

Andreas Krause

Hedging with options

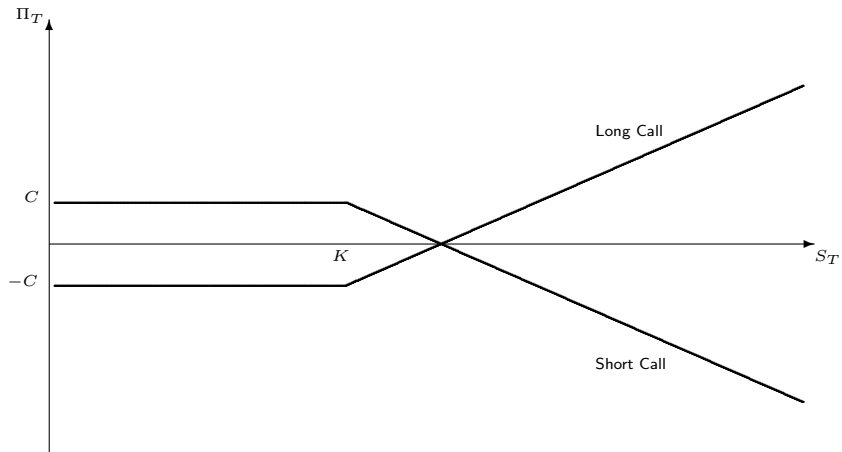
Option types

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

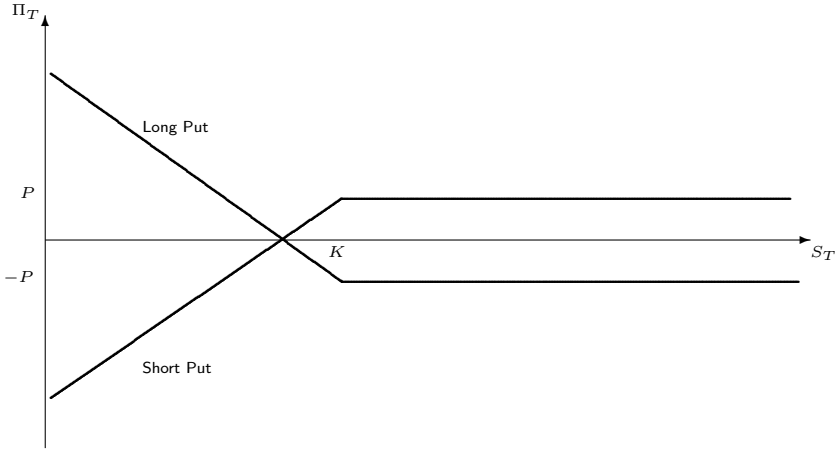
Call option payoffs



European put option payments at maturity

- ▶ If at maturity the underlying asset is worth more than 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 than 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
- ▶ $\Pi_T = \max \{0; K - S\} - P$

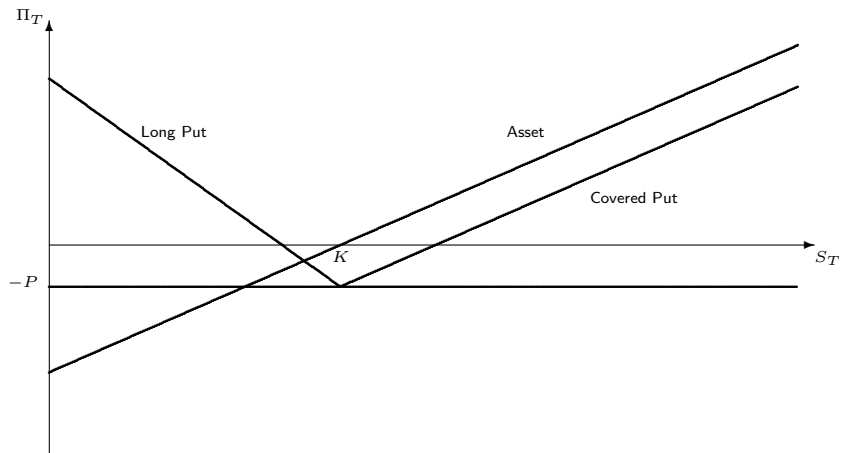
Put option payoffs



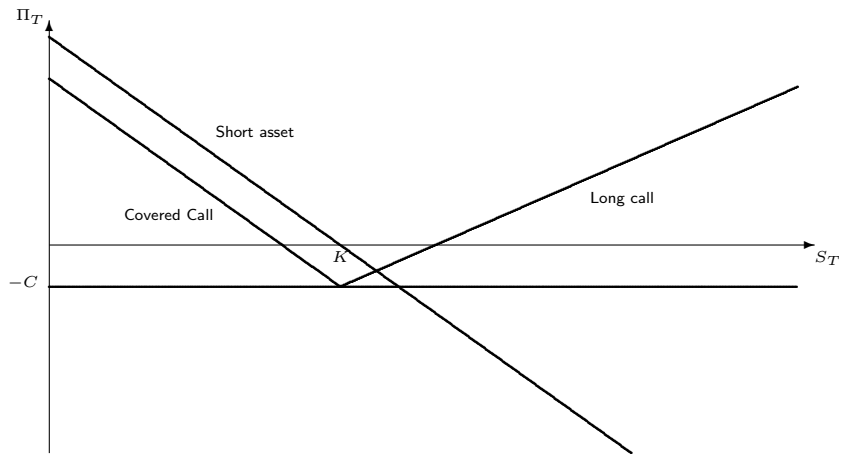
Eliminating risks

- ▶ 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



Copyright © by Andreas Krause

Picture credits:

Cover: Premier regard, Public domain, via Wikimedia Commons, [https://commons.wikimedia.org/wiki/File:DALL-E_-_Financial_markets_\(1\).jpg](https://commons.wikimedia.org/wiki/File:DALL-E_-_Financial_markets_(1).jpg)

Back: Rhododendrites, CC BY-SA 4.0 <https://creativecommons.org/licenses/by-sa/4.0>, via Wikimedia Commons, [https://upload.wikimedia.org/wikipedia/commons/0/04/Manhattan_at_night_south_of_Rockefeller_Center_panorama_\(11263p\).jpg](https://upload.wikimedia.org/wikipedia/commons/0/04/Manhattan_at_night_south_of_Rockefeller_Center_panorama_(11263p).jpg)

Andreas Krause
Department of Economics
University of Bath
Claverton Down
Bath BA2 7AY
United Kingdom

E-mail: mnsak@bath.ac.uk