Andreas Krause

Hedging with options

Option types

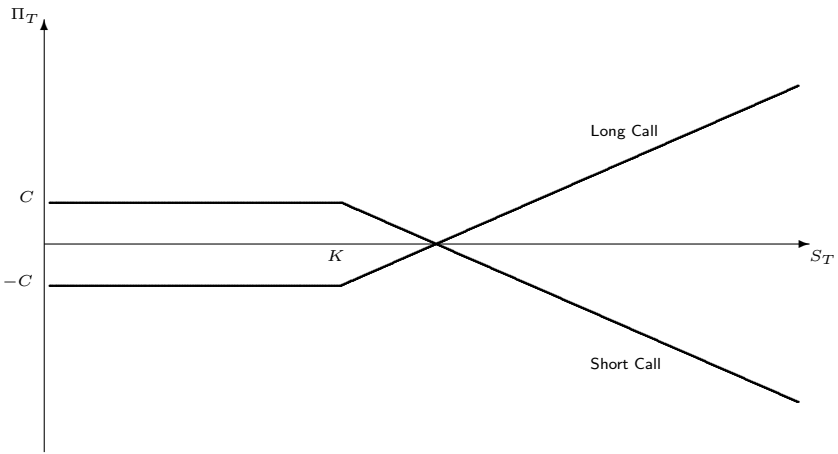
- Options give the purchaser the right (but not the obligation) to buy or sell the underlying asset in the future at a given price (strike price)
- The seller of the option has to sell or buy the underlying asset on demand of the purchaser
- Call options give the right to buy the underlying asset
- Put options give the right to sell the underlying asset
- European options give the right to exercise the option at maturity only
- American options give the right to exercise the option at any time until maturity

European call option payments at maturity

- If at maturity the underlying asset is worth less then the strike price, the option will not be exercised
- Exercising the option would result in buying the asset at a price above its value
- If at maturity the underlying asset is worth more then the strike price, the option will be exercised
- Exercising the option would result in buying the asset below its value
- In this case the profits made by the purchaser are the difference between the asset value and the strike price, provided it is positive, less the option premium paid

$\Rightarrow \Pi_T = \max\{0; S - K\} - C$

Call option payoffs

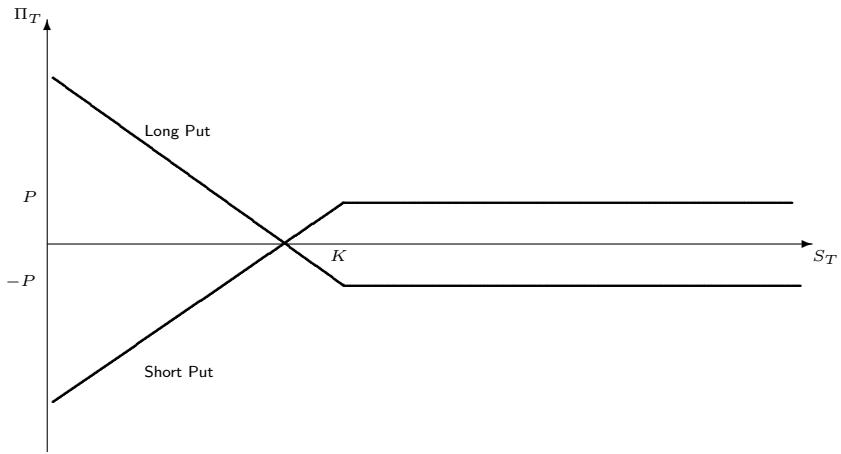


European put option payments at maturity

- If at maturity the underlying asset is worth more then the strike price, the option will not be exercised
- Exercising the option would result in selling the asset at a price below its value
- If at maturity the underlying asset is worth less then the strike price, the option will be exercised
- Exercising the option would result in selling the asset above its value
- In this case the profits made by the purchaser are the difference between the asset value and the strike price, provided it is positive, less the option premium paid

$\Rightarrow \Pi_T = \max\{0; K - S\} - P$

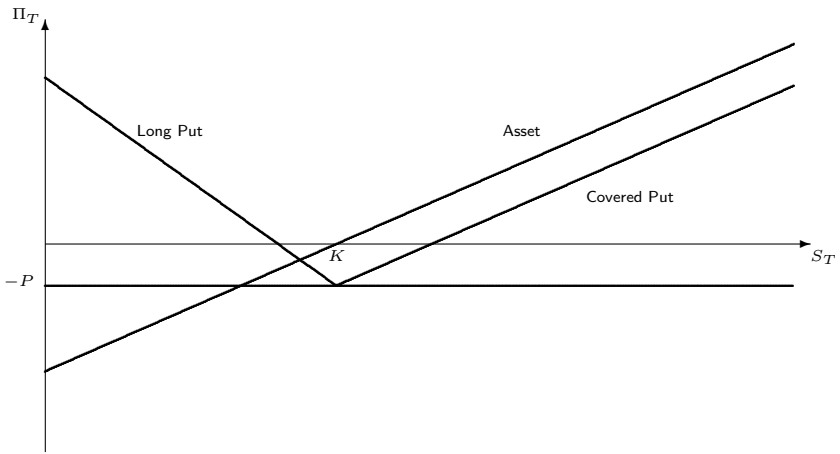
Put option payoffs



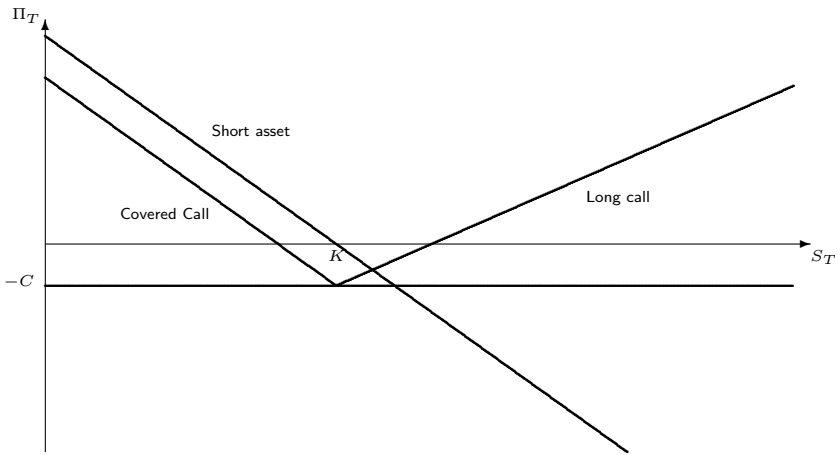
Eliminating risks

- Options can be used to eliminate losses from the underlying asset falling below the strike price (long position)
- Options can be used to eliminate losses from the underlying asset rising above the strike price (short position)
- With options, the risk of losses is eliminated, but the possibility of gains is preserved
- Such protection is not free, an option premium has to be paid

Hedging a long position in the underlying asset



Hedging a short position in the underlying asset



Risk elimination only at maturity

- Purchasing an option that allows to sell or buy the position if it is loss-making, eliminates the risk of losses from the underlying asset beyond the strike price
- As an option premium is payable, losses are not fully eliminated but cannot exceed the premium paid
- Risk is only eliminated at maturity of the option, the value of the portfolio can vary prior to maturity

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