

Options

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An option gives the holder of the option the right to do something, but the holder does not have to exercise this right. By contrast, in a forward or future contract, the two parties have committed themselves to some action. It costs a trader nothing to enter into a forward or future contract, whereas the purchase of an option requires an up-front payment called option price.

Types of options.

- 1) Call option! - A call option gives the holder of the option the right to buy an asset by a certain date for certain price.
- 2) Put option! - It gives the holder the right to sell an asset by a certain date for certain price.

Options can either be American or European.

American option! - It can be ~~exercised~~ exercised at any time up to expiration date.

European option! - It can be exercised only on the expiration date.

The date specified in the contract is known as expiration date or maturity date.

The price specified in the contract is known as the exercise price or the strike price.

Call options!- Call options should always be ~~exercised~~ exercised at the expiration date if the stock price is above the strike price.

Example!- buys a European call option with a strike price of \$100 per share to purchase 100 shares. Let price of an option to purchase is \$5 per share and expiration date of option is 4 months. Suppose the current stock price is \$98.

If the stock price after 4 months is less than \$100. $\rightarrow$ will not exercise

If the stock price is more than \$100 (say \$115) then investor will exercise the option

$$\text{In this case profit} = 100 \times (115 - 100) - 500 = 1500 - 500 = \$1000$$

If price of stock is \$102.

$$\text{profit} = 100 \times (102 - 100) - 500 = \$-300 \quad \left(\begin{array}{l} \text{less we have} \\ \text{less but still} \\ \text{we exercise} \end{array} \right)$$

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Put options:- Put options should always be exercised at the expiration date if the stock price is below the strike price.

Example:- buys a European put option with strike price of \$100 per share to sell 100 shares. Other data is same as ~~earlier~~ earlier example.

Then If the stock price is above \$100, say \$110.
→ will not exercise the option, rather sell the shares in market.

and if the stock price is below strike price say \$80 → then exercise the option

$$\text{Profit} = 100 \times (100 - 80) - 500 = \$1500$$

Factors affecting Option Prices:-

There are six factors affecting the price of a stock option:

- 1.) The current stock price, S_0 .
- 2.) The strike price, K .
- 3.) The time to expiration, T .
- 4.) The volatility of the stock price, σ .
- 5.) The risk-free interest rate, r .
- 6.) The dividends that are expected to be paid.

Stock Price and Strike price

Call option become more valuable as the the stock price increases and less valuable as the strike price increases.

Put option becomes less valuable as the stock price increases and more valuable as the the strike price increases.

Time to expiration:-

Put and call American option become more valuable as the time to expiration increases.

European option usually become more valuable as the time to expiration increases, but not always.

Volatility:- Volatility of a stock price is a measure of how uncertain we are about future stock price movements.

Values of both calls and puts increases as the volatility increases.

Risk-free interest rate:-

As risk-free interest increase, value of call option increases, whereas value of put option decreases.

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Amount of future dividends:-

The value of option is negatively related to the size of the dividend if the option is a call and positively related if the option is put.

Put - Call Parity

Consider the two portfolio:

A :- One European call option plus a zero-coupon bond that provides a payoff of K at time T .

B :- One European put option plus one share of the stock.

We are using following notations.

$S_0 \rightarrow$ Current stock price

$K \rightarrow$ Strike price of option

$T \rightarrow$ Time to expiration of option

$S_T \rightarrow$ Stock price on the expiration date

$r \rightarrow$ Continuously compounded risk-free rate of interest for time T .

$C \rightarrow$ Value of American call option

$P \rightarrow$ Value of American Put option

$c \rightarrow$ value of European call option

$p \rightarrow$ value of European put option.

Values of portfolio A and Portfolio C at time T

		$S_T > K$	$S_T < K$
A	Call option	$S_T - K$	0
	zero-coupon bond	K	K
	Total	S_T	K
C	Put option	0	$K - S_T$
	Share	S_T	S_T
	Total	S_T	K

So, both portfolio are worth $\max(S_T, K)$ when the option expires at time T.

And since the portfolios have identical value at time T, they must have identical values today.

Components of portfolio A are worth $C + Ke^{rt}$ today and ———— portfolio C are worth $P + S_0$ today

Hence, $C + Ke^{rt} = P + S_0$

This relationship is called Put-call parity.