

Lecture 14: Options

ECON435: Financial Markets and the Macroeconomy

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Derivative Securities

Derivative Securities (or “derivatives”):

- ❑ price depends on (derives from) another security, e.g. stocks
 - “contingent” securities
- ❑ useful for both hedging and speculation

Main Categories:

- ❑ Options
- ❑ Futures
- ❑ Swaps

Definition of Options

Call Option = right to **buy** an *underlying security*

- ❑ at a specified price: *exercise* or *strike price*
- ❑ on or before the *maturity date* or *expiration date*

Premium or purchase price = compensation to the seller for “writing” (= selling) the option

Definition of Options

Put Option = right to **sell** an *underlying security*

- ❑ at a specified price: *exercise (or strike price)*
- ❑ on or before the *maturity date (or expiration date)*

Note:

- ❑ holder will exercise the option to buy the security only if market price $>$ strike price
→ make profit
- ❑ no obligation for holder to exercise
→ can let the option expire: value is zero

Option Terminology

- “In the money”
 - option can be exercised profitably
- “At the money”
 - market price = exercise price
 - investor indifferent
- “Out of the money”
 - exercising the option would not be profitable

Options Trading

- ❑ OTC → offers more flexibility
- ❑ On exchanges, e.g.
 - Chicago Board Options Exchange (CBOE)
 - International Securities Exchange (ISE)
- more liquid, cheaper

Clearinghouse: Options Clearing Corporation

- ❑ becomes counterparty to each buyer/writer
- ❑ guarantees contract performance
- ❑ imposes margin requirement on writer

American vs. European Options

European option: can only be exercised at the maturity date

American option: can be exercised at any time before maturity

BUT: typically this is not done
→ the holder would lose the *time value* of the option (i.e. the chance to profit from future price increases)

Examples of Option Contracts

- Stock options
- Index options
- Futures options
- Foreign currency options
- Interest rate options
- Commodity price options
- ...

Notation of Option Contract

S_T = Stock Price

X = Exercise Price

Payoff to holder of call option:

$S_T - X$ if $S_T > X$

0 if $S_T \leq X$

Cost to writer of call option:

$-(S_T - X)$ if $S_T > X$

0 if $S_T \leq X$

Option Premium

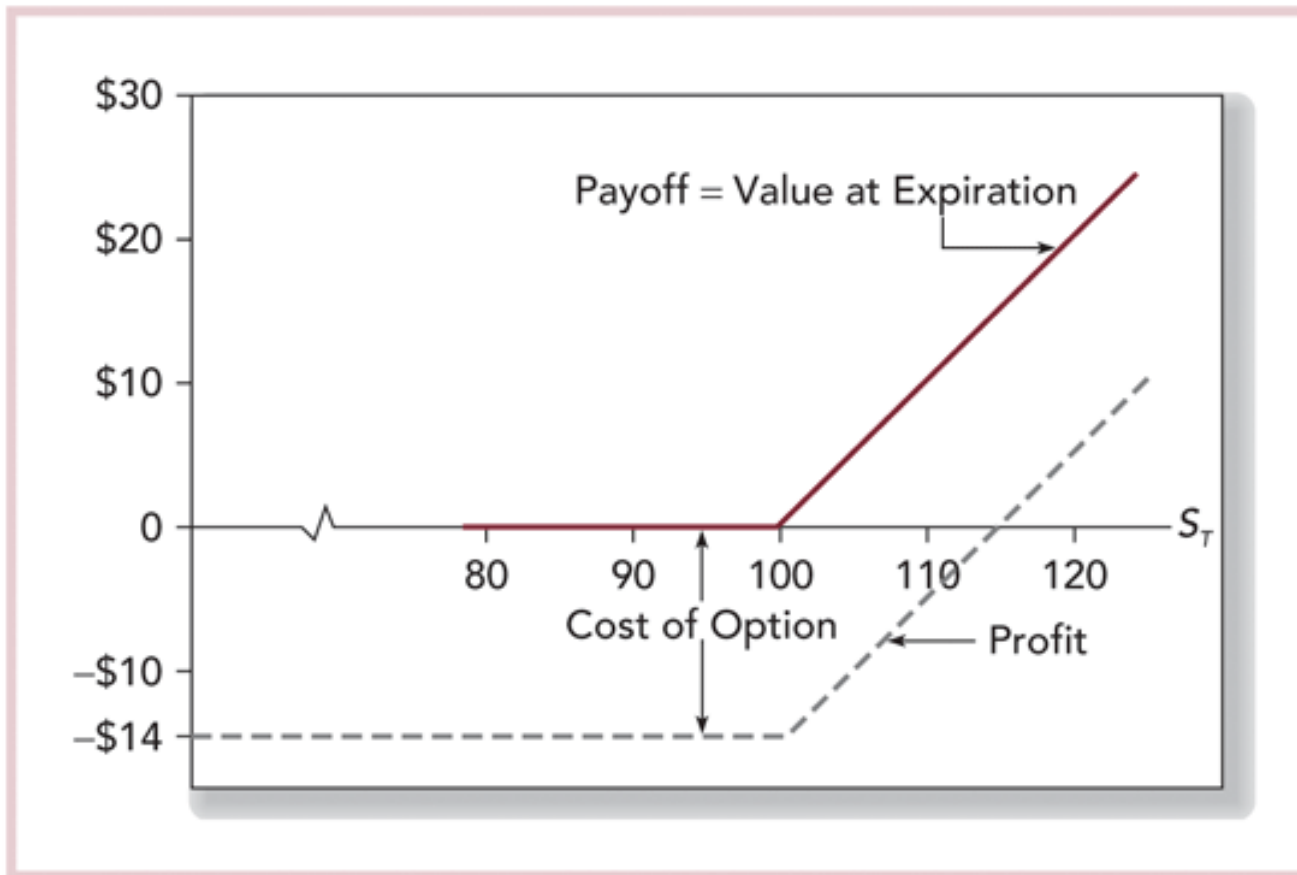
Buyer needs to compensate writer of option by paying a premium (purchase price)

- Total profit for holder: $\text{payoff} - \text{premium}$
- Total profit for writer: $\text{premium} - \text{payoff}$

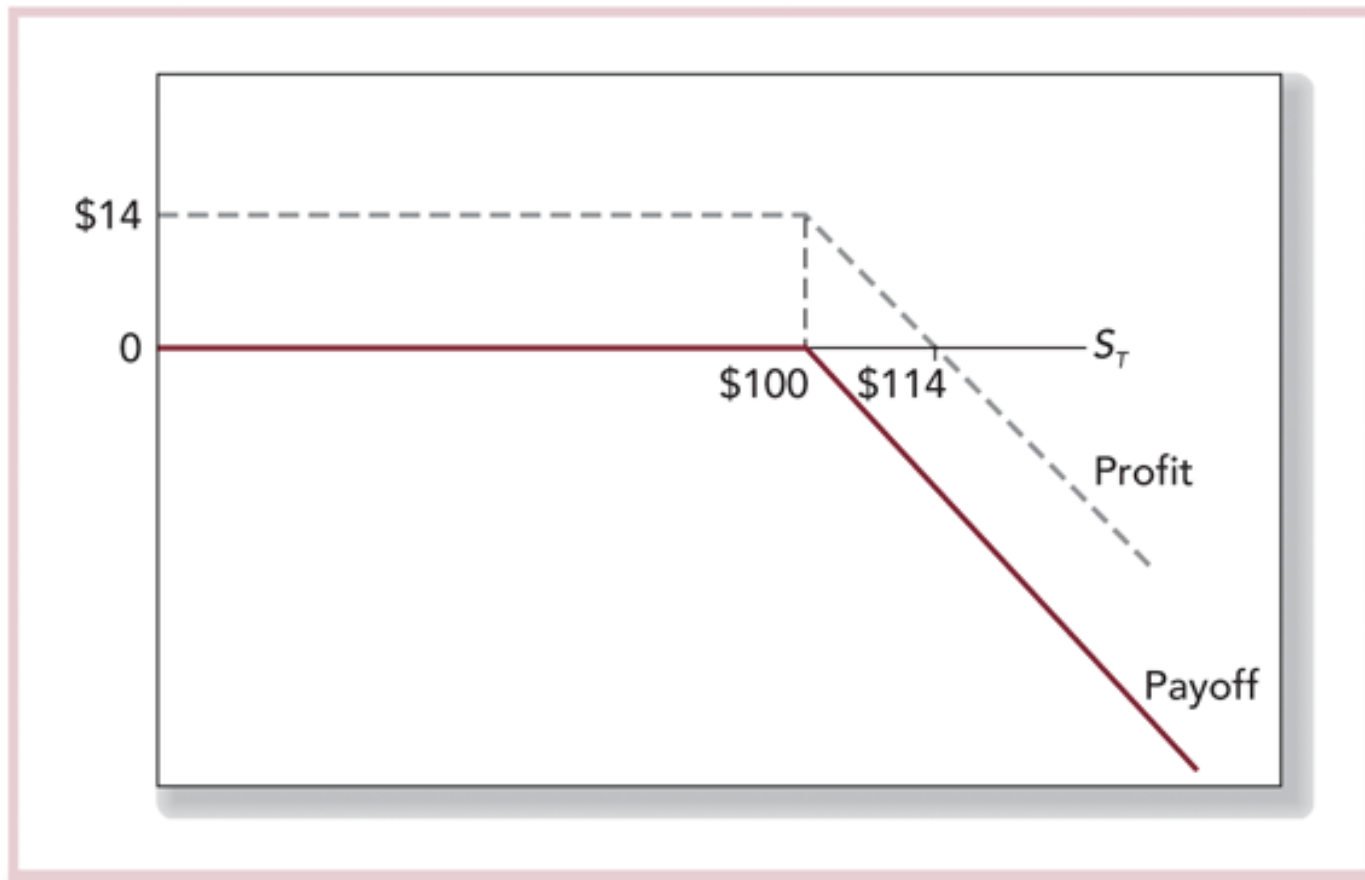
Example: Call option on Apple shares

- Strike price: \$100
- Premium: \$14

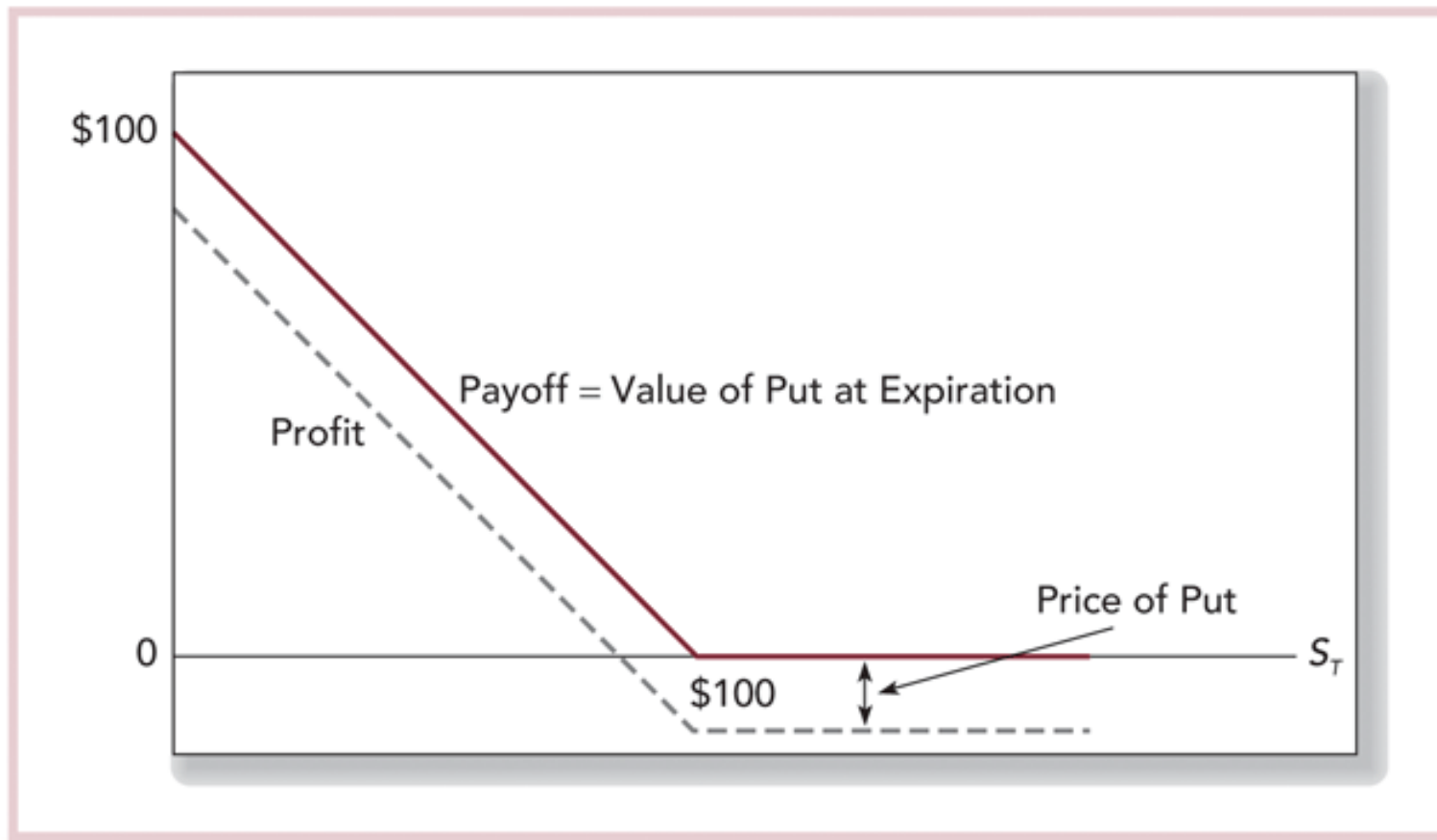
Payoff to the Option Holder



Payoff to the Option Writer



Payoff of a Put Option



Risks of Option Investing

Buying an option leads to:

- large gains if shares move in the right direction
- a total loss if shares move in the wrong direction

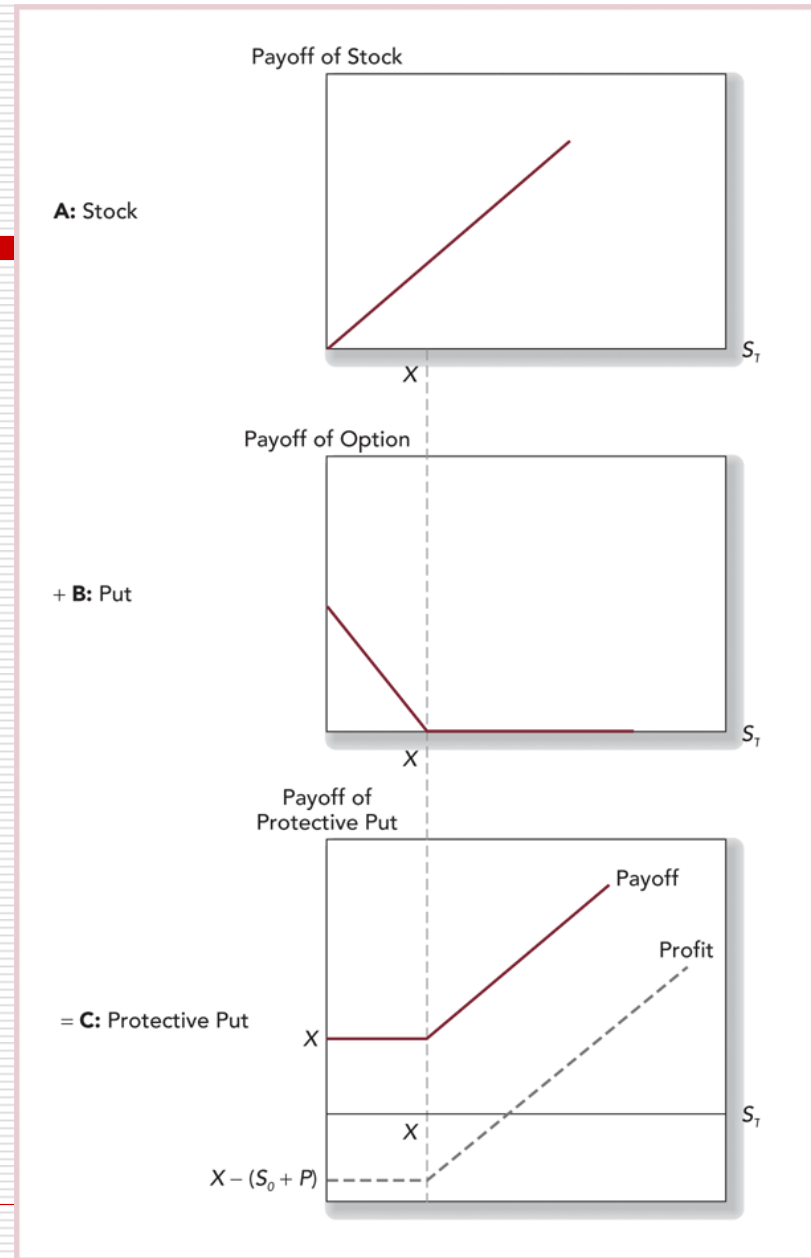
Writing an option leads to:

- immediate income from the premium received
- no losses if shares move in the right direction
- unlimited losses if shares move in the wrong direction

Protective Put

Protective Put Strategy:

- owning a stock
- buying a put to hedge against price declines
- potential losses are limited
- gains are reduced by premium
- “portfolio insurance”

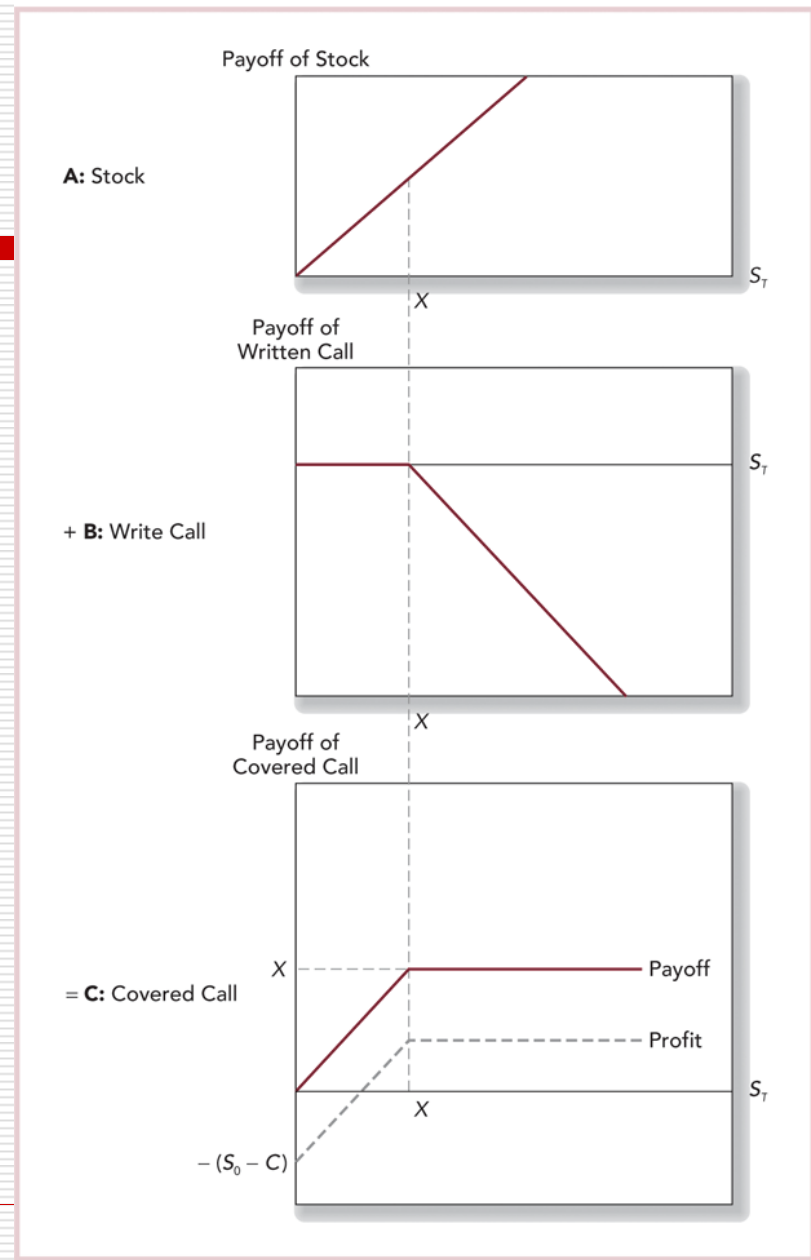


Covered Call

Covered Call Strategy:

- owning a stock
- writing a call option
- obtain premium income
- potential gains are limited by call option

Note: the call option is “covered” by the shares owned, as opposed to “naked” option writing



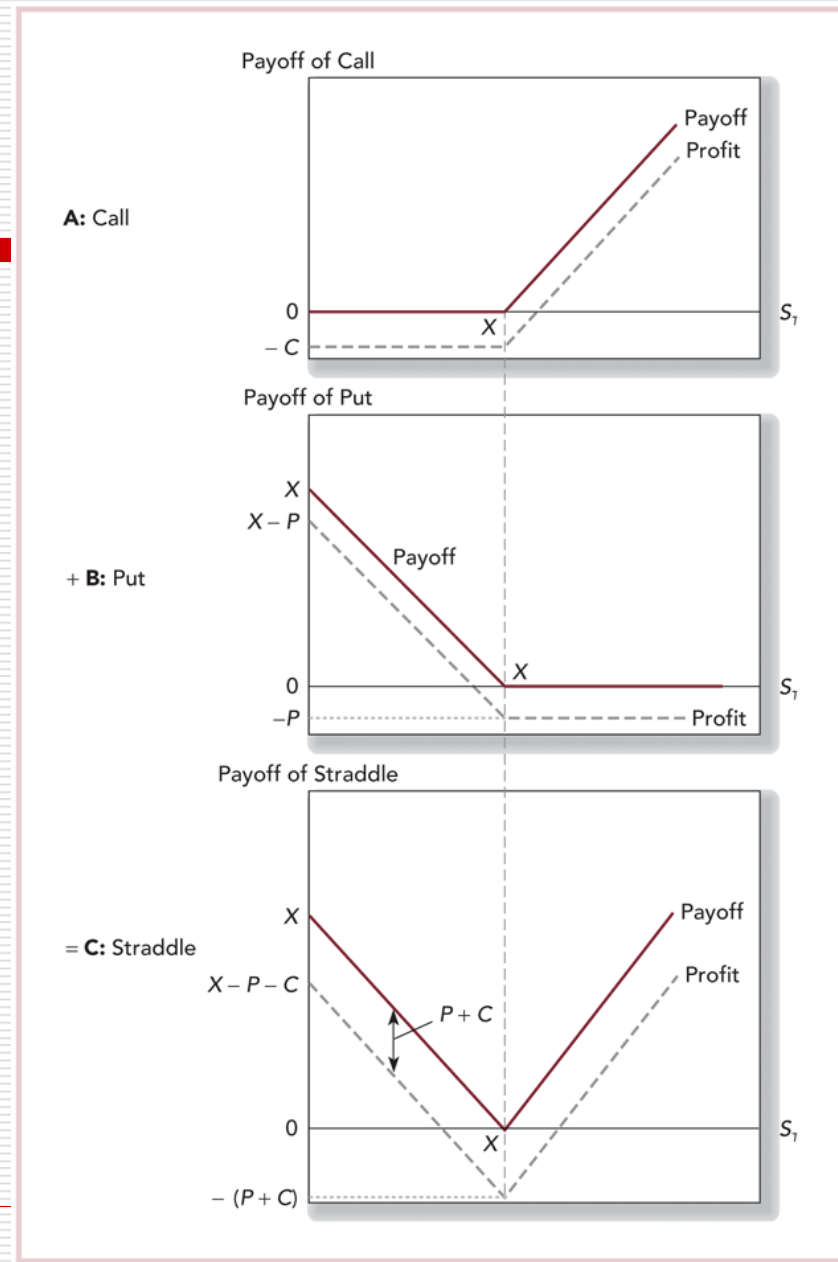
Straddle

Straddle = buying

- a call option and
- a put option

on the same stock with identical strike price

- gain if stock moves sharply up or down
- loss of premium if stock doesn't move much



Put-Call Parity

Two strategies with identical payoffs:

- holding a call option with strike price X and T-bills that pay out X
 - a stock and a put option on it with strike price X (protective put portfolio)
- need to trade at identical price

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

Put-Call Parity: Example

Stock Price = 110

Call Price = 17

Put Price = 5

Risk Free = 5%

Maturity = 1 yr

Strike = 105

$$117 > 115$$

→ sell call and buy put to make a risk-less arbitrage profit of \$2

Payoffs of Arbitrage Strategy

Position	Immediate Cash Flow	Cash Flow in 1 year	
		$S_T < 105$	$S_T \geq 105$
Buy stock	-110	S_T	S_T
Borrow $\$105/1.05 = \100	+100	-105	-105
Sell call	+17	0	$-(S_T - 105)$
Buy put	-5	$105 - S_T$	0
TOTAL	2	0	0