350 and sells for \$3 a call with a strike price of \$30.

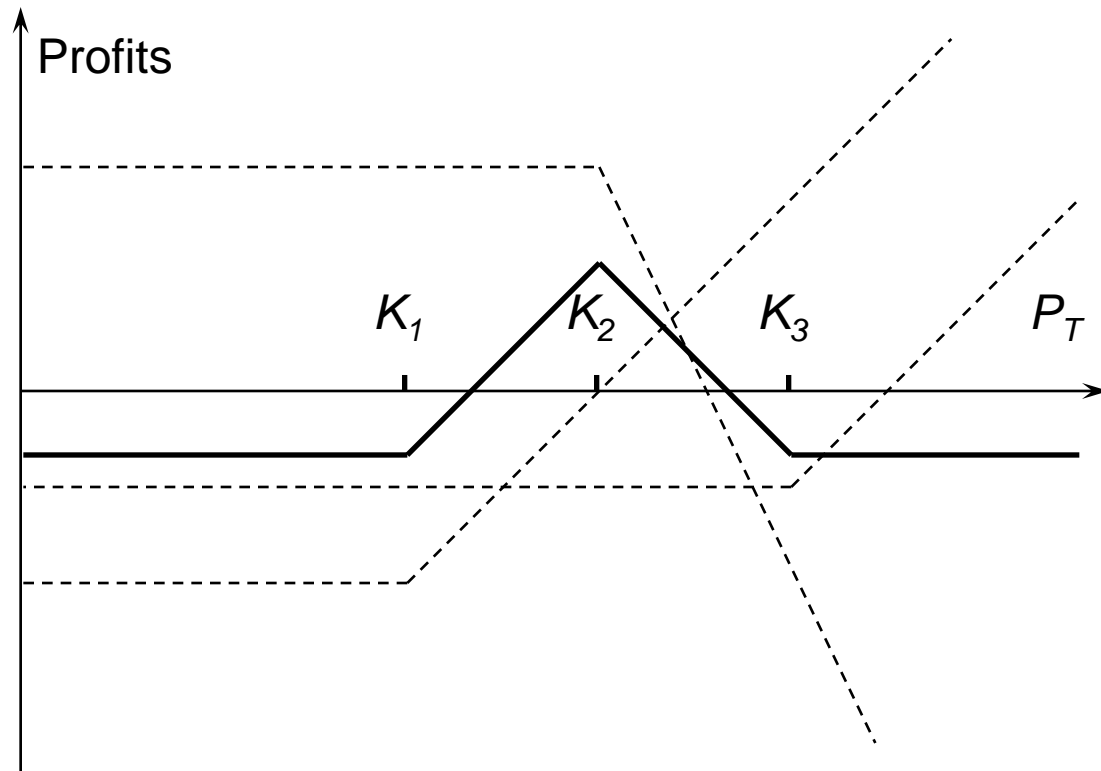
Stock price range	Profit
$ST \leq 30$	+2
$30 < ST < 35$	$32 - ST$
$ST \geq 35$	-3

Bear Spread with Puts



Butterfly Spread with Calls

Three different strike prices (on the same stock). Buy a call with a relatively low strike price x_1 , buy a call with a relatively high strike price x_3 and sell two calls with a strike price half way x_2 (can use put options too). Generally K_2 is close to the current stock price



Butterfly spread leads to a profit if the stock price stays close to K_2 but gives rise to a small loss if there is a significant stock price move in either direction.

It is an appropriate strategy for an investor who feels that large stock price moves are unlikely

Example:

Stock currently worth \$61 Market prices of six-months calls are as follows:

Strike Price (\$)	Call Price (\$)
55	10
60	7
65	5

Costs: $\$10 + \$5 - (2 \times \$7) = \1

$ST < \$55$ or $ST > \$65$ (in 6 months)

Total payoff is zero (net loss \$1)

$\$56 < ST < \64 profit is made

Maximum profit (\$4) when the stock price in six months is \$60

Stock Price Range	Payoff from first long Call	Payoff from second long Call	Payoff from short Calls	Total Payoff
$St < K1$	0	0	0	0
$K1 < ST < K2$	$ST - K1$	0	0	$ST - K1$
$K2 < ST < K3$	$ST - K1$	0	$-2 (ST - K2)$	$K3 - ST$
$ST > K3$	$ST - K1$	$ST - K3$	$-2 (ST - K2)$	0

Butterfly Spread with Puts

