



SECTION - 6

OPTIONS

This Section includes

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6.1. OPTIONS

- 6.1.1 Options are derivative instruments that give the buyer a right to buy or sell an underlying asset at a specified price on or before a certain period.
- 6.1.2 Options are another type of financial derivative product available for risk management.
- 6.1.3 Options help manage contingent risks, which means risks to which we will be exposed if a particular event or situation happens.
- 6.1.4 Assume that a company has submitted a tender bid for a large, overseas contract, bids to be in US dollars. The event here is winning the award of the contract, which will create considerable foreign exchange risk.
- 6.1.5 Options are traded on exchanges. The Chicago Board Options Exchange(CBOE) was the first registered securities exchange for the trading of options.

6.2. BASIC STRUCTURE OF OPTIONS

- 6.2.1 The following are the important basic parties and features of option contracts:
- Underlying asset: An option is a contract derived from an underlying asset which can be a share, bond or interest rate or commodity.
 - Parties: There are two main parties in an option contract, namely the buyer and the seller or the writer. The buyer of the option has the right but no obligation and the seller or writer of the option has the obligation and no right.
 - The buyer and the seller of the options have different expectations about the future.
 - Strike price: This is the price at which the buyer can either buy or sell an asset.
 - Time: the right to buy or sell is valid within a certain period. In other words, the option expires on a specified date.
 - Option premium: To obtain the right to buy or sell, the option buyer has to pay certain amount of money which is known as the option price or premium which can also be called the value of the option.



6.3. TYPES OF OPTIONS

- 6.3.1 **Call option:** Call option is the right to buy an underlying asset at the strike price on or before a certain time. Call option is entered into when a buyer anticipates that the price of the underlying is likely to increase in future.
- 6.3.2 **Put option:** Put option is the right to sell an underlying asset at the strike price on or before a certain time. Put option is entered into when a buyer anticipates that the price of the underlying is likely to go down in future.
- 6.3.3 Premium is the price paid by the option buyer to the option seller upfront.

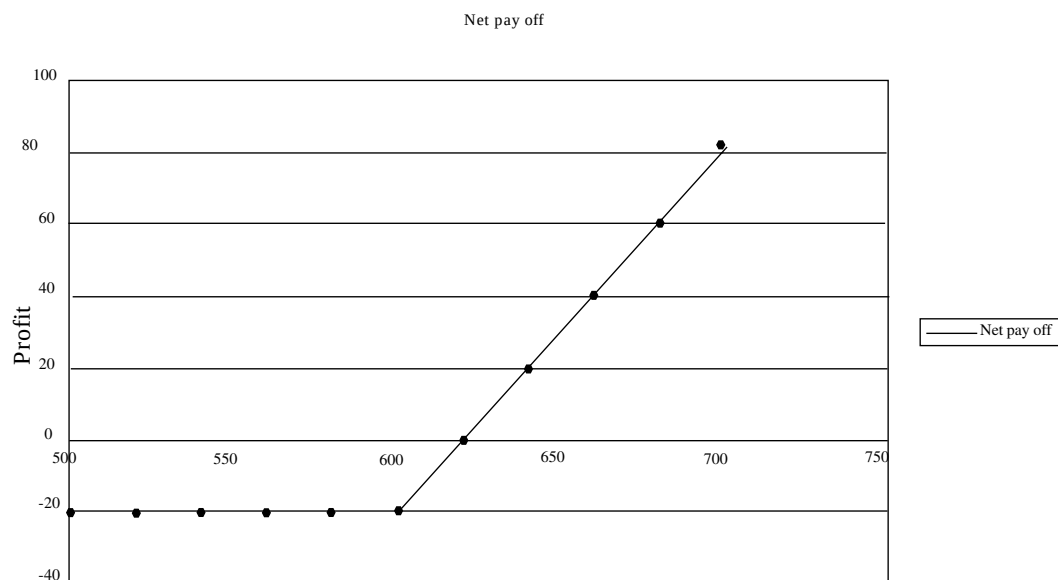
6.4. ILLUSTRATIONS USING PAY OFF DIAGRAMS OF RISK MANAGEMENT THROUGH OPTIONS

Call option[Buyer]	
spot price	500
Exercise price	600
Option premium	20
Profit	-20

- The spot price is today's price of the underlying asset
- In the above example, the call buyer has the right to buy the asset at 600 in three month's time and its today's price is 500. He expects that the price will be above 600 in three months to come.
- Option premium is the price to be paid per contract
- If the spot price is 500, he is incurring a loss of 20 as he will not exercise his right to buy this asset at 600 as in the market it is available for 500. Option has value only when the spot price is above the exercise price. Then it is called the "in-the-money" call option otherwise, it is called the out of the money call option
- The main advantage of option is that it gives the owner, the right to benefit in case the conditions are favorable and incur only the premium cost in case things are not favorable. This is the most unique feature of the option which is it protects the buyer from the downside while leaving the upside potential intact.
- The pay off table shows the relationship between the spot price and the net cash flows from an option.
- Pay off table of a call option buyer:

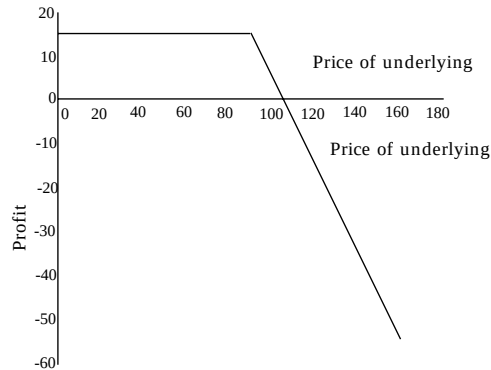
Spot price	Net pay off
500	-20
520	-20
540	-20
560	-20
580	-20
600	-20
620	0
640	20
660	40
680	60
700	80

- The option buyer incurs a loss of only 20 as long as the spot price is below the strike price
- The option buyer has the right to exercise his option of buying this asset at the agreed exercise price even though the spot price is much above the strike price when the option buyer's net pay off turns positive and keeps increasing as the spot price increases over and above the strike price.



Sold Call option

Pay-off diagram at option expiration



- Sell option, so gain the premium
- Lose if price of underlying rises and option in-the-money
- Maximum gain when option expires worthless, gain premium

- In the above case, the seller of the call option gains when spot price is below the strike price and starts losing when the spot price is above the strike price as the buyer of the option will exercise his option. The seller of the call option expects the price to go down. He collects the option premium upfront which is his gain

Put option buyer:

- Put option is the right to sell an asset at a predetermined price, known as the exercise price.
- The buyer of the put option expects the price of the underlying to go down
- The buyer of the put option protects himself against the price decrease

Put option[Buyer]	
spot price	500
Exercise price	600
Option premium	20
Profit	80

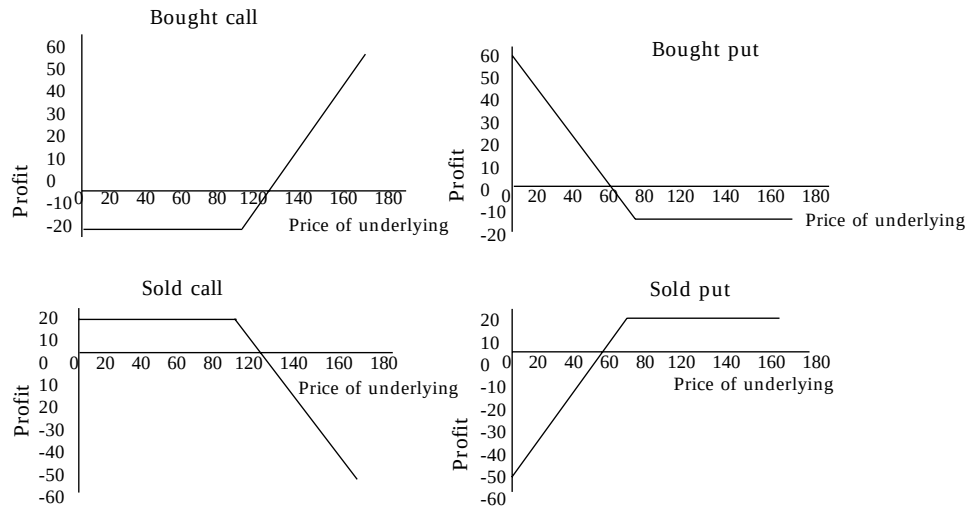
Spot price	Net pay off
500	80
520	60
540	40
560	20
580	0
600	-20
620	-20
640	-20
660	-20
680	-20
700	-20

- As long as the spot price is below the strike price, the buyer of the put option gains and when once the spot price is above the strike price, the loss is restricted to only the option premium paid as the buyer of the put option has only the right and not the obligation to sell.

6.5. SUMMARY

- 6.5.1 The diagram below shows the summary of different payoff diagrams of option buyer and option seller, in the case of call option and put option.
- 6.5.2 The most important point to be noted is that in the case of a buyer of a call option or put option, the buyer has the potential to obtain unlimited benefits if the conditions are favorable while restricting the loss to only the option premium.
- 6.5.3 In the case of the seller of a call or put option known as the writer of the option, there is a possibility of unlimited loss but the writer collects the premium upfront.
- 6.5.4 It is possible to be an option buyer and seller at the same time which opens up the possibility of infinite number of combinations and pay offs to be engineered by an investor. This discipline is known as financial engineering.

Call and put options





6.6. OPTION VALUATION

6.6.1 The price of an option is the option premium. At any point in time, the buyer or seller of the option must judge whether an option is under priced or overpriced.

6.6.2 There are two popular models for determining the option value, namely the Binomial and Black and Scholes models.

6.6.3 Option value is driven by a number of variables, as explained below:

- Let C = call option price
- S = current price
- K = strike price
- T = time to expiry
- R = risk free rate of interest
- S_d = standard deviation of the price of the underlying

6.6.4 Drivers of option value:

- $S-K$, the difference between the current price and the exercise price
 - If the strike price is more than the current price, likelihood of option being exercised is small, and so its value
- S_d , the volatility
 - The higher the volatility, the chances of spot price being much higher or lower at expiry than now is relatively high and hence the higher value of the option
- T , Time to expiry
 - The longer the option has to run, the greater the chance that the price will end up above the exercise price, so as t gets longer, the option value goes higher
- R , the risk free interest rate
 - This is to account for the time value of money

6.7. OPTION VALUATION MODEL-THE BLACK AND SCHOLES MODEL

S	25	Current stock price
X	25	Exercise price
r	6.00%	Risk-free rate of interest
T	0.5	Time to maturity of option (in years)
sd	30%	Stock volatility
Call price $C = S N(d_1) - K e^{-rt} N(d_2)$		
d_1	0.2475	$\leftarrow (LN(S/X) + (r + 0.5 \cdot sd^2) \cdot T) / (sd \cdot \sqrt{T})$
d_2	0.0354	$\leftarrow d_1 - sd \cdot \sqrt{T}$
$N(d_1)$	0.597	$\leftarrow$ Uses formula NormSDist(d_1)
$N(d_2)$	0.5141	$\leftarrow$ Uses formula NormSDist(d_2)
Call price	2.47	$\leftarrow S \cdot N(d_1) - X \cdot \exp(-r \cdot T) \cdot N(d_2)$
Put price	1.73	$\leftarrow$ call price - S + X * Exp(-r*T): by Put-Callparity