Let’s Talk Options!

Options - Introduction

Technical Terms -

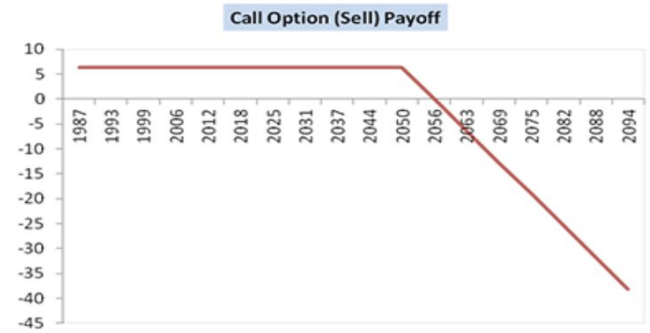
- Strike Price :- The price at which an option can be exercised.
- Underlying Price :- The underlying price is the price at which the underlying asset trades in the spot market.
- Exercising of an option contract :- The act of claiming your right to buy the options contract at the end of the expiry.
- Option Expiry :- Similar to a futures contract, options contract also has expiry.
- Option Premium :- Premium is the money required to be paid by the option buyer to the option seller/writer. Against the payment of premium, the option buyer buys the right to exercise the option.

Call Options -

- The buyer of the call option has the right, but not the obligation to buy an agreed quantity of the underlying from the seller, at the expiration date for the strike price. The seller (or “writer”) is obligated to sell the commodity or financial instrument should the buyer so decide. The buyer pays a fee (called a premium) for this right.

Call Buying	Call selling
It makes sense to be a buyer of a call option when you expect the underlying price to increase. If the underlying price remains flat or goes down then the buyer of the call option loses money.	Selling a call option makes sense only when you believe that upon expiry, the underlying asset will not increase beyond the strike price. If the underlying price remains flat or goes up then the seller of the call option loses money.

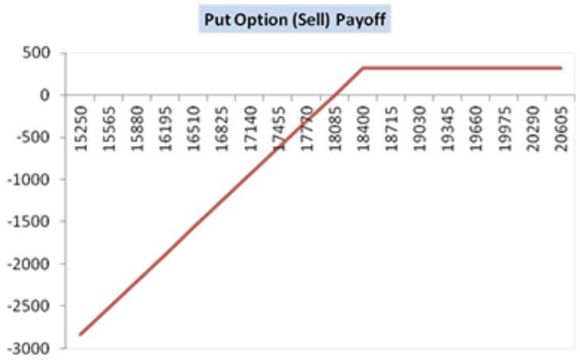
The call option buyer has limited risk (to the extent of the premium paid) and a potential to make an unlimited profit.	The profit of an option seller is restricted to the premium he receives, however his loss is potentially unlimited. Since a short option position carries unlimited risk, he is required to deposit margin.
Intrinsic value, IV = Spot Price – Strike Price	

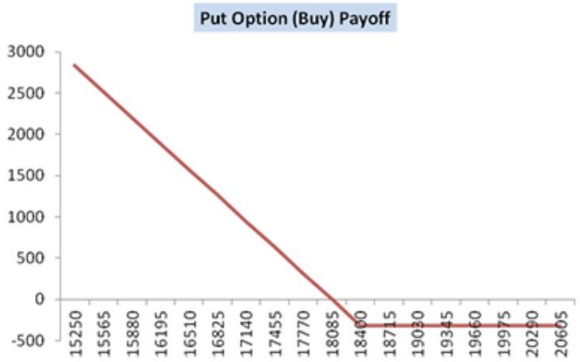


Put Options -

- A put option buyer buys the right to sell the underlying to the put option writer at the strike price. This means the put option seller, upon expiry will have to buy if the ‘put option buyer’ is selling him.

Put Buying	Put selling
It makes sense to buy a put option when you are bearish about the prospects of the underlying.	Clearly the put option seller must have a bullish view on the markets.
The loss is limited to the extent of the premium paid. The gains can be potentially unlimited.	The loss is theoretically unlimited (therefore the risk). The gains are restricted to the extent of premium received.
Intrinsic value, IV = Strike Price – Spot Price	





Summary -

Market View	Option Type	Alternatives	Premium
Bullish	Long Call	Buy Futures or Buy Spot	Pay
Flat or Bearish	Short Put	Buy Futures or Buy Spot	Receive
Flat or Bearish	Short Call	Sell Futures	Receive
Bullish	Long Put	Sell Futures	Pay

Moneyness of the option -

Moneyness of an option is a classification method which classifies each option strike based on how much money a trader is likely to make if he were to exercise his option contract today. There are 3 broad classifications -

- In the Money (ITM) - Profitable
- At the Money (ATM) - Neutral
- Out of the Money (OTM) - Loss-making

Options - Greeks

- Delta – Measures the rate of change of options premium based on the directional movement of the underlying.

- Gamma – Rate of change of delta itself.

- Vega – Rate of change of premium based on change in volatility.

- Theta – Measures the impact on premium based on time left for expiry.

Delta

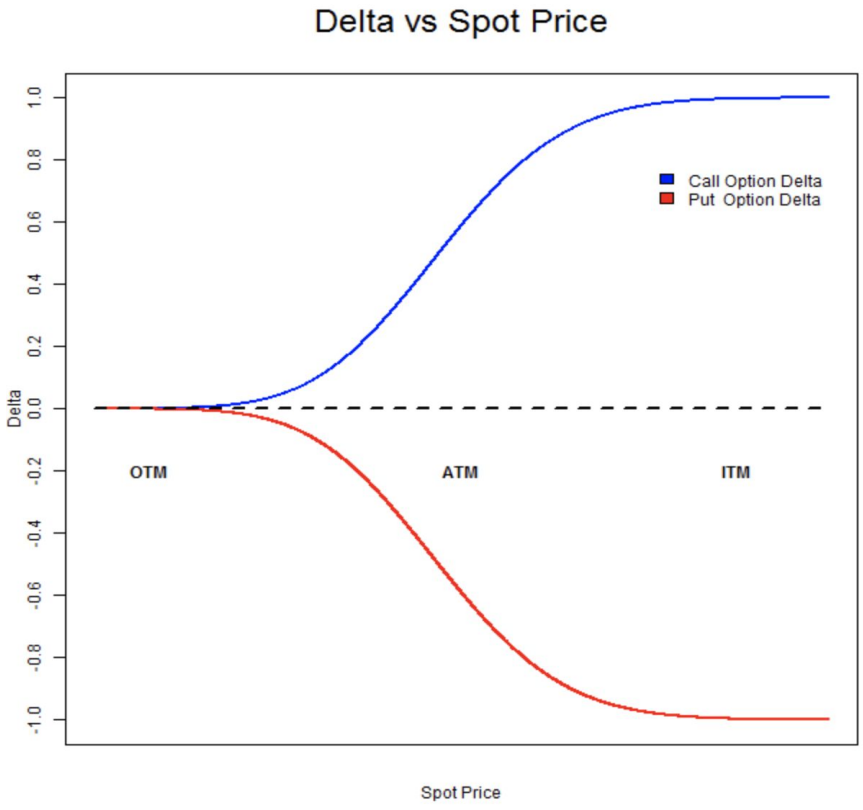
- Option Greek's 'Delta' captures the effect of the directional movement of the market on the Option's premium.

- Between 0 and 1 for a call option, Between 0 and -1 for a put option.

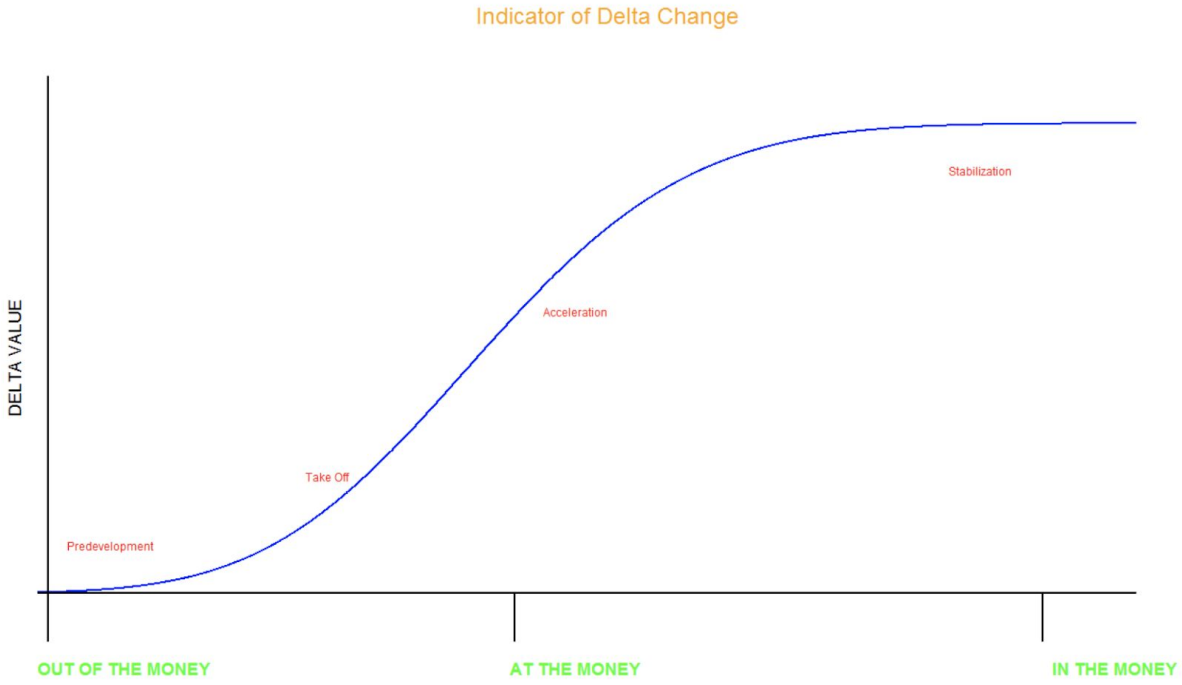
- An approx estimate -
  Expected change in option premium = Option Delta * Points change in underlying

Option Type	Approx Delta value (CE)	Approx Delta value (PE)
Deep ITM	Between + 0.8 to + 1	Between – 0.8 to – 1
Slightly ITM	Between + 0.6 to + 1	Between – 0.6 to – 1
ATM	Between + 0.45 to + 0.55	Between – 0.45 to – 0.55
Slightly OTM	Between + 0.45 to + 0.3	Between – 0.45 to -0.3
Deep OTM	Between + 0.3 to + 0	Between – 0.3 to – 0

Delta vs Spot price



Delta Acceleration



- Predevelopment
    - This is the stage when the option is OTM or deep OTM. The delta here is close to 0. The delta will remain close to 0 even when the option moves from deep OTM to OTM.
    - Deep OTM options tend to put on an impressive percentage however for this to happen the spot has to move by a large value.

- Take off & Acceleration
    - This is the stage when the option transitions from OTM to ATM. This is where the maximum bang for the buck lies, and therefore the risk.
    - The slightly OTM option which usually has a delta value of say 0.2 or 0.3 is more sensitive to changes in the underlying. For any meaningful change in the underlying the percentage change in the slightly OTM options is very impressive.

- Stabilization
    - When the option transitions from ATM to ITM and Deep ITM the delta starts to stabilize at 1. The delta starts to flatten out when it hits the value of 1.
    - Buying a deep ITM option is as good as buying the underlying itself.

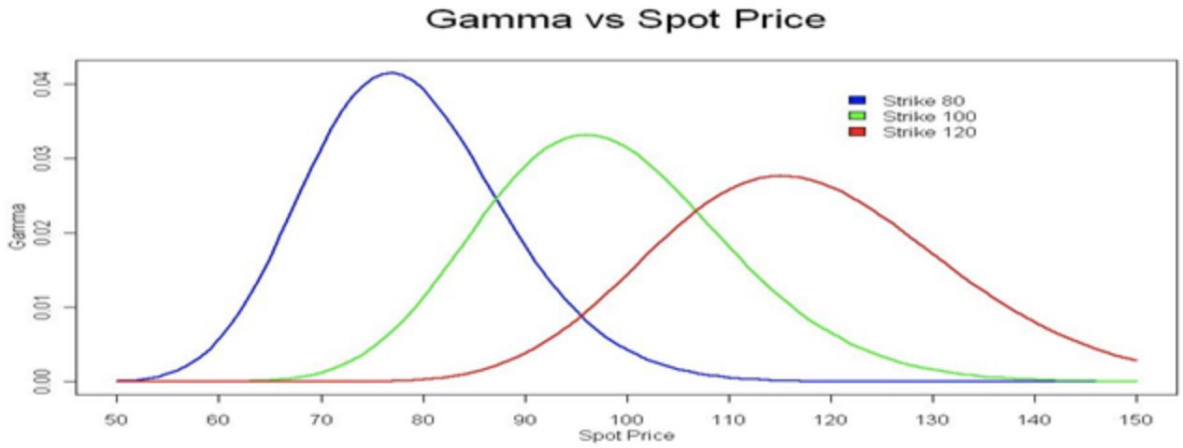
Gamma

- Change in delta is with respect to change in the underlying value is captured by Gamma, hence Gamma is called the 2nd order derivative of the premium.

- Gamma also changes with the change in the underlying. This change in Gamma due to changes in underlying is captured by 3rd derivative of underlying called “Speed”.

- Gamma is always a positive number for both Call and Put Option.

Gamma vs Spot Price



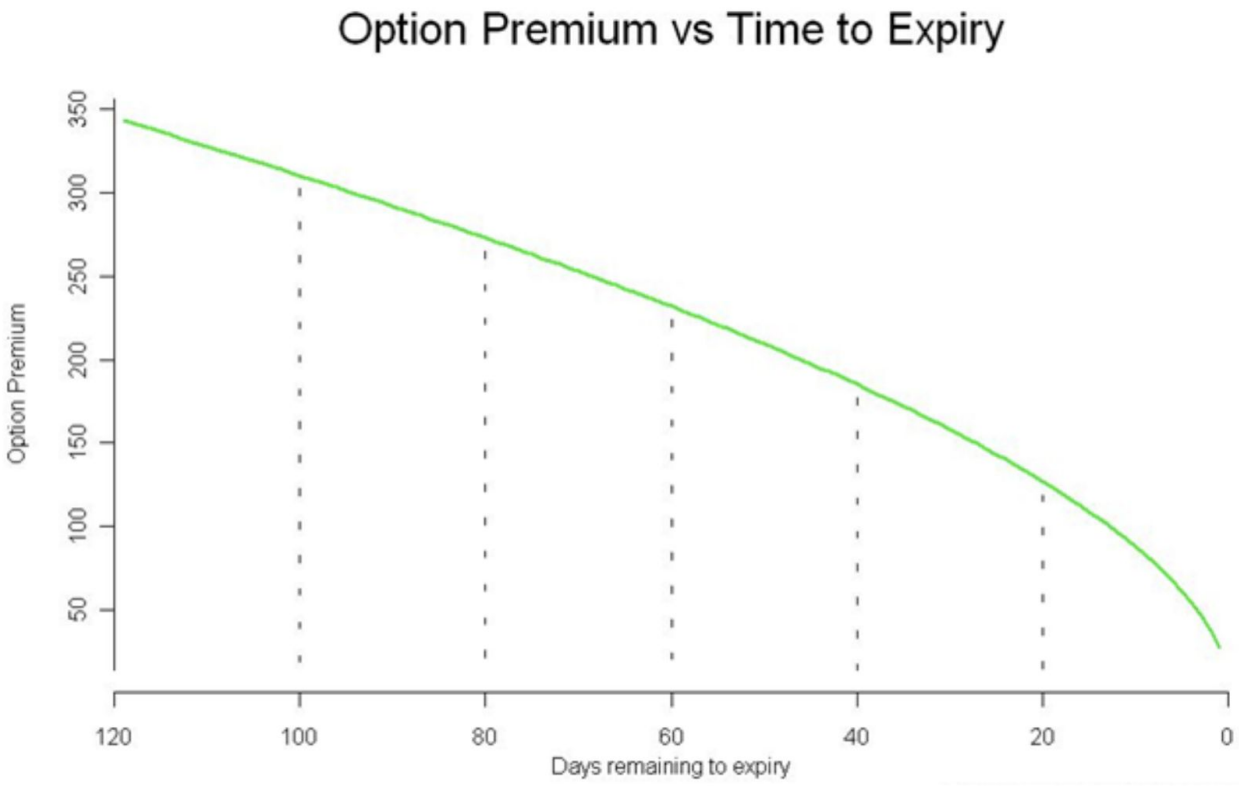
Theta

- The Theta or time decay factor is the rate at which an option loses value as time passes. Time runs in one direction, hence theta is always a positive number, however to remind traders it’s a loss in options value it is sometimes written as a negative number.

- Option buyer in order to entice the option seller to sell options offers to compensate for the ‘time risk’ (given time, there is always a chance for the option to expire ITM which is a risk seller assumes). This is called the “time value”.
  Premium = Time value + Intrinsic Value

- All other things being equal, an option is a depreciating asset. The option's premium erodes daily and this is attributable to the passage of time.

Option premium vs Time to Expiry



- Selling options at the start of the series – have the advantage of pocketing a large premium value (as the time value is very high) but the fall in premium happens at a low rate. Selling options closer to the expiry – get a lower premium but the drop in premium is high, which is advantageous to the options seller.

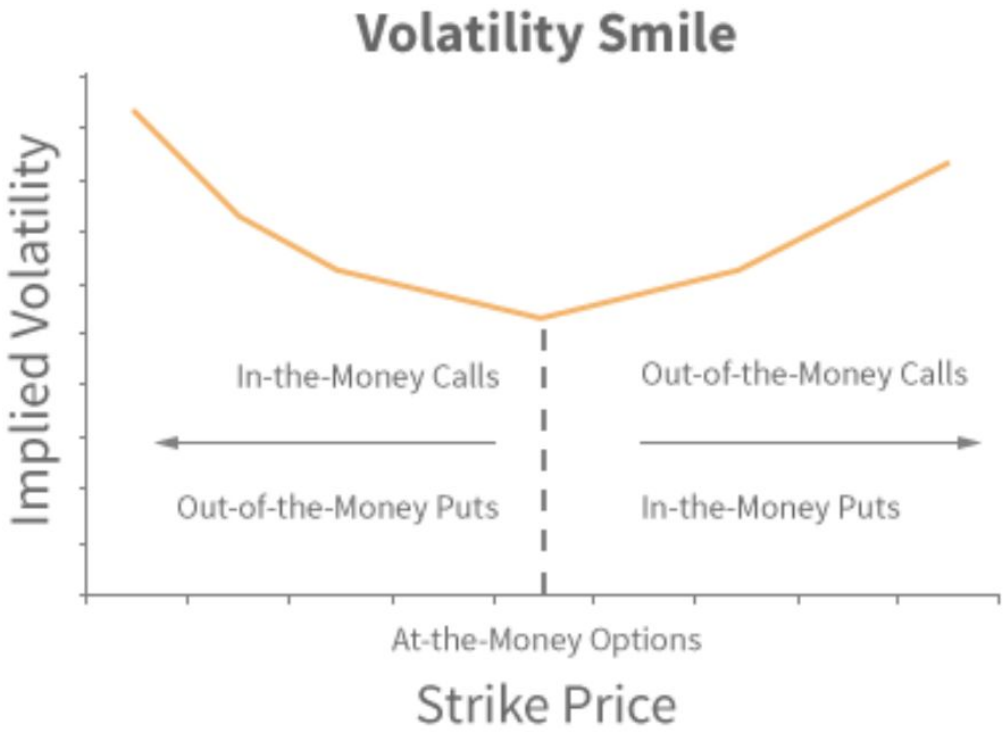
Vega

Volatility

- A statistical measure of the dispersion of returns for a given security or market index. Volatility can either be measured by using the standard deviation or variance between returns from that same security or market index. Commonly higher the standard deviation, higher is the risk.
- Volatility is used for :- Selecting the right strike to short/write, Calculating the stop-loss for a trade!

Volatility Types

- Historical Volatility : Calculated from historical prices
- Forecasted Volatility : Forecasted using GARCH time series models
- Implied Volatility (IV) : India VIX is the official 'Implied Volatility' index

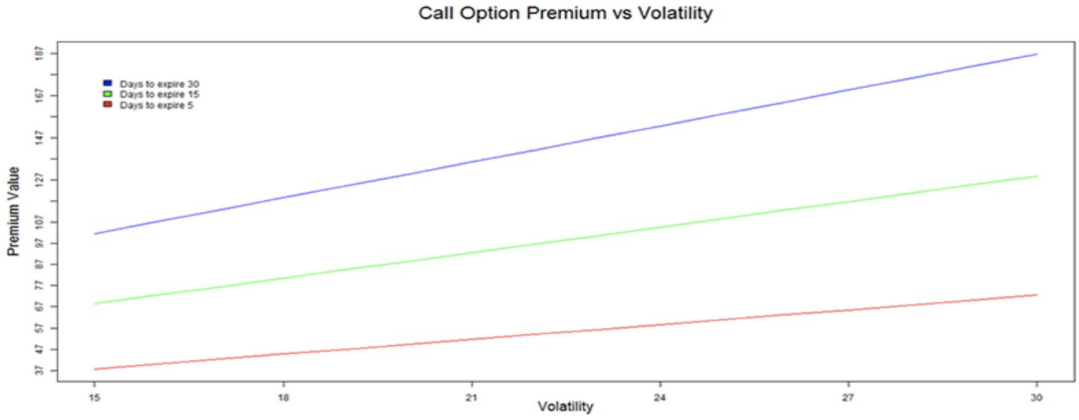


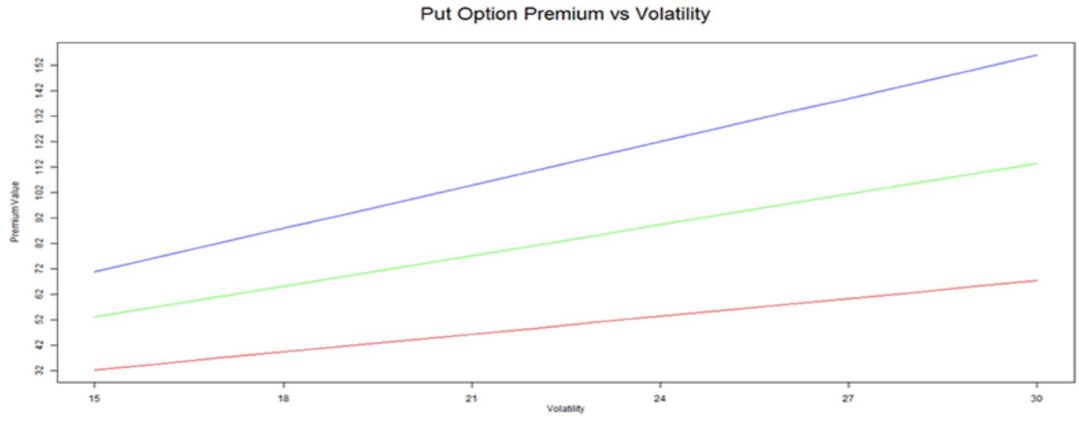
Theoretically, all options of the same underlying, expiring on the same expiry day should display similar IV. However, as you go away from the ATM option (for both Calls and Puts) the implied volatilities increase, in fact the further you move from ATM, the higher is the IV.

Vega

- The Vega of an option measures the rate of change of option's value (premium) with every percentage change in volatility. Since options gain value with increase in volatility, the vega is a positive number, for both calls and puts.

- When volatility increases (or is expected to increase) – option writers start fearing that they could be caught writing options that can potentially transition to 'in the money'. Hence option writers expect higher premiums for writing options, and therefore the premiums of call and put options go up when volatility is expected to increase.

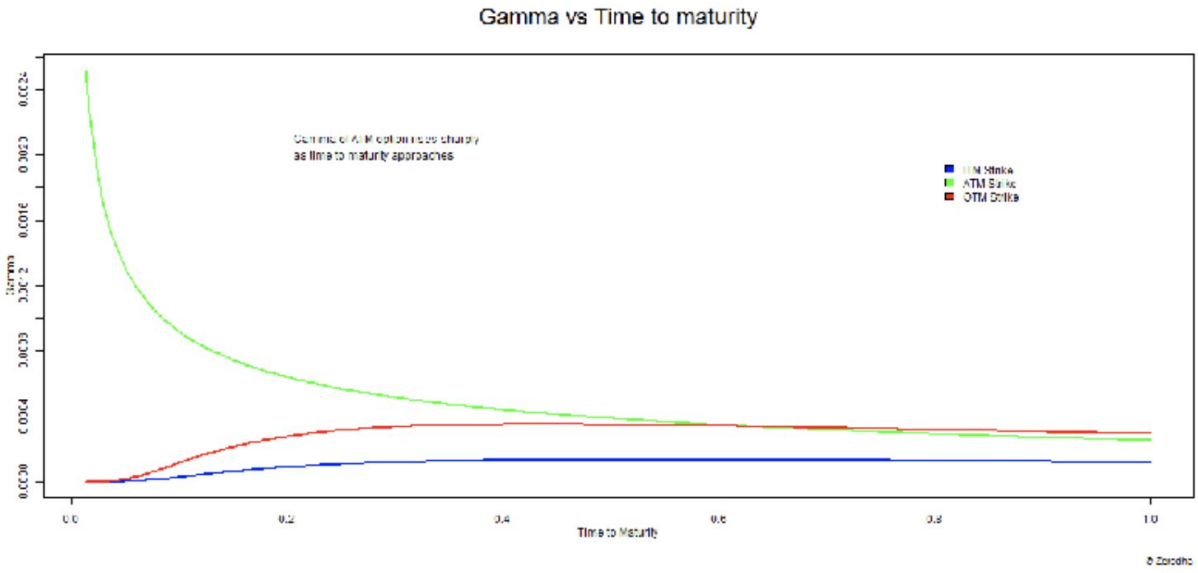




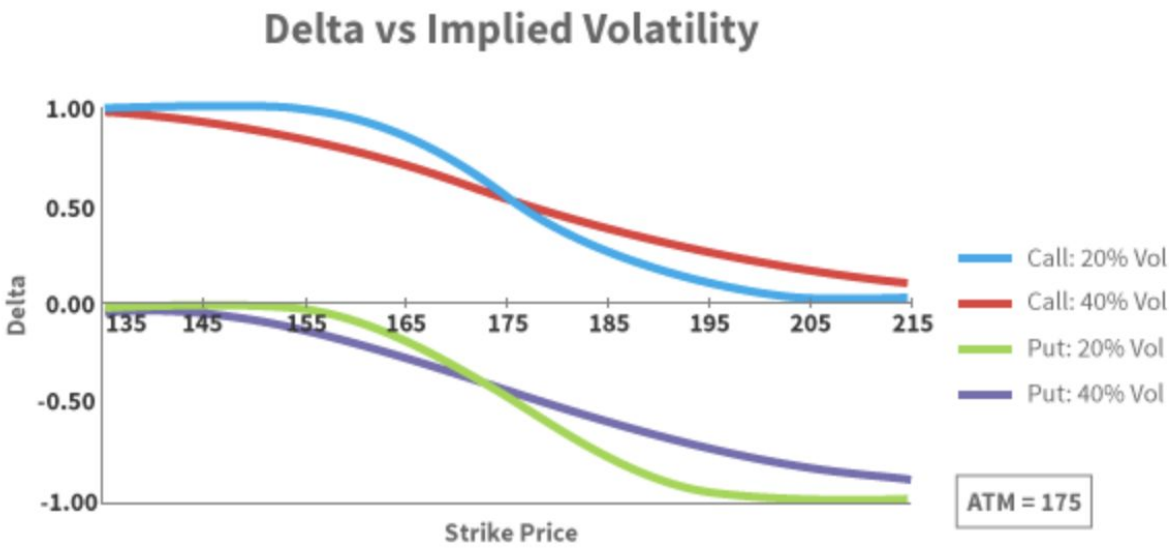
- The effect of Increase in volatility is maximum when there are more days to expiry. Maybe a good idea to write these options and collect the premiums – invariably when volatility cools off, the premiums also cool off and one could pocket the differential in premium.

Greek Interactions

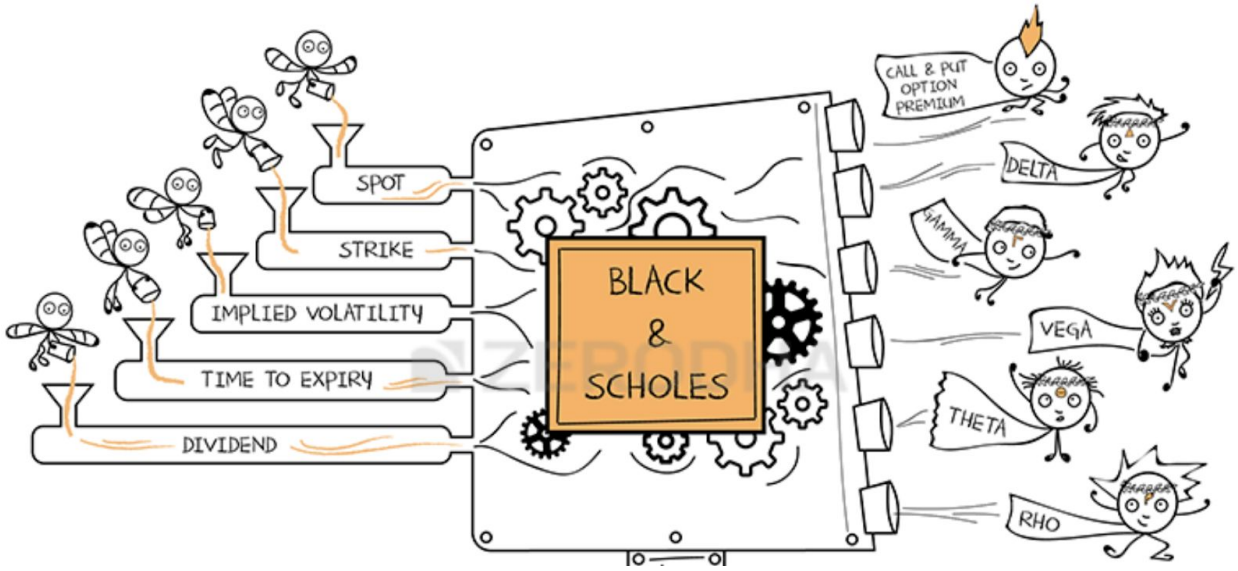
Gamma vs Time



Delta vs IV



Black-Scholes-Merton Model



For a European (single-exercise) call option -

The value of a call option for a non-dividend-paying underlying stock in terms of the Black–Scholes parameters is:

$$
\begin{aligned}
C(S_t, t) &= N(d_1)S_t - N(d_2)PV(K) \\
d_1 &= \frac{1}{\sigma\sqrt{T-t}}\left[\ln\left(\frac{S_t}{K}\right) + \left(r + \frac{\sigma^2}{2}\right)(T-t)\right] \\
d_2 &= d_1 - \sigma\sqrt{T-t} \\
PV(K) &= Ke^{-r(T-t)}
\end{aligned}
$$

The price of a corresponding put option based on put–call parity is:

$$
\begin{aligned}
P(S_t, t) &= Ke^{-r(T-t)} - S_t + C(S_t, t) \\
&= N(-d_2)Ke^{-r(T-t)} - N(-d_1)S_t
\end{aligned}
$$

For both, as above:

- $N(\cdot)$ is the cumulative distribution function of the standard normal distribution
- $T - t$ is the time to maturity (expressed in years)
- S_t is the spot price of the underlying asset
- K is the strike price
- r is the risk free rate (annual rate, expressed in terms of continuous compounding)
- σ is the volatility of returns of the underlying asset

Put-Call Parity -

Put Value + Spot Price = Present value of strike (invested to maturity) + Call Value

Calculation of Greeks-

		Calls	Puts
Delta	$\frac{\partial V}{\partial S}$	$N(d_1)$	$-N(-d_1) = N(d_1) - 1$
Gamma	$\frac{\partial^2 V}{\partial S^2}$	$\frac{N'(d_1)}{S\sigma\sqrt{T-t}}$	
Vega	$\frac{\partial V}{\partial \sigma}$	$SN'(d_1)\sqrt{T-t}$	
Theta	$\frac{\partial V}{\partial t}$	$-\frac{SN'(d_1)\sigma}{2\sqrt{T-t}} - rKe^{-r(T-t)}N(d_2)$	$-\frac{SN'(d_1)\sigma}{2\sqrt{T-t}} + rKe^{-r(T-t)}N(-d_2)$

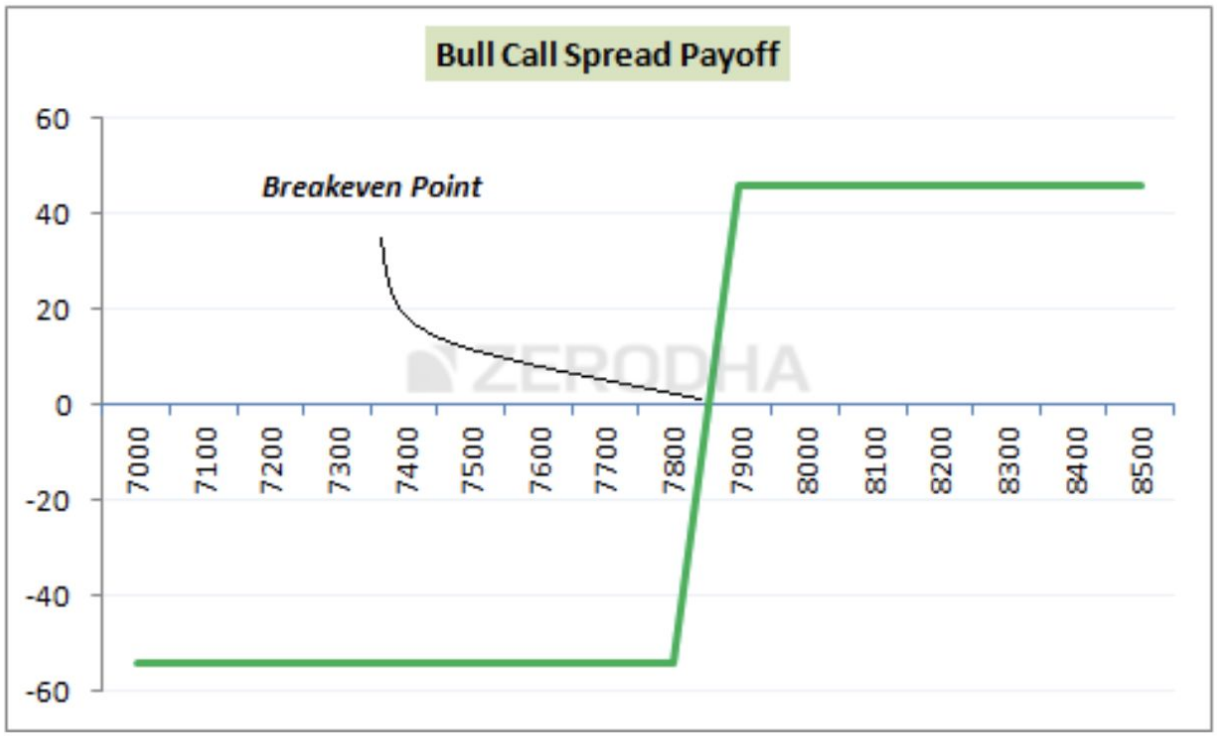
Options - Strategies

Bull-Call Spread -

- The strategy comes handy when you have a moderately bullish view on the stock/index.The bull call spread is a two leg spread strategy traditionally involving ATM and OTM options.
    - **Buy 1 ATM call option (leg 1)**
    - **Sell 1 OTM call option (leg 2)**

- When you do this ensure –
    - All strikes belong to the same underlying
    - Belong to the same expiry series
    - Each leg involves the same number of options

- Payoff



Bull-Put Spread -

Bull Call spread is executed for a debit, the bull put spread is executed for a credit. So if you are at a point in the market where –

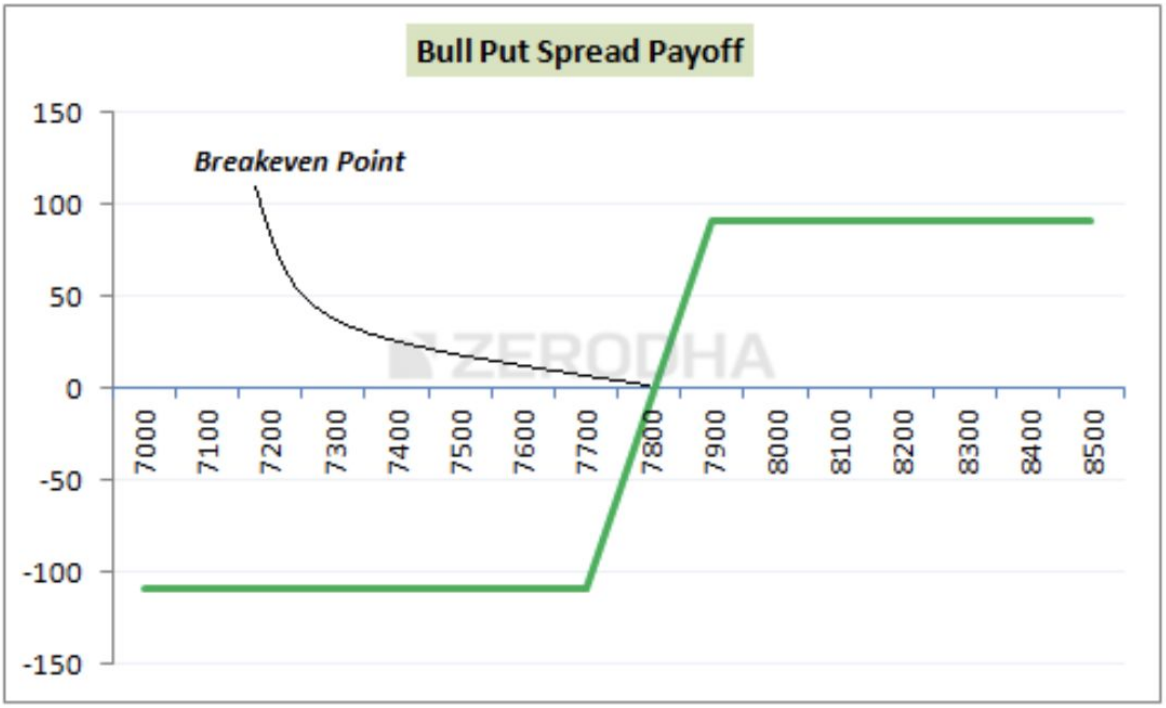
- The markets have declined considerably (therefore PUT premiums have swelled)
- The volatility is on the higher side
- There is plenty of time to expiry

And you have a moderately bullish outlook looking ahead, then it makes sense to invoke a Bull Put Spread for a net credit as opposed to invoking a Bull Call Spread for a net debit.

    - Buy 1 OTM Put option (leg 1)
    - Sell 1 ITM Put option (leg 2)

- When you do this ensure –
    - All strikes belong to the same underlying
    - Belong to the same expiry series
    - Each leg involves the same number of options

- Payoff

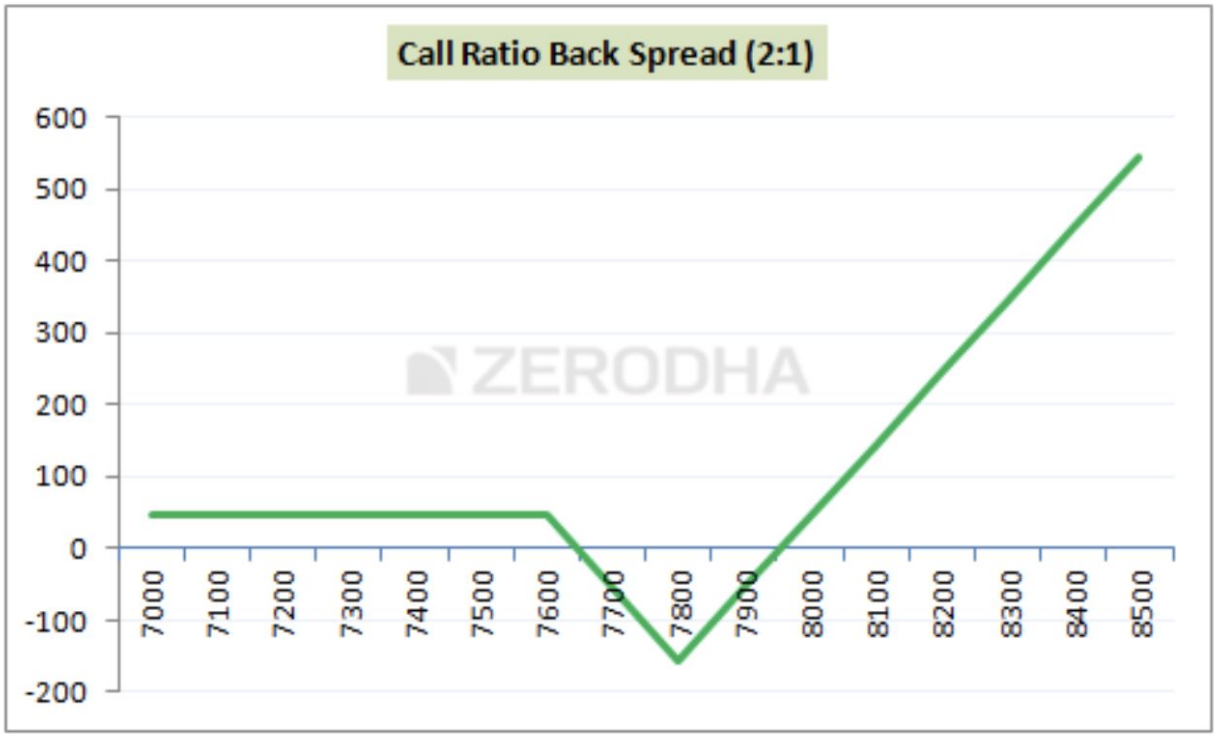


Call Ratio Back Spread -

- The strategy is deployed when one is out rightly bullish on a stock (or index). The Call Ratio Back Spread is a 3 leg option strategy as it involves **buying two OTM** call options and **selling one ITM** Call option.

- Make sure –
    - The Call options belong to the same expiry
    - Belongs to the same underlying
    - The ratio is maintained

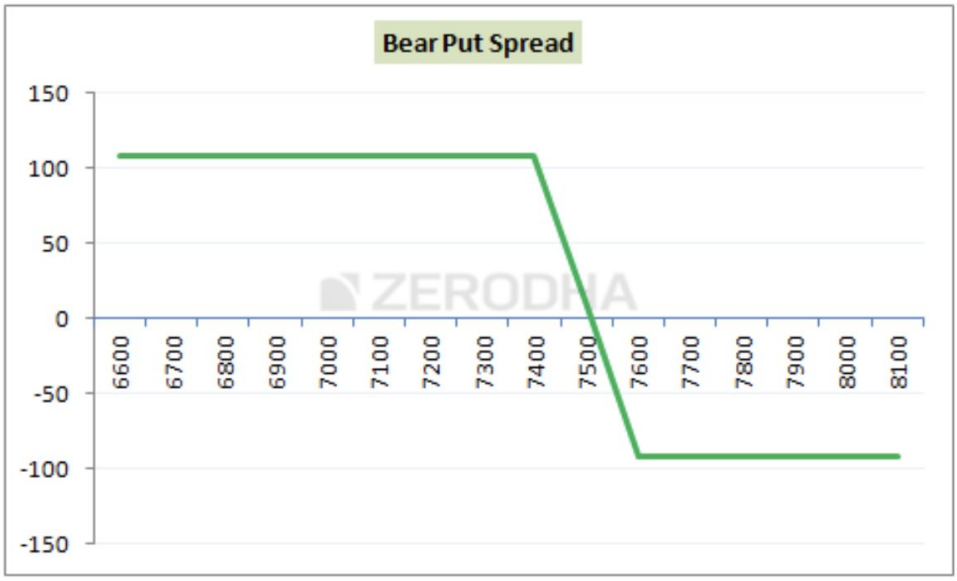
- Payoff



Bear Put Spread

- One would implement a bear put spread when the market outlook is moderately bearish.
    - Buying an In the money Put option
    - Selling an Out of the Money Put option

- Payoff



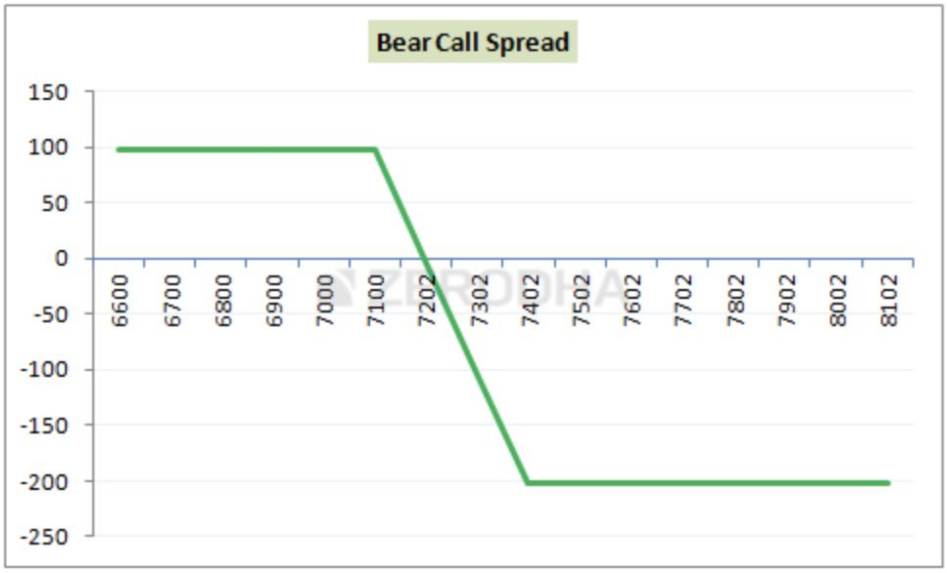
Bear Call Spread -

While the Bear Put spread is executed for a debit, the Bear Call spread is executed for a credit. Do it when –

- The markets have rallied considerably (therefore CALL premiums have swelled)
- The volatility is favorable
- Ample time to expiry

  To implement
  - Buy 1 OTM Call option (leg 1)
  - Sell 1 ITM Call option (leg 2)

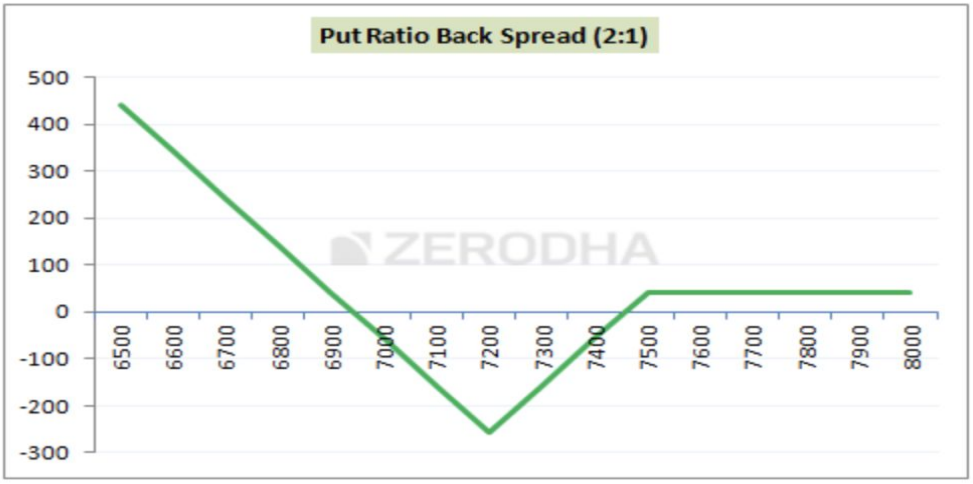
- Payoff



Put Back Ratio Spread -

The Put ratio back spread is similar to Call ratio, except that the trader invokes this when he is bearish on the market or stock. The Put Ratio Back Spread is a 3 leg option strategy as it involves **buying two OTM** Put options and **selling one ITM** Put option.

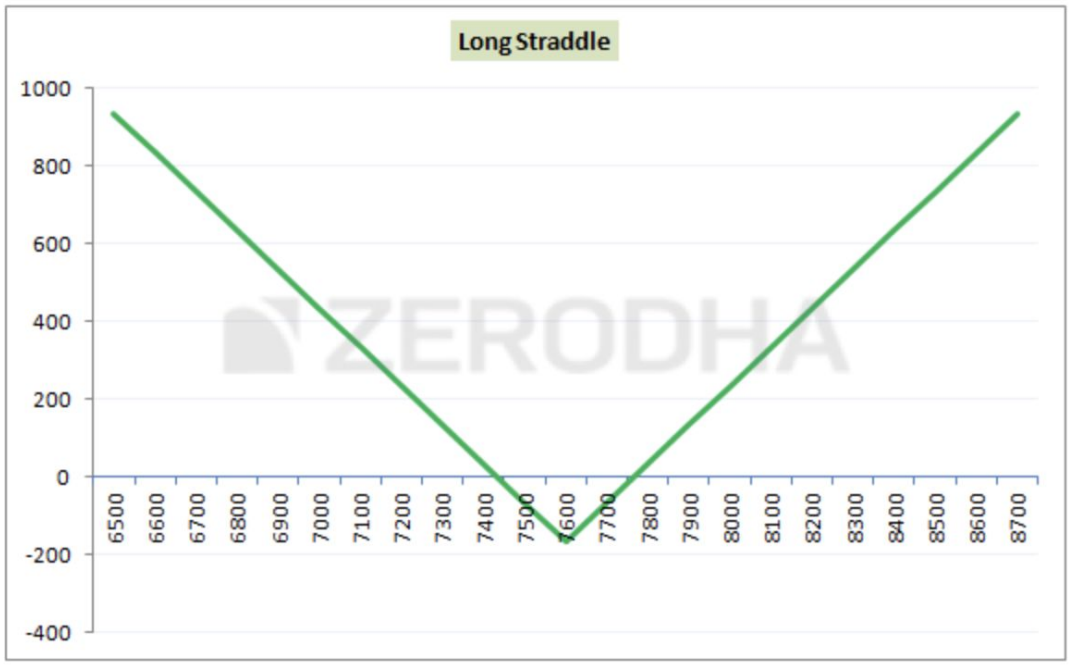
Payoff



Long Straddle/Short Straddle -

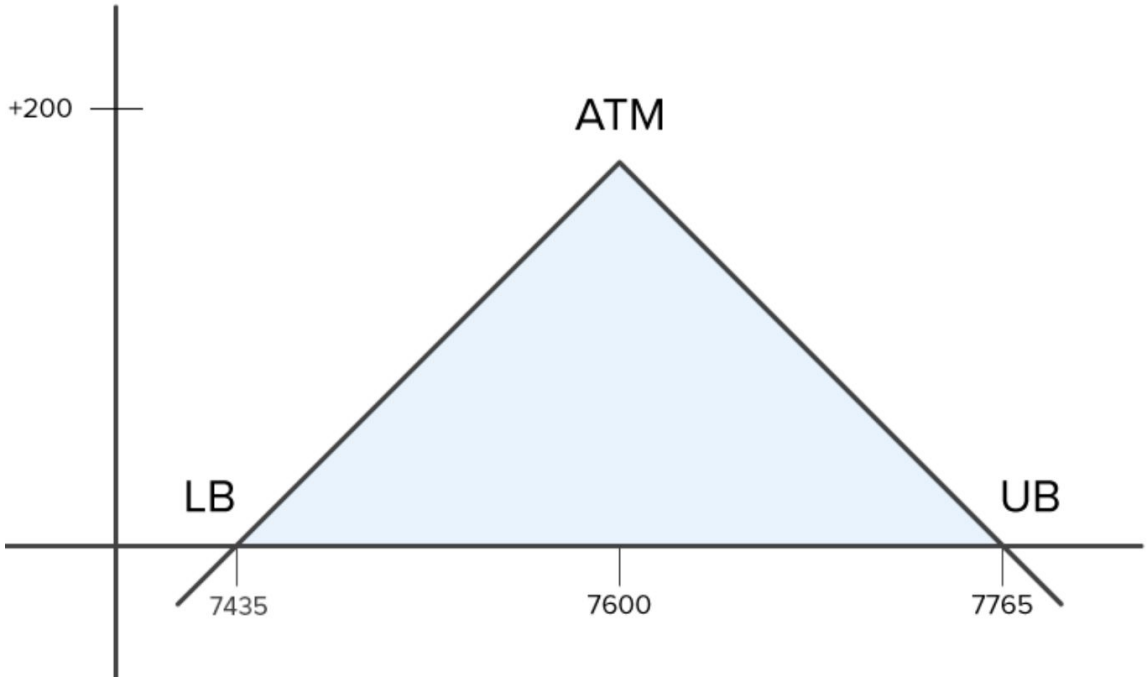
- Long straddle is perhaps the simplest market neutral strategy to implement. Once implemented, the P&L is not affected by the direction in which the market moves.
    - Buy a Call option
    - Buy a Put option

- Payoff



- The short strategy is set up for a net credit, as when you sell the ATM options, you receive the premium in your account.
    - Sell the ATM Call
    - Sell the Put option

- Payoff

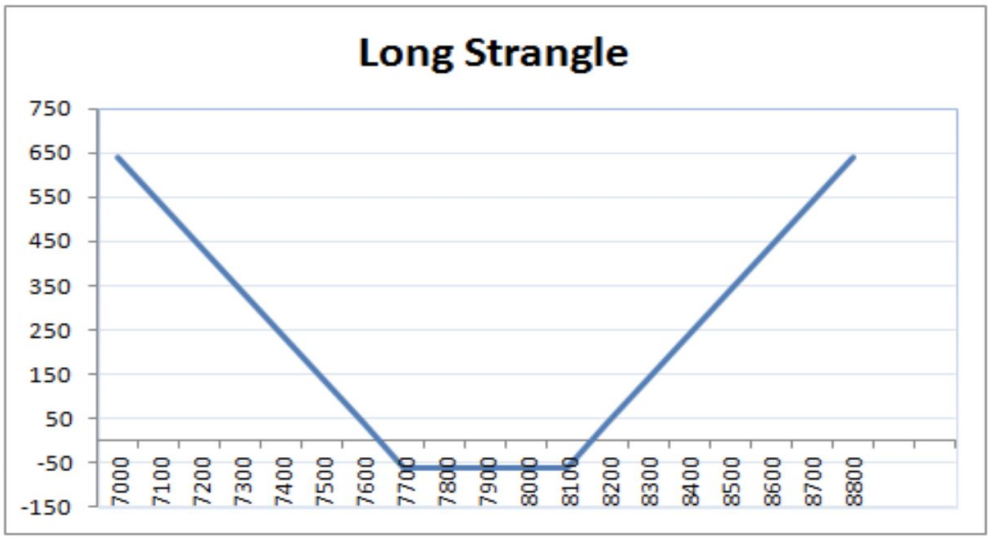


Long/Short Strangle -

- In a straddle you are required to buy call and put options of the ATM strike. Strangle requires you to buy OTM call and put options. When compared to the ATM strike, the OTM will always trade cheap, therefore this implies setting up a strangle is cheaper than setting up a straddle.

The execution of a short strangle is the exact opposite of the long strangle. One needs to sell OTM Call and Put options which are equidistant from the ATM strike.

Payoffs


Long Strangle
750
650
550
450
350
250
150
50
-50
-150
7000
7100
7200
7300
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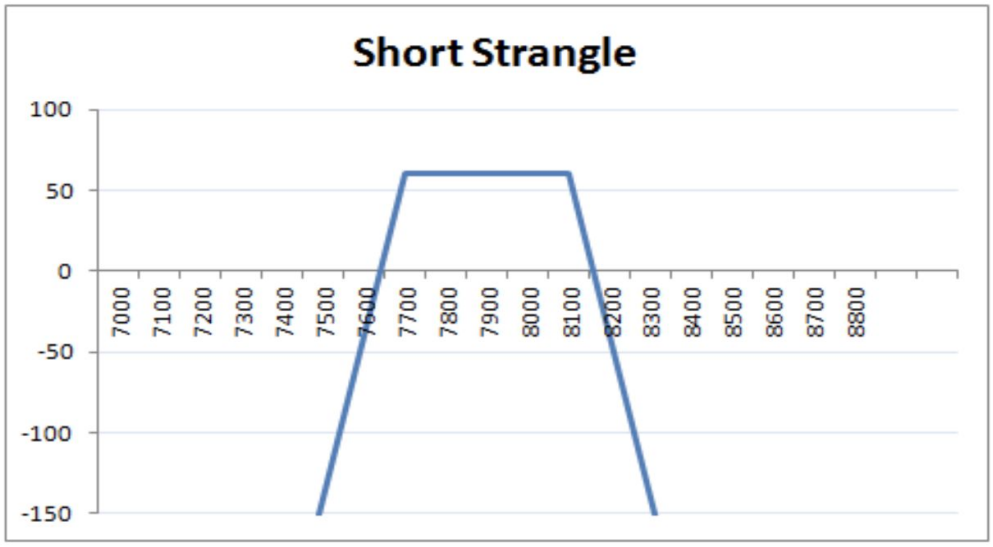
Short Strangle
100
50
0
-50
-100
-150
7000
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