# Options

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1

# Options

- Put Options
- Call Options
- Examples of derivatives

2

# Put Options

- A ***put*** option is a contract that gives the owner the right, but not the obligation, to ***sell*** an underlying asset, at a fixed price ($K), on (or on or before) a specific day.
- The put writer is obligated to buy the underlying asset, and pay $K for it.

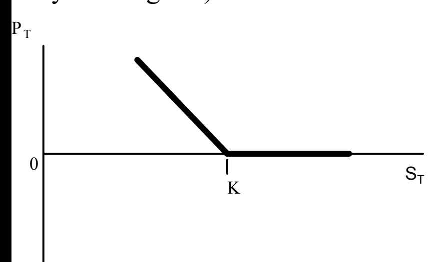
3

# Put Options

- Define S as the price of the underlying asset, and K as the strike price.
- In, out of, and at the money for puts
  - In the money if $S < K$
  - Out of the money if $S > K$
  - At the money if $S \sim K$
  - Deep in (out of) the money if $S << K$ ($S >> K$)
- Intrinsic value of a put = max(0,K-S)

4

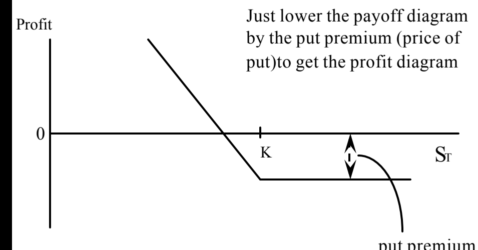
# Value of Put at Expiration (A.K.A. Payoff Diagram)




5

# Profit Diagram -- Long Put (Buying a Put)

Just lower the payoff diagram by the put premium (price of put)to get the profit diagram




6

## Example of a Put Option

- *buy a put option to purchase 100 Exxon shares*
  - *strike price = $70*
  - *price of an option to buy one share = $7*
- *initial investment is 100 x $7 = $700*
- *The outcome*
  - *Exxon's share price is $55 at the expiration*
  - *to exercise the option for a gain of ($70-$55) x 100 = $1,500*
  - *the net gain = $1,500 - $700 = $800*



## Example of a Put Option (cont.)

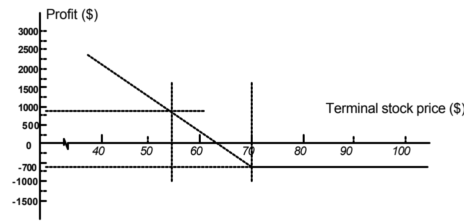
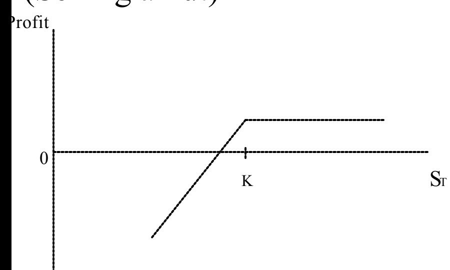



**Figure** Profit from buying a Put Option on 100 Exxon share. Option price = $7; strike price = $70



## Profit Diagram – Short Put (Selling a Put)






## Insurance

- Insurance. If you own the underlying asset, buying a *put* provides protection against the possibility that the underlying asset price will fall below $K. Of course, insurance costs money (the put premium).



## Call Options

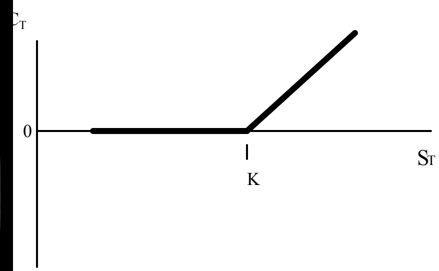
- A call option is a contract that gives the owner the right, but not the obligation, to buy an underlying asset, at a fixed price, on (or on or before) a specific day.
- The fixed price is called the *strike price*, or the *exercise price*.



## Call Options

- In, out of, and at the money: Define S as the price of the underlying asset, and K as the strike price. Then, for a call:
  - In the money if S > K
  - Out of the money if S < K
  - At the money if S ~ K
  - Deep in (out of) the money if S >> K (S << K)

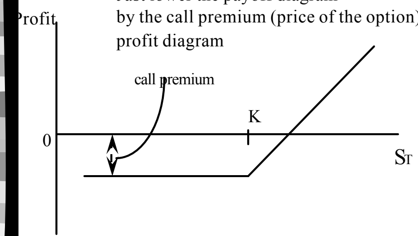
## Value of Call at Expiration, (A.K.A. Payoff Diagram)




13

## Profit Diagram -- Long Call (Buying a Call Option)

Just lower the payoff diagram
by the call premium (price of the option), to get the profit diagram



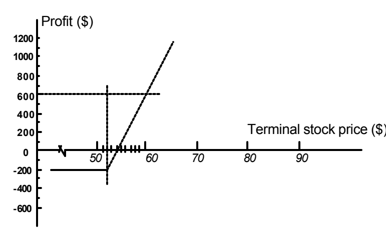

14

## Example of a Call Option

- *buy a call option to purchase 100 MSFT share*
  - *strike price = $52*
  - *current share price = $50*
  - *price of an option to buy one share = $2*
- *initial investment is 100 x $2 = $200*
- *The outcome*
  - *MSFT's share price is $55 at the expiration*
  - *to exercise the option for a gain of ($55-$52) x 100 = $300*
  - *the net gain = $300 - $200 = $100*

15

## Example of a Call Option (cont.)




16

## Example of a Call Option

- *buy a call option to purchase 100 IBM shares*
  - *strike price = $100*
  - *current share price = $98*
  - *price of an option to buy one share = $5*
- *initial investment is 100 x $5 = $500 (Worse case is that this will be lost)*
- *The outcome*
  - *IBM's share price is $115 at the expiration*
  - *to exercise the option for a gain of ($115-$100) x 100 = $1,500*
  - *the net gain = $1,500 - $500 = $1,000*

17

## Example of a Call Option (cont.)

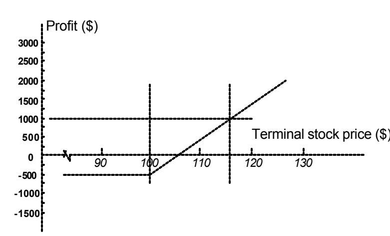
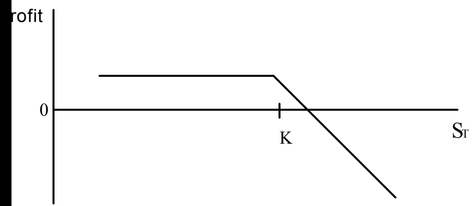



**Figure** Profit from buying a Call Option on 100 IBM share. Option price = $5; strike price = $100

18

# Profit Diagram – Short Call (Selling a Call Option)




19

# Example of a Call Option (cont.)

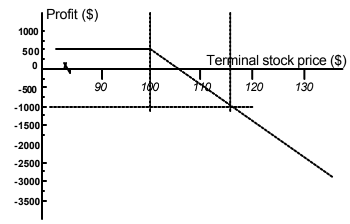



**Figure** Profit from writing a Call Option on 100 IBM share. Option price = $5; strike price = $100

20

# Example of a Put Option (cont.)

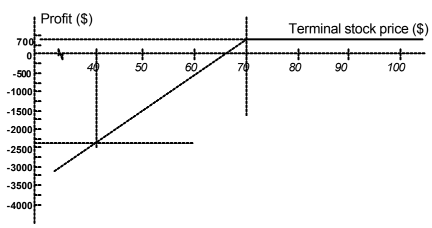
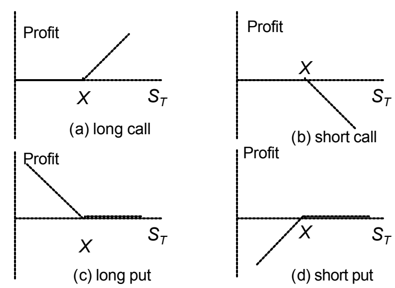



**Figure** Profit from writing a Put Option on 100 Exxon share. Option price = $7; strike price = $70

21

# Option Positions (cont.)




22