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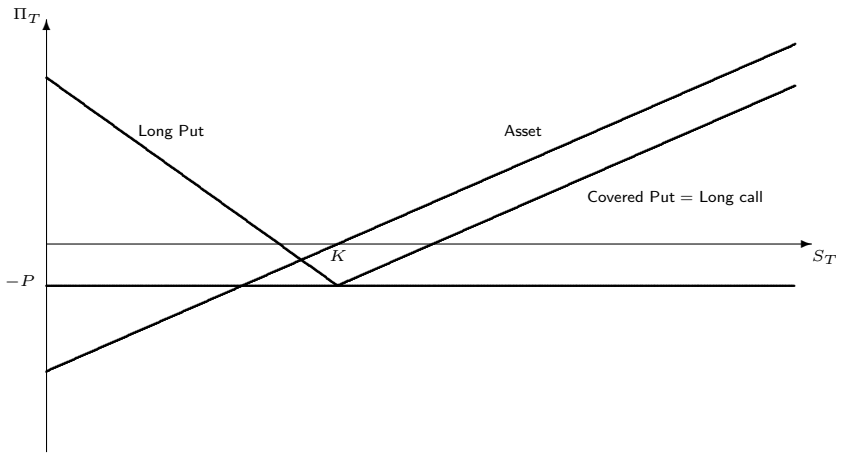
Put-Call parity

Option payoffs at maturity

- If we combine options and the underlying asset, we are able to derive different payoff profiles
- Hedging a long position in the underlying asset with a long put option gives us the payoff of a call option at maturity
- We can therefore use the asset and the put option to create a call option

Hedging with a put option



Investment strategies

- We can invest into the underlying asset and will always obtain the value at maturity of the option, S_T
- Value of call option: $C_T = \max\{0; S_T - K\}$
- Value of put option: $P_T = \max\{0; K - S_T\}$
- We can also invest into a risk-free asset and accumulate interest

Comparing portfolio payoffs

Portfolio A		
Initial investment	Payoff at maturity	
	$S_T < K$	$S_T \geq K$
S	S_T	S_T
P	$K - S_T$	0
	K	S_T

Portfolio B		
Initial investment	Payoff at maturity	
	$S_T < K$	$S_T \geq K$
C	0	$S_T - K$
Ke^{-rT}	K	K
	K	S_T

Relationship between put and call prices

- The portfolios have the same value at maturity of the option, then they must have the same value prior to maturity

$\Rightarrow$ $P = C - S + Ke^{-rT}$

- This relationship is called the Put-Call parity for European options

Implications of the Put-Call parity

- Assume that the strike price is equal to the current price: $K = S$

$\Rightarrow$ $P = C - \left(1 - e^{-rT}\right) K < C$

- If the strike price is equal to the current price of the underlying (at-the-money), put options are worth less than call options
- Profits from put options are limited to the value of the underlying asset, but profits from call options are unlimited

$\Rightarrow$ Profits of call options are potentially higher, requiring a higher premium

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