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Option Theory for Professional Trading - Part 2

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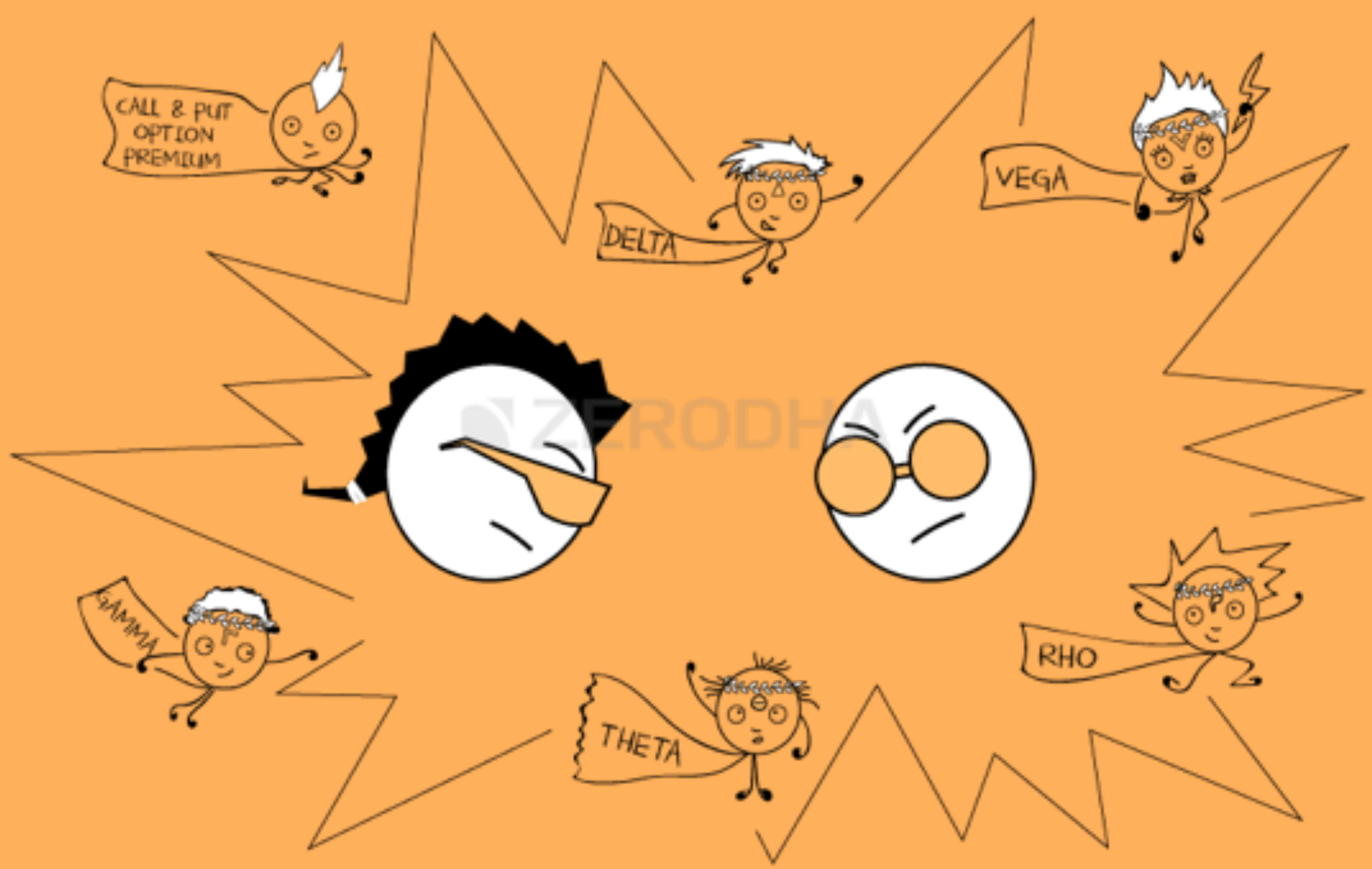
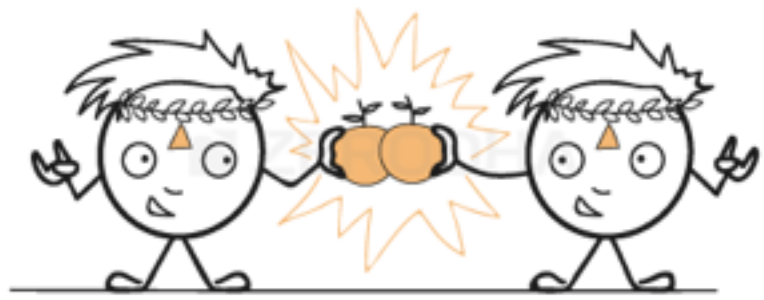


TABLE OF CONTENTS

CHAPTER 11

Delta (Part 3)



11.1 – Add up the Deltas

Here is an interesting characteristic of the Delta – The Deltas can be added up!

Let me explain – we will go back to the Futures contract for a moment. We know for every point change in the underlying's spot value the futures also changes by 1 point. For example if Nifty Spot moves from 8340 to 8350 then the Nifty Futures will also move from 8347 to 8357 (i.e. assuming Nifty Futures is trading at 8347 when the spot is at 8340). If we were to assign a delta value to Futures, clearly the future's delta would be 1 as we know for every 1 point change in the underlying the futures also changes by 1 point.

Now, assume I buy 1 ATM option which has a delta of 0.5, then we know that for every 1 point move in the underlying the option moves by 0.5 points. In other words owning 1 ATM option is as good as holding half futures contract. Given this, if I hold 2 such ATM contracts, then it as good as holding 1 futures contract because the delta of the 2 ATM options i.e. 0.5 and 0.5, which adds up to total delta of 1! In other words the deltas of two or more option contracts can be added to evaluate the total delta of the position.

Let us take up a few case studies to understand this better –

Case 1 – Nifty spot at 8125, trader has 3 different Call option.

Sl No	Contract	Classification	Lots	Delta	Position Delta
1	8000 CE	ITM	1 -Buy	0.7	+ 1 * 0.7 = + 0.7

Sl No	Contract	Classification	Lots	Delta	Position Delta
2	8120 CE	ATM	1 -Buy	0.5	+ 1 * 0.5 = + 0.5
3	8300 CE	Deep OTM	1- Buy	0.05	+ 1 * 0.05 = + 0.05
Total Delta of positions					**0.7 + 0.5 + 0.05 = + 1.25**

Observations –

1. The positive sign next to 1 (in the Position Delta column) indicates 'Long' position

2. The combined positions have a positive delta i.e. +1.25. This means both the underlying and the combined position moves in the same direction

3. For every 1 point change in Nifty, the combined position changes by 1.25 points

4. If Nifty moves by 50 points, the combined position is expected to move by 50 * 1.25 = 62.5 points

Case 2 – Nifty spot at 8125, trader has a combination of both Call and Put options.

Sl No	Contract	Classification	Lots	Delta	Position Delta
1	8000 CE	ITM	1- Buy	0.7	+ 1*0.7 =0.7
2	8300 PE	Deep ITM	1- Buy	– 1.0	+ 1*-1.0 = -1.0
3	8120 CE	ATM	1- Buy	0.5	+ 1*0.5 = 0.5
4	8300 CE	Deep OTM	1- Buy	0.05	+ 1*0.05 = 0.05
Total Delta of positions					**0.7 – 1.0 + 0.5 + 0.05 = +0.25**

Observations –

1. The combined positions have a positive delta i.e. +0.25. This means both the underlying and the combined position move in the same direction

2. With the addition of Deep ITM PE, the overall position delta has reduced, this means the combined position is less sensitive to the directional movement of the market

3. For every 1 point change in Nifty, the combined position changes by 0.25 points

4. If Nifty moves by 50 points, the combined position is expected to move by 50 * 0.25 = 12.5 points

5. Important point to note here – Deltas of the call and puts can be added as long as it belongs to the same underlying.

Case 3 – Nifty spot at 8125, trader has a combination of both Call and Put options. He has 2 lots Put option here.

Sl No	Contract	Classification	Lots	Delta	Position Delta
1	8000 CE	ITM	1- Buy	0.7	+ 1 * 0.7 = + 0.7
2	8300 PE	Deep ITM	2- Buy	-1	+ 2 * (-1.0) = -2.0
3	8120 CE	ATM	1- Buy	0.5	+ 1 * 0.5 = + 0.5
4	8300 CE	Deep OTM	1- Buy	0.05	+ 1 * 0.05 = + 0.05
Total Delta of positions					**0.7 – 2 + 0.5 + 0.05 = – 0.75**

Observations –

1. The combined positions have a negative delta. This means the underlying and the combined option position move in the opposite direction

2. With an addition of 2 Deep ITM PE, the overall position has turned delta negative, this means the combined position is less sensitive to the directional movement of the market

3. For every 1 point change in Nifty, the combined position changes by – 0.75 points

4. If Nifty moves by 50 points, the position is expected to move by 50 * (- 0.75) = -37.5 points

Case 4 – Nifty spot at 8125, the trader has Calls and Puts of the same strike, same underlying.

Sl No	Contract	Classification	Lots	Delta	Position Delta
1	8100 CE	ATM	1- Buy	0.5	+ 1 * 0.5 = + 0.5
2	8100 PE	ATM	1- Buy	-0.5	+ 1 * (-0.5) = -0.5
Total Delta of positions					**+ 0.5 – 0.5 = 0**

Observations –

1. The 8100 CE (ATM) has a positive delta of + 0.5

2. The 8100 PE (ATM) has a negative delta of – 0.5

3. The combined position has a delta of 0, which implies that the combined position does not get impacted by any change in the underlying

   a. For example – If Nifty moves by 100 points, the change in the options positions will be 100 * 0 = 0

4. Positions such as this – which have a combined delta of 0 are also called '**Delta Neutral**' positions

5. Delta Neutral positions do not get impacted by any directional change. They behave as if they are insulated to the market movements

6. However Delta neutral positions react to other variables like Volatility and Time. We will discuss this at a later stage.

Case 5 – Nifty spot at 8125, trader has sold a Call Option

Sl No	Contract	Classification	Lots	Delta	Position Delta
1	8100 CE	ATM	1- Sell	0.5	– 1 * 0.5 = – 0.5
2	8100 PE	ATM	1- Buy	-0.5	+ 1 * (-0.5) = – 0.5
Total Delta of positions					**– 0.5 – 0.5 = – 1.0**

Observations –

1. The negative sign next to 1 (in the Position Delta column) indicates 'short' position

2. As we can see a short call option gives rise to a negative delta – this means the option position and the underlying move in the opposite direction. This is quite intuitive considering the fact that the increase in spot value results in a loss to the call option seller

3. **Likewise if you short a PUT option the delta turns positive**

   a. -1 * (-0.5) = +0.5

Lastly just consider a case wherein the trader has 5 lots long deep ITM option. We know the total delta of such position would + 5 * + 1 = + 5. This means for every 1 point change in the underlying the combined position would change by 5 points in the same direction.

Do note the same can be achieved by shorting 5 deep ITM PUT options –

– 5 * – 1 = + 5

-5 indicate 5 short positions and -1 is the delta of deep ITM Put options.

The above case study discussions should give you a perspective on how to add up the deltas of the individual positions and figure out the overall delta of the positions. This technique of adding up the deltas is very helpful when you have multiple option positions running simultaneously and **you want to identify the overall directional impact on the positions**.

In fact I would strongly recommend you always add the deltas of individual position to get a perspective – this helps you understand the sensitivity and leverage of your overall position.

Also, here is another important point you need to remember –

Delta of ATM option = 0.5

If you have 2 ATM options = delta of the position is 1

So, for every point change in the underlying the overall position also changes by 1 point (as the delta is 1). This means the option mimics the movement of a Futures contract. However, do remember these two options should not be considered as a surrogate for a futures contract. Remember the Futures contract is only affected by the direction of the market, however the options contracts are affected by many other variables besides the direction of the markets.

There could be times when you would want to substitute the options contract instead of futures (mainly from the margins perspective) – but whenever you do so be completely aware of its implications, more on this topic as we proceed.

11.2 – Delta as a probability

Before we wrap up our discussion on Delta, here is another interesting application of Delta. You can use the Delta to gauge the probability of the **option contract to expire in the money**.

Let me explain – when a trader buys an option (irrespective of Calls or Puts), what is that he aspires? For example what do you expect when you buy Nifty 8000 PE when the spot is trading at 8100? (Note 8000 PE is an OTM option here). Clearly we expect the market to fall so that the Put option starts to make money for us.

In fact the trader hopes the spot price falls below the strike price so **that the option transitions from an OTM option to ITM option** – and in the process the premium goes higher and the trader makes money.

The trader can use the delta of an option to figure out the probability of the option to transition from OTM to ITM.

In the example 8000 PE is slightly OTM option; hence its delta must be below 0.5, let us fix it to 0.3 for the sake of this discussion.

Now to figure out the probability of the option to transition from OTM to ITM, simply convert the delta to a percentage number.

When converted to percentage terms, delta of 0.3 is 30%. Hence there is only 30% chance for the 8000 PE to transition into an ITM option.

Interesting right? Now think about this situation – although an arbitrary situation, this in fact is a very real life market situation –

1. 8400 CE is trading at Rs.4/-
2. Spot is trading at 8275
3. There are two day left for expiry – would you buy this option?

Well, a typical trader would think that this is a low cost trade, after all the premium is just Rs.4/- hence there is nothing much to lose. In fact the trader could even convince himself thinking that if the trade works in his favor, he stands a chance to make a huge profit.

Fair enough, in fact this is how options work. But let's put on our 'Model Thinking' hat and figure out if this makes sense –

1. 8400 CE is deep OTM call option considering spot is at 8275
2. The delta of this option could be around 0.1
3. Delta suggests that there is only 10% chance for the option to expire ITM
4. Add to this the fact that there are only 2 more days to expiry – the case **against** buying this option becomes stronger!

A prudent trader would never buy this option. However don't you think it makes perfect sense to sell this option and pocket the premium? Think about it – there is just 10% chance for the option to expire ITM or in other words there is 90% chance for the option to expire as an OTM option. With such a huge probability favoring the seller, one should go ahead and take the trade with conviction!

In the same line – what would be the delta of an ITM option? Close to 1 right? So this means there is a very high probability for an already ITM option to expire as ITM. In other words the probability of an ITM option expiring OTM is very low, so beware while shorting/writing ITM options as the odds are already against you!

Remember smart trading is all about taking trades wherein the odds favor you, and to know if the odds favor you, you certainly need to know your numbers and don your 'Model Thinking' hat.

And with this I hope you have developed a fair understanding on the very first Option Greek – The delta.

The Gamma beckons us now.

Key takeaways from this chapter

1. The delta is additive in nature
2. The delta of a futures contract is always 1
3. Two ATM option is equivalent to owning 1 futures contract
4. The options contract is not really a surrogate for the futures contract
5. The delta of an option is also the probability for the option to expire ITM

Gamma (Part 1)

12.1 – The other side of the mountain

How many of you remember your high school calculus? Does the word differentiation and integration ring a bell? The word 'Derivatives' meant something else to all of us back then – it simply referred to solving lengthy differentiation and integration problems.

Let me attempt to refresh your memory – the idea here is to just drive a certain point across and not really get into the technicalities of solving a calculus problem. Please note, the following discussion is very relevant to options, so please do read on.

Consider this –

A car is set into motion; it starts from 0 kms travels for 10 minutes and reaches the 3rd kilometer mark. From the 3rd kilometer mark, the car travels for another 5 minutes and reaches the 7th kilometer mark.

Let us focus and note what really happens between the **3rd and 7th kilometer**, –

1. Let 'x' = distance, and 'dx' the change in distance
2. Change in distance i.e. 'dx', is 4 (7 – 3)
3. Let 't' = time, and 'dt' the change in time
4. Change in time i.e. 'dt', is 5 (15 – 10)

If we divide **dx over dt** i.e. change in distance over change in time we get 'Velocity' (V)!

V = dx / dt

= 4/5

This means the car is travelling 4Kms for every 5 Minutes. Here the velocity is being expressed in Kms travelled per minute, clearly this is not a convention we use in our day to day conversation as we are used to express speed or velocity in Kms travelled per hour (KMPH).

We can convert 4/5 to KMPH by making a simple mathematical adjustment –

5 minutes when expressed in hours equals 5/60 hours, plugging this back in the above equation

= 4 / (5/ 60)

= (4*60)/5

= 48 Kmph

Hence the car is moving at a velocity of 48 kmph (kilometers per hour).

Do remember Velocity is **change in distance travelled divided over change in time**. In the calculus world, the Speed or Velocity is called the **'1st order derivative'** of distance travelled.

Now, let us take this example forward – In the 1st leg of the journey the car reached the 7th Kilometer after 15 minutes. Further assume in the 2nd leg of journey, starting from the 7th kilometer mark the car travels for another 5 minutes and reaches the 15th kilometer mark.

We know the velocity of the car in the first leg was 48 kmph, and we can easily calculate the velocity for the 2nd leg of the journey as 96 kmph (here dx = 8 and dt = 5).

It is quite obvious that the car travelled twice as fast in the 2nd leg of the journey.

Let us call the change in velocity as 'dv'. Change in velocity as we know is also called 'Acceleration'.

We know the change in velocity is

= 96KMPH – 48 KMPH

= 48 KMPH /??

The above answer suggests that the change in velocity is 48 KMPH…. but over what? Confusing right?

Let me explain –

*** The following explanation may seem like a digression from the main topic about Gamma, but it is not, so please read on, if not for anything it will refresh your high school physics ***

When you want to buy a new car, the first thing the sales guy tells you is something like this – "the car is really fast as it can accelerate 0 to 60 in 5 seconds". Essentially he is telling you that the car can change velocity from 0 KMPH (from the state of complete rest) to 60 KMPH in 5 seconds. Change in velocity here is 60KMPH (60 – 0) **over 5 seconds.**

Likewise in the above example we know the change in velocity is 48KMPH but over what? Unless we answer "over what" part, we would not know what the acceleration really is.

To find out the acceleration in this particular case, we can make some assumptions –

1. Acceleration is constant

2. We can ignore the 7th kilometer mark for time being – hence we consider the fact that the car was at 3rd kilometer mark at the 10th minute and it reached the 15th kilometer mark at the 20th minute

Using the above information, we can further deduce more information (in the calculus world, these are called the 'initial conditions').

➡ Velocity @ the 10th minute (or 3rd kilometer mark) = 0 KMPS. This is called the initial velocity

➡ Time lapsed @ the 3rd kilometer mark = 10 minutes

➡ Acceleration is constant between the 3rd and 15th kilometer mark

➡ Time at 15th kilometer mark = 20 minutes

➡ Velocity @ 20th minute (or 15th kilometer marks) is called 'Final Velocity"

➡ While we know the initial velocity was 0 kmph, we do not know the final velocity

➡ Total distance travelled = 15 – 3 = 12 kms

➡ Total driving time = 20 -10 = 10 minutes

➡ Average speed (velocity) = 12/10 = 1.2 kmps per minute or in terms of hours it would be 72 kmph

Now think about this, we know –

➡ Initial velocity = 0 kmph

➡ Average velocity = 72 kmph

➡ Final velocity =??

By reverse engineering we know the final velocity should be 144 Kmph as the average of 0 and 144 is 72.

Further we know acceleration is calculated as = Final Velocity / time (provided acceleration is constant).

Hence the acceleration is –

= 144 kmph / 10 minutes

10 minutes when converted to hours is (10/60) hours, plugging this back in the above equation

= 144 kmph / (10/60) hour

= 864 Kilometers

This means the car is gaining a speed of 864 kilometers every hour, and if a salesman is selling you this car, he would say the car can accelerate 0 to 72kmph in 5 secs (I'll let you do this math).

We simplified this problem a great deal by making one assumption – acceleration is constant. However in reality acceleration is not constant, you accelerate at different speeds for obvious reasons. Generally speaking, to calculate such problems **involving change in one variable due to the change in another variable** one would have to dig into derivative calculus, more precisely one needs to use the concept of 'differential equations'.

Now just think about this for a moment –

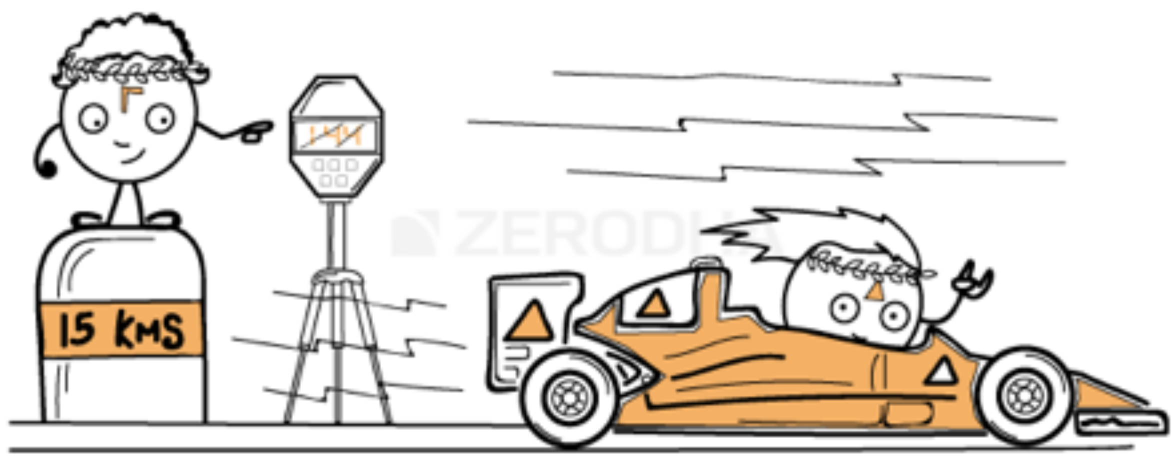
We know change in distance travelled (position) = Velocity, this is also called the 1st order derivative of distance position.

Change in Velocity = Acceleration

Acceleration = Change in Velocity over time, which is in turn the change in position over time.

Hence it is apt to call Acceleration as the 2nd order derivative of the position or the 1st derivative of Velocity!

Keep this point about the 1st order derivative and 2nd order derivative in perspective as we now proceed to understand the Gamma.



12.2 – Drawing Parallels

Over the last few chapters we understood how Delta of an option works. Delta as we know represents the change in premium for the given change in the underlying price.

For example if the Nifty spot value is 8000, then we know the 8200 CE option is OTM, hence its delta could be a value between 0 and 0.5. Let us fix this to 0.2 for the sake of this discussion.

Assume Nifty spot jumps 300 points in a single day, this means the 8200 CE is no longer an OTM option, rather it becomes slightly ITM option and therefore by virtue of this jump in spot value, the delta of 8200 CE will no longer be 0.2, it would be somewhere between 0.5 and 1.0, let us assume 0.8.

With this change in underlying, one thing is very clear – **the delta itself changes**. Meaning delta is a variable, whose value changes based on the changes in the underlying and the premium! If you notice, Delta is very similar to velocity whose value changes with change in time and the distance travelled.

The Gamma of an option measures this change in delta for the given change in the underlying. In other words Gamma of an option helps us answer this question – "For a given change in the underlying, what will be the corresponding change in the delta of the option?"

Now, let us re-plug the velocity and acceleration example and draw some parallels to Delta and Gamma.

1st order Derivative

➡ Change in distance travelled (position) with respect to change in time is captured by velocity, and velocity is called the 1st order derivative of position

➡ Change in premium with respect to change in underlying is captured by delta, and hence delta is called the 1st order derivative of the premium

2nd order Derivative

➡ Change in velocity with respect to change in time is captured by acceleration, and acceleration is called the 2nd order derivative of position

➡ 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

As you can imagine, calculating the values of Delta and Gamma (and in fact all other Option Greeks) involves number crunching and heavy use of calculus (differential equations and stochastic calculus).

Here is a trivia for you – as we know, derivatives are called derivatives because the derivative contracts derives its value based on the value of its respective underlying.

This value that the derivatives contracts derive from its respective underlying is measured using the application of "Derivatives" as a mathematical concept, hence the reason why Futures & Options are referred to as 'Derivatives' .

You may be interested to know there is a parallel trading universe out there where traders apply derivative calculus to find trading opportunities day in and day out. In the trading world, such traders are generally called 'Quants', quite a fancy nomenclature I must say. Quantitative trading is what really exists on the other side of this mountain called 'Markets'.

From my experience, understanding the 2nd order derivative such as Gamma is not an easy task, although we will try and simplify it as much as possible in the subsequent chapters.

Key takeaways from this chapter

1. Financial derivatives are called Financial derivatives because of its dependence on calculus and differential equations (generally called Derivatives)

2. Delta of an option is a variable and changes for every change in the underlying and premium

3. Gamma captures the rate of change of delta, it helps us get an answer for a question such as “What is the expected value of delta for a given change in underlying”

4. Delta is the 1st order derivative of premium

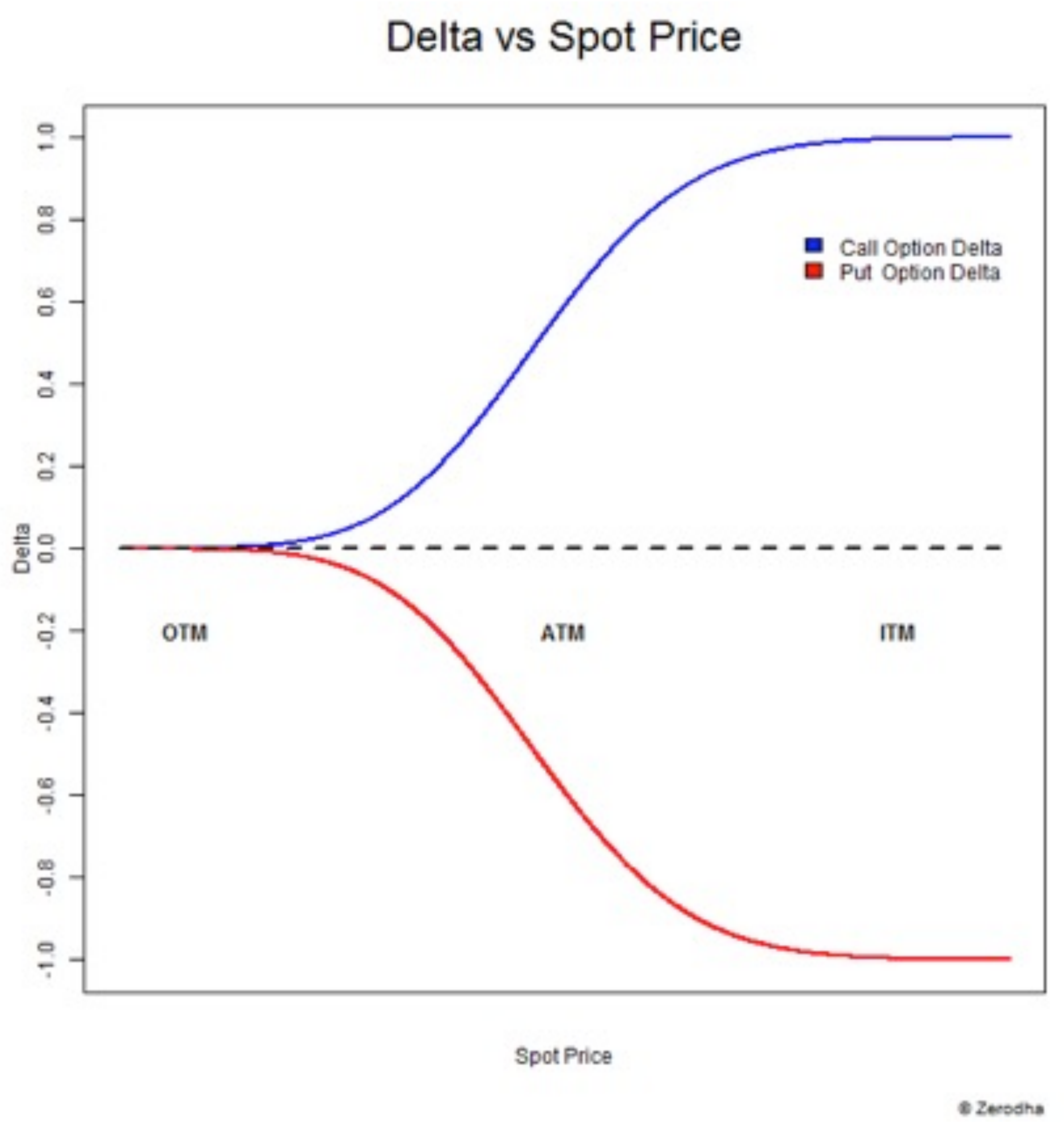
5. Gamma is the 2nd order derivative of premium

CHAPTER 13

Gamma (Part 2)

13.1 – The Curvature

We now know for a fact that the Delta of an option is a variable, as it constantly changes its value relative to the change in the underlying. Let me repost the graph of the delta's movement here –



If you look at the blue line representing the delta of a call option, it is quite clear that it traverses between 0 and 1 or maybe from 1 to 0 as the situation would demand. Similar observations can be made on the red line representing the put option's delta (except the value changes between 0 to -1). This graph reemphasizes what we already know i.e the delta is a variable and it changes all the time. Given this, the question that one needs to answer is –

1. I know the delta changes, but why should I care about it?
2. If the change in delta really matters, how do I estimate the likely change in delta?

We will talk about the 2nd question first as I'm reasonably certain the answer to the first question will reveal itself as we progress through this chapter.

As introduced in the previous chapter, 'The Gamma' (2nd order derivative of premium) also referred to as **the curvature of the option** gives the rate at which the option's delta changes as the underlying changes. The gamma is usually expressed in deltas gained or lost per one point change in the underlying – with the delta increasing by the amount of the gamma when the underlying rises and falling by the amount of the gamma when the underlying falls.

For example consider this –

- ➡ Nifty Spot = 8326
- ➡ Strike = 8400
- ➡ Option type = CE
- ➡ Moneyness of Option = Slightly OTM
- ➡ Premium = Rs.26/-
- ➡ Delta = 0.3
- ➡ Gamma = 0.0025
- ➡ Change in Spot = 70 points
- ➡ New Spot price = 8326 + 70 = 8396
- ➡ New Premium =??
- ➡ New Delta =??
- ➡ New moneyness =??

Let's figure this out –

- ➡ Change in Premium = Delta * change in spot i.e 0.3 * 70 = 21
- ➡ New premium = 21 + 26 = 47
- ➡ Rate of change of delta = 0.0025 units for every 1 point change in underlying
- ➡ Change in delta = Gamma * Change in underlying i.e 0.0025*70 = 0.175
- ➡ **New Delta = Old Delta + Change in Delta i.e 0.3 + 0.175 = 0.475**
- ➡ New Moneyness = ATM

When Nifty moves from 8326 to 8396, the 8400 CE premium changed from Rs.26 to Rs.47, and along with this the Delta changed from 0.3 to 0.475.

Notice with the change of 70 points, the option transitions from slightly OTM to ATM option. Which means the option's delta has to change from 0.3 to somewhere close to 0.5. This is exactly what's happening here.

Further let us assume Nifty moves up another 70 points from 8396; let us see what happens with the 8400 CE option –

- ➡ Old spot = 8396
- ➡ New spot value = 8396 + 70 = 8466
- ➡ Old Premium = 47
- ➡ Old Delta = 0.475
- ➡ Change in Premium = 0.475 * 70 = 33.25
- ➡ New Premium = 47 + 33.25 = 80.25
- ➡ New moneyness = ITM (hence delta should be higher than 0.5)
- ➡ Change in delta =0.0025 * 70 = 0.175
- ➡ New Delta = 0.475 + 0.175 = **0.65**

Let's take this forward a little further, now assume Nifty falls by 50 points, let us see what happens with the 8400 CE option –

- ➡ Old spot = 8466
- ➡ New spot value = 8466 – 50 = 8416
- ➡ Old Premium = 80.25
- ➡ Old Delta = 0.65
- ➡ Change in Premium = 0.65 *(50) = – 32.5
- ➡ New Premium = 80.25 – 32. 5 = **47.75**
- ➡ New moneyness = slightly ITM (hence delta should be higher than 0.5)
- ➡ Change in delta = 0.0025 * (50) = **– 0.125**
- ➡ New Delta = 0.65 – 0.125 = **0.525**

Notice how well the delta transitions and adheres to the delta value rules we discussed in the earlier chapters. Also, you may wonder why the Gamma value is kept constant in the above examples. Well, in reality the 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" or "Gamma of Gamma" or "**D**gamma**D**spot". For all practical purposes, it is not necessary to get into the discussion of Speed, unless you are mathematically inclined or you work for an Investment Bank where the trading book risk can run into several $ Millions.

Unlike the delta, the Gamma is always a positive number for both Call and Put Option. Therefore when a trader is long options (both Calls and Puts) the trader is considered 'Long Gamma' and when he is short options (both calls and puts) he is considered 'Short Gamma'.

For example consider this – The Gamma of an ATM Put option is 0.004, if the underlying moves 10 points, what do you think the new delta is?

Before you proceed I would suggest you spend few minutes to think about the solution for the above.

Here is the solution – Since we are talking about an ATM Put option, the Delta must be around – 0.5. Remember Put options have a –ve Delta. Gamma as you notice is a positive number i.e +0.004. The underlying moves by 10 points without specifying the direction, so let us figure out what happens in both cases.

Case 1 – Underlying moves up by 10 points

➡ Delta = – 0.5

➡ Gamma = 0.004

➡ Change in underlying = 10 points

➡ Change in Delta = Gamma * Change in underlying = 0.004 * 10 = 0.04

➡ New Delta = We know the Put option loses delta when underlying increases, hence – 0.5 + 0.04 = **– 0.46**

Case 2 – Underlying goes down by 10 points

➡ Delta = – 0.5

➡ Gamma = 0.004

➡ Change in underlying = – 10 points

➡ Change in Delta = Gamma * Change in underlying = 0.004 * – 10 = – 0.04

➡ New Delta = We know the Put option gains delta when underlying goes down, hence – 0.5 + (-0.04) = **– 0.54**

Now, here is trick question for you – In the earlier chapters, we had discussed that the Delta of the Futures contract in always 1, so what do you think the gamma of the Futures contract is? Please leave your answers in the comment box below :).

13.2 – Estimating Risk using Gamma

I know there are many traders who define their risk limits while trading. Here is what I mean by a risk limit – for example the trader may have a capital of Rs.300,000/- in his trading account. Margin required for each Nifty Futures is approximately Rs.16,500/-. Do note you can use Zerodha's SPAN calculator to figure out the margin required for any F&O contract. So considering the margin and the M2M margin required, the trader may decide at any point he may not want to exceed holding more than **5 Nifty Futures contracts**, thus defining his risk limits, this seems fair enough and works really well while trading futures.

But does the same logic work while trading options? Let's figure out if it is the right way to think about risk while trading options.

Here is a situation –

- ➡ Number of lots traded = 10 lots (Note – 10 lots of ATM contracts with delta of 0.5 each is equivalent to 5 Futures contract)
- ➡ Option = 8400 CE
- ➡ Spot = 8405
- ➡ Delta = 0.5
- ➡ Gamma = 0.005
- ➡ Position = Short

The trader is short 10 lots of Nifty 8400 Call Option; this means the trader is within his risk boundary. Recall the discussion we had in the Delta chapter about adding up the delta. We can essentially add up the deltas to get the overall delta of the position. Also each delta of 1 represents 1 lot of the underlying. So we will keep this in perspective and we can figure out the overall position's delta.

- ➡ Delta = 0.5
- ➡ Number of lots = 10
- ➡ Position Delta = 10 * 0.5 = 5

So from the overall delta perspective the trader is within his risk boundary of trading not more than 5 Futures lots. Also, do note since the trader is short options, he is essentially **short gamma**.

The position's delta of 5 indicates that the trader's position will move 5 points for every 1 point movement in the underlying.

Now, assume Nifty moves 70 points against him and the trader continues to hold his position, hoping for a recovery. The trader is obviously under the impression that he is holding 10 lots of options which is within his risk appetite…

Let's do some forensics to figure out behind the scenes changes –

- ➡ Delta = 0.5
- ➡ Gamma = 0.005
- ➡ Change in underlying = 70 points
- ➡ Change in Delta = Gamma * change in underlying = 0.005 * 70 = 0.35
- ➡ New Delta = 0.5 + 0.35 = **0.85**
- ➡ New Position Delta = 0.85*10 = **8.5**

Do you see the problem here? Although the trader has defined his risk limit of 5 lots, thanks to a high Gamma value, he has overshot his risk limit and now holds positions equivalent to 8.5 lots, way beyond his perceived risk limit. An inexperienced trader can be caught unaware of this and still be under the impression that he is well under his risk radar. But in reality his risk exposure is getting higher.

Now since the delta is 8.5, his overall position is expected to move 8.5 points for every 1 point change in the underlying. For a moment assume the trader is long on the call option instead of being short – obviously he would enjoy the situation here as the market is moving in his favor. Besides the favorable movement in the market, his positions is getting 'Longer' since the 'long gamma' tends to add up the deltas, and therefore the delta tends to get bigger, which means the rate of change on premium with respect to change in underlying is faster.

Suggest you read that again in small bits if you found it confusing.

But since the trader is short, he is essentially short gamma…this means when the position moves against him (as in the market moves up while he is short) the deltas add up (thanks to gamma) and therefore at every stage of market increase, the delta and gamma gang up against the short option trader, making his position riskier way beyond what the plain eyes can see. Perhaps this is the reason why they say – shorting options carry huge amount of risk. In fact you can be more precise and say “shorting options carries the risk of being short gamma”.

Note – By no means I’m suggesting that you should not short options. In fact a successful trader employs both short and long positions as the situation demands. I’m only suggesting that when you short options you need to be aware of the Greeks and what they can do to your positions.

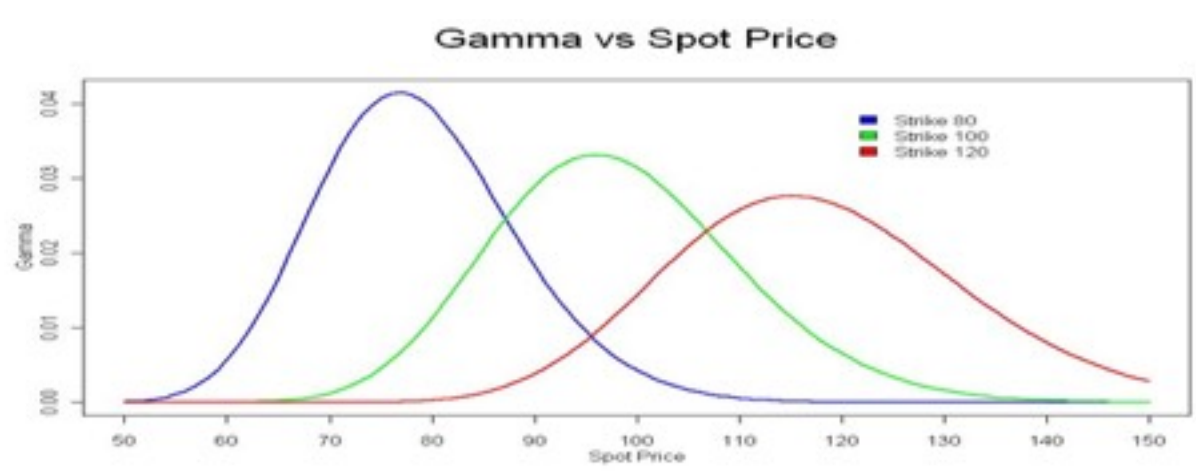
Also, I’d strongly suggest you avoid shorting option contracts which has a large Gamma.

This leads us to another interesting topic – what is considered as ‘large gamma’.

13.3 – Gamma movement

Earlier in the chapter we briefly discussed that the Gamma changes with respect to change in the underlying. This change in Gamma is captured by the 3rd order derivative called ‘Speed’. I won’t get into discussing ‘Speed’ for reasons stated earlier. However we need to know the behavior of Gamma movement so that we can avoid initiating trades with high Gamma. Of course there are other advantages of knowing the behavior of Gamma, we will talk about this at a later stage in this module. But for now we will look into how the Gamma behaves with respect to changes in the underlying.

Have a look at the chart below,



The chart above has 3 different CE strike prices – 80, 100, and 120 and their respective Gamma movement. For example the blue line represents the Gamma of the 80 strike price. I would suggest you look at each graph individually to avoid confusion. In fact for sake of simplicity I will only talk about the 80 strike option, represented by the blue line.

Let us assume the spot price is at 80, thus making the 80 strike ATM. Keeping this in perspective we can observe the following from the above chart –

1. Since the strike under consideration is 80 CE, the option attains ATM status when the spot price is at 80

2. Strike Values below 80 (65, 70, 75 etc) are ITM and values above 80 (85, 90, 95 etc) are OTM options.

3. Notice the gamma value is low for OTM Options (80 and above). This explains why the premium for OTM options don't change much in terms of absolute point terms, however in % terms the change is higher. For example – the premium of an OTM option can change from Rs.2 to Rs.2.5, while absolute change in is just 50 paisa, the % change is 25%

4.The gamma peaks when the option hits ATM status. This implies that the rate of change of delta is highest when the option is ATM. In other words, ATM options are most sensitive to the changes in the underlying

a. Also, since ATM options have highest Gamma – **avoid shorting ATM options**

5. The gamma value is also low for ITM options (80 and below). Hence for a certain change in the underlying, the rate of change of delta for an ITM option is much lesser compared to ATM option. However do remember the ITM option inherently has a high delta. So while ITM delta reacts slowly to the change in underlying (due to low gamma) the change in premium is high (due to high base value of delta).

6. You can observe similar Gamma behavior for other strikes i.e 100, and 120. In fact the reason to show different strikes is to showcase the fact that the gamma behaves in the same way for all options strikes

Just in case you found the above discussion bit overwhelming, here are 3 simple points that you can take home –

➡ Delta changes rapidly for ATM option

➡ Delta changes slowly for OTM and ITM options

➡ Never short ATM or ITM option with a hope that they will expire worthless upon expiry

➡ OTM options are great candidates for short trades assuming you intend to hold these short trades upto expiry wherein you expect the option to expire worthless

13.4 – Quick note on Greek interactions

One of the keys to successful options trading is to understand how the individual option Greeks behave under various circumstances. Now besides understanding the individual Greek behavior, one also needs to understand how these individual option Greeks react with each other.

So far we have considered only the premium change with respect to the changes in the spot price. We have not yet discussed time and volatility. Think about the markets and the real time changes that happen. Everything changes – time, volatility, and the underlying price. So an option trader should be in a position to understand these changes and its overall impact on the option premium.

You will fully appreciate this only when you understand the cross interactions of the option Greeks. Typical Greek cross interactions would be – gamma versus time, gamma versus volatility, volatility vs time, time vs delta etc.

Finally all your understanding of the Greeks boils down to a few critical decision making factors such as –

1. For the given market circumstances which is the best strike to trade?

2. What is your expectation of the premium of that particular strike – would it increase or decrease? Hence would you be a buyer or a seller in that option?

3. If you plan to buy an option – is there a realistic chance for the premium to increase?

4. If you plan to short an option – is it really safe to do so? Are you able to see risk beyond what the naked eyes can spot?

The answers to all these questions will evolve once you fully understand individual Greeks and their cross interactions.

Given this, here is how this module will develop going further –

1. So far we have understood Delta and Gamma

2. Over the next few chapters we will understand Theta and Vega

3. When we introduce Vega (change in premium with respect to change in volatility) – we will digress slightly to understand volatility based stoploss

4. Introduce Greek cross interactions – Gamma vs time, Gamma vs spot, Theta vs Vega, Vega vs Spot etc

5. Overview of Black and Scholes option pricing formula

6. Option calculator

So as you see, we have miles to walk before we sleep :-)

Key takeaways from this chapter

1. Gamma measures the rate of change of delta
2. Gamma is always a positive number for both Calls and Puts
3. Large Gamma can translate to large gamma risk (directional risk)
4. When you buy options (Calls or Puts) you are long Gamma
5. When you short options (Calls or Puts) you are short Gamma
6. Avoid shorting options which have large gamma
7. Delta changes rapidly for ATM option
8. Delta changes slowly for OTM and ITM options

Special thanks to our good friend Prakash Lekkala *for providing the Greek graphs in this and other chapters.*

CHAPTER 14

Theta

14.1 – Time is money

Remember the adage "Time is money", it seems like this adage about time is highly relevant when it comes to options trading. Forget all the Greek talk for now, we shall go back to understand one basic concept concerning time.

Assume you have enrolled for a competitive exam, you are inherently a bright candidate and have the capability to clear the exam, however if you do not give it sufficient time and brush up the concepts, you are likely to flunk the exam – so given this what is the likelihood that you will pass this exam?

Well, it depends on how much time you spend to prepare for the exam right? Let's keep this in perspective and figure out the likelihood of passing the exam against the time spent preparing for the exam.

Number of days for preparation	Likelihood of passing
30 days	Very high
20 days	High
15 days	Moderate
10 days	Low
5 days	Very low
1 day	Ultra low

Quite obviously higher the number of days for preparation, the higher is the likelihood of passing the exam.

Keeping the same logic in mind, think about the following situation –

Nifty Spot is 8500, you buy a Nifty 8700 Call option – what is the likelihood of this call option to expire In the Money (ITM)?

Let me rephrase this question in the following way –

- ➡ Given Nifty is at 8500 today, what is the likelihood of Nifty moving 200 points over the next 30 days and therefore 8700 CE expiring ITM?
    - ➡ The chance for Nifty to move 200 points over next 30 days is quite high, hence the likelihood of option expiring ITM upon expiry is **very high**
- ➡ What if there are only 15 days to expiry?
    - ➡ An expectation that Nifty will move 200 points over the next 15 days is reasonable, hence the likelihood of option expiring ITM upon expiry is **high** (notice it is not very high, but just high).
- ➡ What if there are only 5 days to expiry?
    - ➡ Well, 5 days, 200 points, not really sure hence the likelihood of 8700 CE expiring in the money is **low**
- ➡ What if there was only 1 day to expiry?
    - ➡The probability of Nifty to move 200 points in 1 day is quite low, hence I would be reasonably certain that the option will not expire in the money, therefore the chance is **ultra low.**

Is there anything that we can infer from the above?

Clearly, the more time for expiry the likelihood for the option to expire In the Money (ITM) is higher. Now keep this point in the back of your mind as we now shift our focus on the 'Option Seller'.

We know an option seller sells/writes an option and receives the premium for it. When he sells an option he is very well aware that he carries an unlimited risk and limited reward potential. The reward is limited to the extent of the premium he receives. He gets to keep his reward (premium) **fully** only if the option expires worthless.

Now, think about this – if he is selling an option **early in the month** he very clearly knows the following –

1. He knows he carries unlimited risk and limited reward potential

2. He also knows that by virtue of time, there is a chance for the option he is selling to transition into ITM option, which means he will not get to retain his reward (premium received)

In fact at any given point, thanks to 'time', there is always a chance for the option to expiry in the money (although this chance gets lower and lower as time progresses towards the expiry date).

Given this, an option seller would not want to sell options at all right? After all why would you want to sell options when you very well know that simply because of time there is scope for the option you are selling to expire in the money. Clearly time in the option sellers context acts as a risk.

Now, what if the option buyer in order to entice the option seller to sell options offers to compensate for the 'time risk' that he (option seller) assumes? In such a case it probably makes sense to evaluate the time risk versus the compensation and take a call right?

In fact this is what happens in real world options trading. Whenever you pay a premium for options, you are indeed paying towards –

1. Time Risk
2. Intrinsic value of options

In other words –

Premium = Time value + Intrinsic Value

Recall earlier in this module we defined 'Intrinsic Value' as the money you are to receive, if you were to exercise your option today.

Just to refresh your memory, let us calculate the intrinsic value for the following options assuming Nifty is at 8423 –

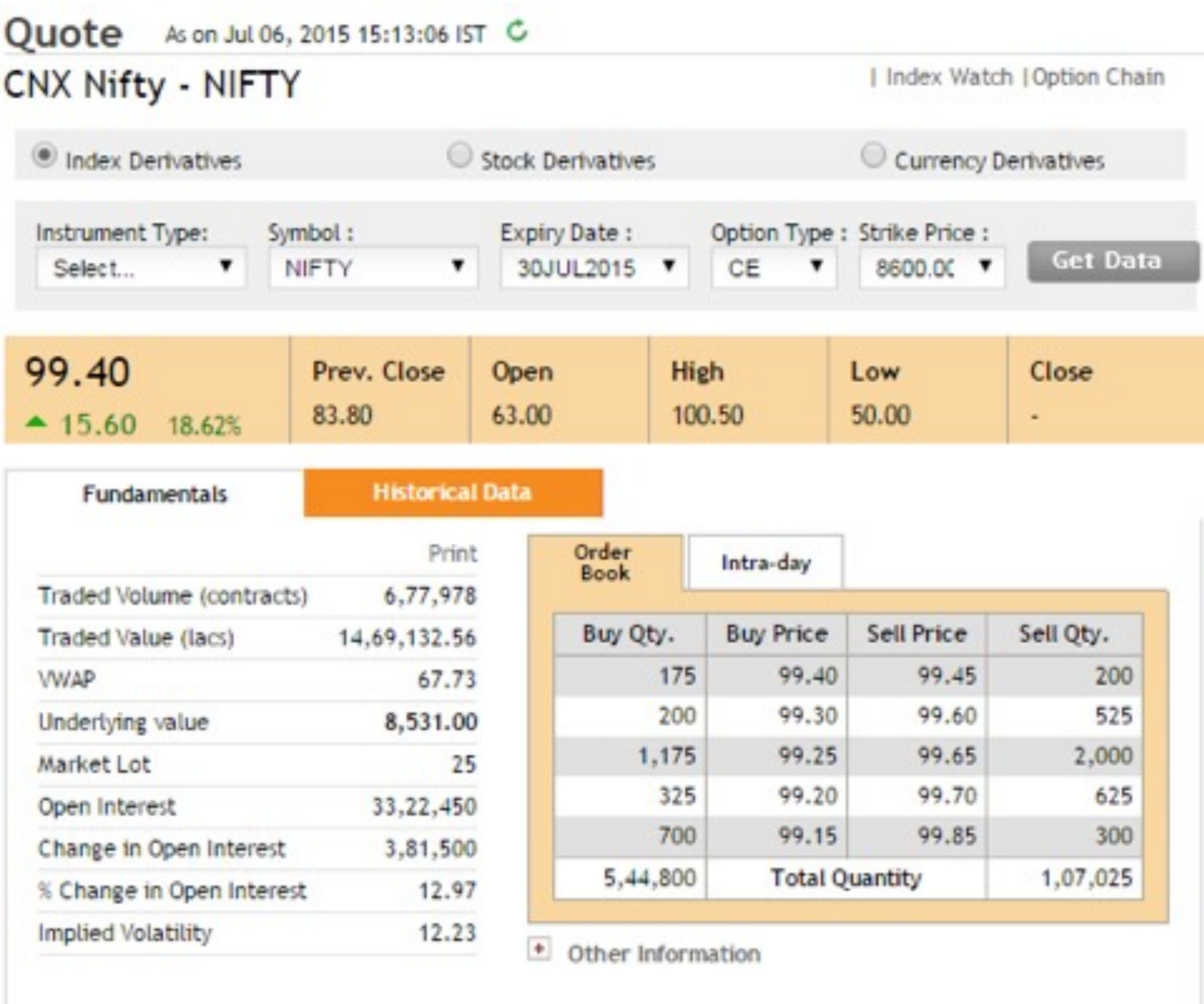
1. 8350 CE
2. 8450 CE
3. 8400 PE
4. 8450 PE

We know the intrinsic value is **always a positive value or zero and can never be below zero**. If the value turns out to be negative, then the intrinsic value is considered zero. We know for Call options the intrinsic value is **"Spot Price – Strike Price"** and for Put options it is **"Strike Price – Spot Price".** Hence the intrinsic values for the above options are as follows –

1. 8350 CE = 8423 – 8350 = +73
2. 8450 CE = 8423 – 8450 = -ve value hence 0
3. 8400 PE = 8400 – 8423 = -ve value hence 0
4. 8450 PE = 8450 – 8423 = + 27

So given that we know how to calculate the intrinsic value of an option, let us attempt to decompose the premium and extract the time value and intrinsic value.

Have a look at the following snapshot –



Details to note are as follows –

- ➡ Spot Value = 8531
- ➡ Strike = 8600 CE
- ➡ Status = OTM
- ➡ Premium = 99.4
- ➡ Today's date = 6th July 2015
- ➡ Expiry = 30th July 2015

Intrinsic value of a call option –

Spot Price – Strike Price i.e 8531 – 8600 = 0 (since it's a negative value)

We know –

Premium = Time value + Intrinsic value

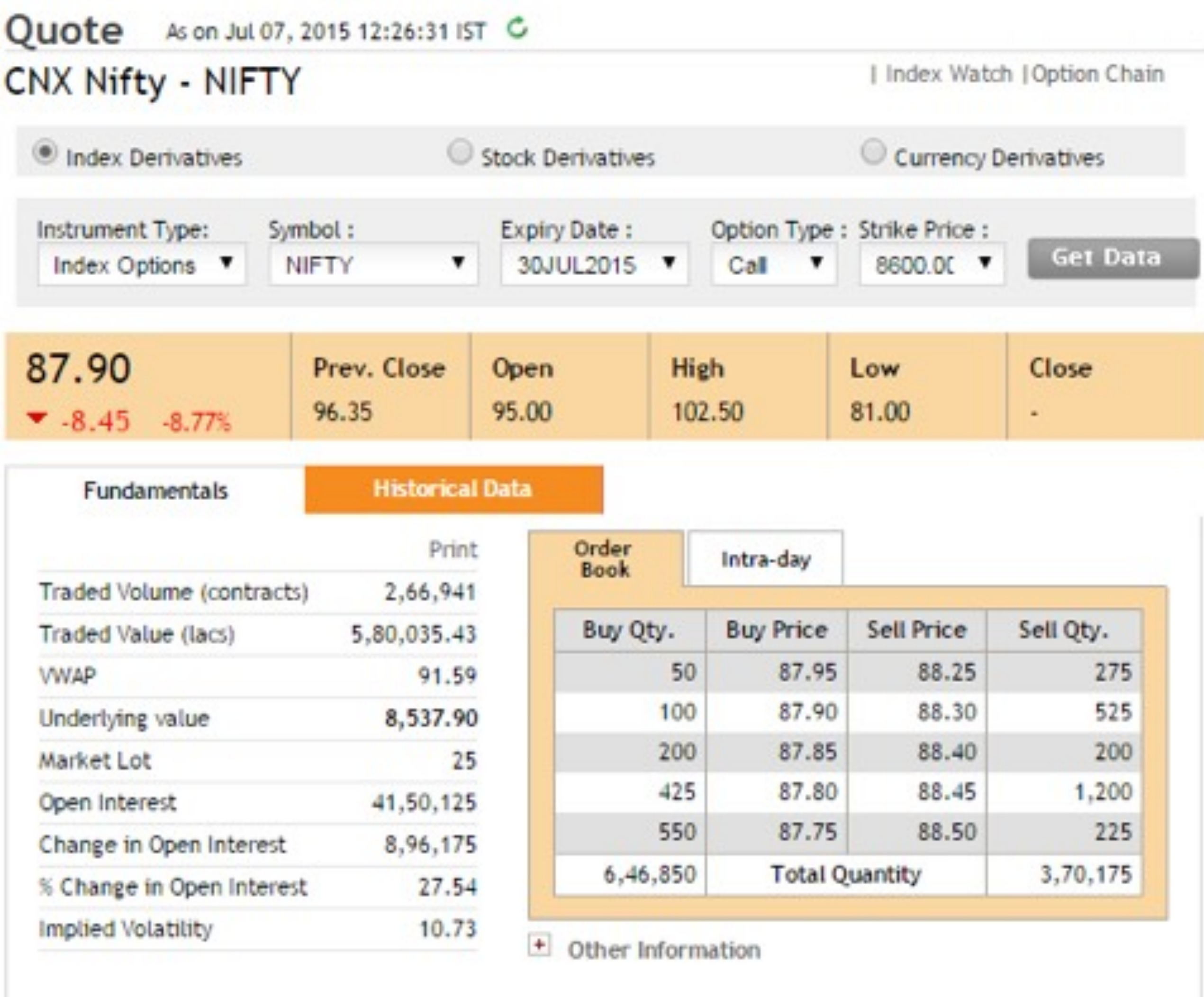
99.4 = Time Value + 0

This implies Time value = 99.4!

Do you see that? The market is willing to pay a premium of Rs.99.4/- for an option that has zero intrinsic value but ample time value!

Recall **time is money :-)**

Here is snapshot of the same contract that I took the next day i.e 7th July –



Notice the underlying value has gone up slightly (8538) but the option premium has decreased quite a bit!

Let’s decompose the premium into its intrinsic value and time value –

Spot Price – Strike Price i.e 8538 – 8600 = 0 (since it’s a negative value)

We know –

Premium = Time value + Intrinsic value

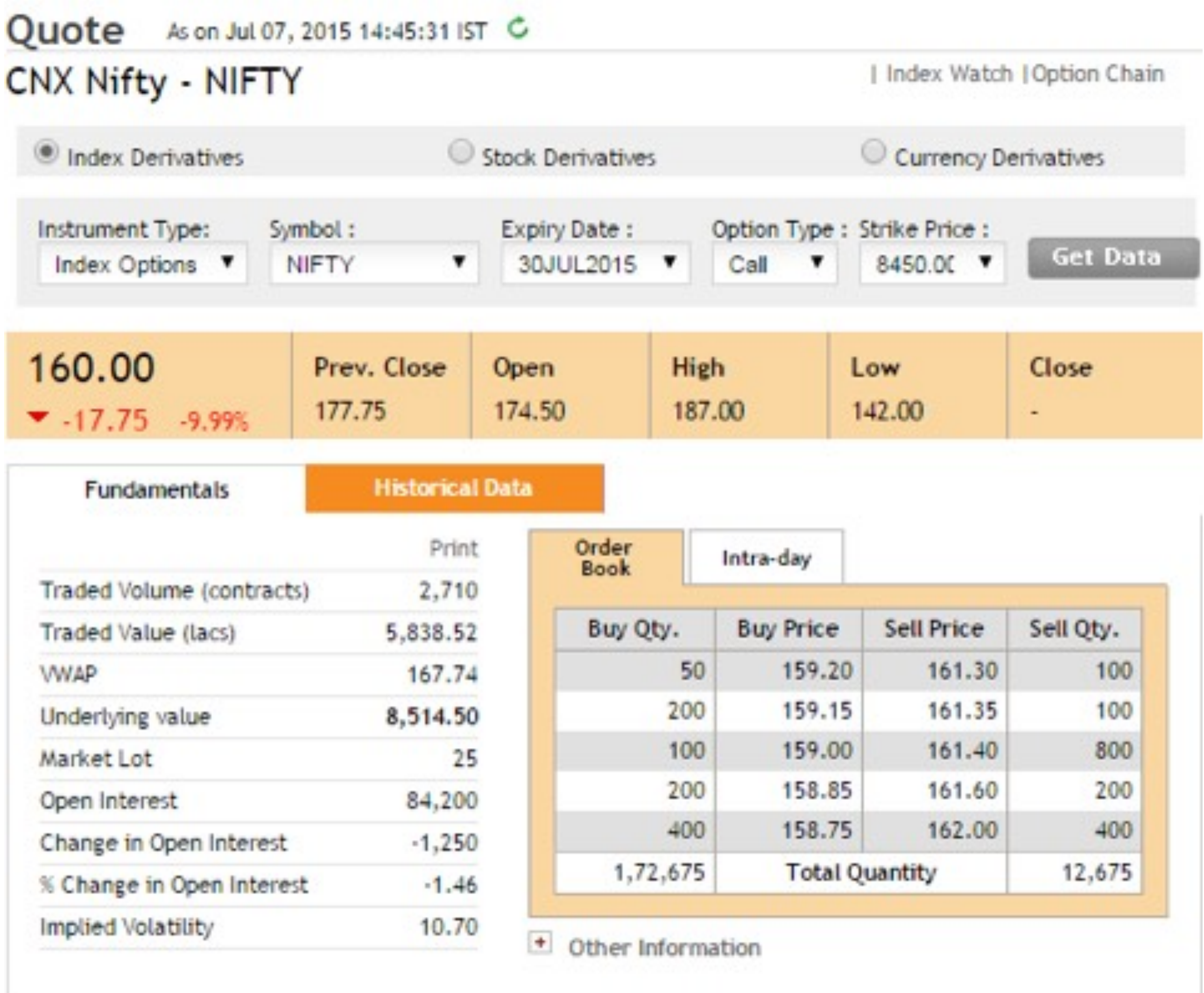
87.9 = Time Value + 0

This implies Time value = 87.9!

Notice the overnight drop in premium value? We will soon understand why this happened.

Note – In this example, the drop in premium value is 99.4 minus 87.9 = 11.5. This drop is attributable to drop in **volatility and time**. We will talk about volatility in the next chapter. For the sake of argument, if both volatility and spot were constant, the drop in premium would be completely attributable to the passage of time. I would suspect this drop would be around Rs.5 or so and not really Rs.11.5/-.

Let us take another example –



➡Spot Value = 8514.5

➡ Strike = 8450 CE

➡ Status = ITM

➡ Premium = 160

➡ Today's date = 7th July 2015

➡ Expiry = 30th July 2015

Intrinsic value of call option –

Spot Price – Strike Price i.e 8514.5 – 8450 = 64.5

We know –

Premium = Time value + Intrinsic value

160 = Time Value + 64.5

This implies the Time value = 160 – 64.5

= 95.5

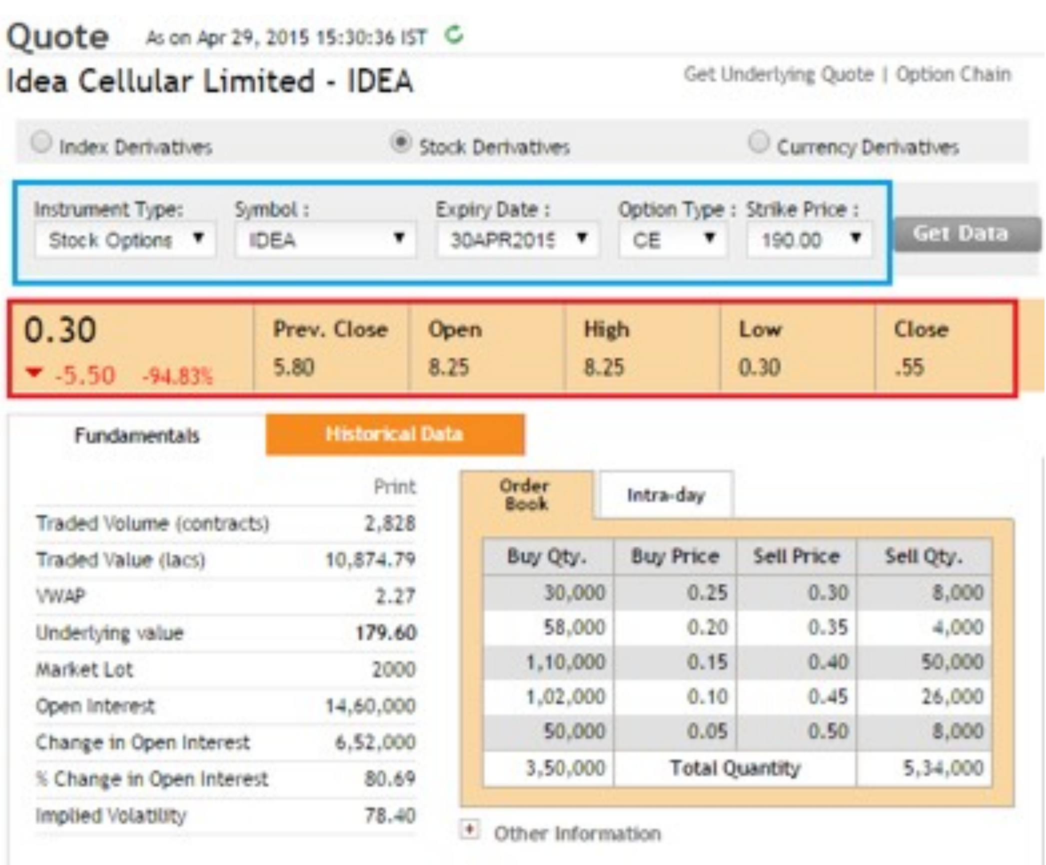
Hence out of the total premium of Rs.160, traders are paying 64.5 towards intrinsic value and 95.5 towards the time value. You can repeat the calculation for all options (both calls and puts) and decompose the premium into the Time value and intrinsic value.

14.2 – Movement of time

Time as we know moves in one direction. Keep the expiry date as the target time and think about the movement of time. Quite obviously as time progresses, the number of days for expiry gets lesser and lesser. Given this let me ask you this question – With roughly 18 trading days to expiry, traders are willing to pay as much as Rs.100/- towards time value, will they do the same if time to expiry was just 5 days?

Obviously they would not right? With lesser time to expiry, traders will pay a much lesser value towards time.

In fact here is a snap shot that I took from the earlier months –



➡ Date = 29th April

➡ Expiry Date = 30th April

➡ Time to expiry = 1 day

➡ Strike = 190

➡ Spot = 179.6

➡ Premium = 30 Paisa

➡ Intrinsic Value = 179.6 – 190 = 0 since it's a negative value

➡ Hence time value should be 30 paisa which equals the premium

With 1 day to expiry, traders are willing to pay a time value of just 30 paisa. However, if the time to expiry was 20 days or more the time value would probably be Rs.5 or Rs.8/-.

The point that I'm trying to make here is this – with every passing day, as we get closer to the expiry day, the time to expiry becomes lesser and lesser. This means the option buyers will pay lesser and lesser towards time value. So if the option buyer pays Rs.10 as the time value today, tomorrow he would probably pay Rs.9.5/- as the time value.

This leads us to a very important conclusion – **"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".**

Now the next logical question is – by how much would the premium decrease on a daily basis owing to the passage of time?

Well, Theta the 3rd Option Greek helps us answer this question.

14.3 – Theta

All options – both Calls and Puts lose value as the expiration approaches. The Theta or **time decay factor** is the rate at which an option loses value as time passes. Theta is expressed in points lost per day when all other conditions remain the same.

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.

A Theta of -0.5 indicates that the option premium will lose -0.5 points for every day that passes by. For example, if an option is trading at Rs.2.75/- with theta of -0.05 then it will trade at Rs.2.70/- the following day (provided other things are kept constant).

A long option (option buyer) will always have a negative theta meaning all else equal, the option buyer will lose money on a day by day basis.

A short option (option seller) will have a positive theta. Theta is a friendly Greek to the option seller. Remember the objective of the option seller is to retain the premium. Given that options loses value on a daily basis, the option seller can benefit by retaining the premium to the extent it loses value owing to time.

For example if an option writer has sold options at Rs.54, with theta of 0.75, all else equal, the same option is likely to trade at –

=0.75 * 3

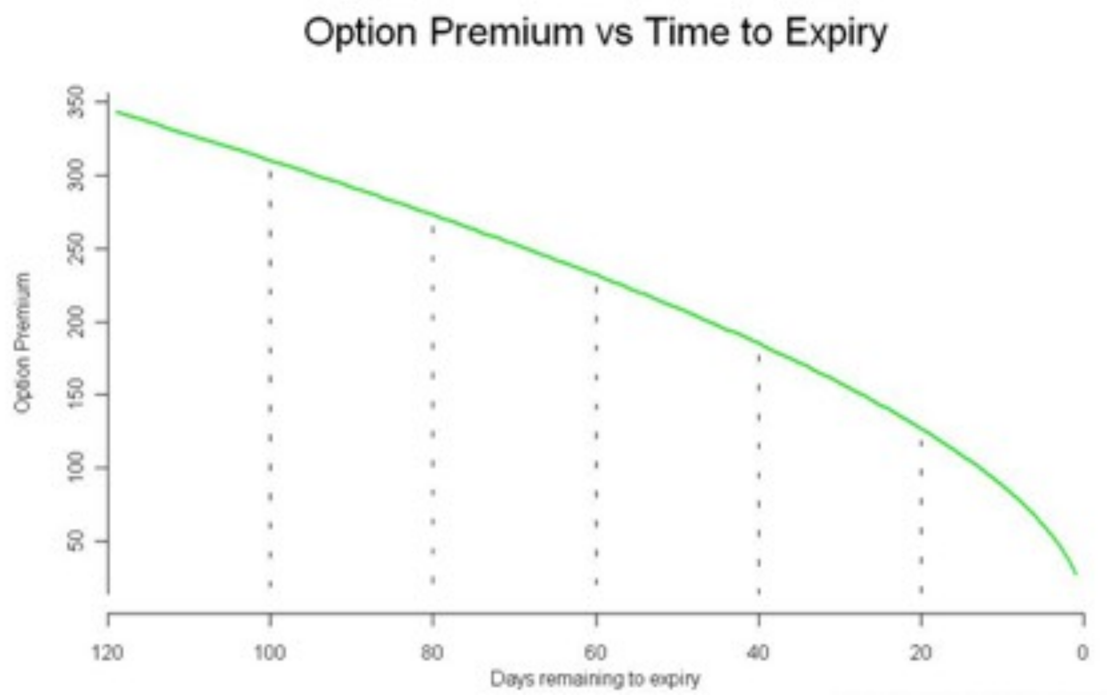
= 2.25

= 54 – 2.25

= 51.75

Hence the seller can choose to close the option position on T+ 3 day by buying it back at Rs.51.75/- and profiting Rs.2.25 …and this is attributable to theta!

Have a look at the graph below –



This is the graph of how premium erodes as time to expiry approaches. This is also called the '**Time Decay'** graph. We can observe the following from the graph –

1. At the start of the series – when there are many days for expiry the option does not lose much value. For example when there were 120 days to expiry the option was trading at 350, however when there was 100 days to expiry, the option was trading at 300. Hence the effect of theta is **low**

2. As we approach the expiry of the series – the effect of theta is **high**. Notice when there was 20 days to expiry the option was trading around 150, but when we approach towards expiry the drop in premium seems to accelerate (option value drops below 50)**.**

So if you are selling options at the start of the series – you have the advantage of pocketing a large premium value (as the time value is very high) but do remember the fall in premium happens at a low rate.

You can sell options closer to the expiry – you will get a lower premium but the drop in premium is high, which is advantageous to the options seller.

Theta is a relatively straightforward and easy Greek to understand. We will revisit theta again when we will discuss cross dependencies of Greeks. But for now, if you have understood all that's being discussed here you are good to go.

We shall now move forward to understand the last and the most interesting Greek – Vega!

Key takeaways from this chapter

1. Option sellers are always compensated for the time risk
2. Premium = Intrinsic Value + Time Value
3. All else equal, options lose money on a daily basis owing to Theta
4. Time moves in a single direction hence Theta is a positive number
5. Theta is a friendly Greek to option sellers
6. When you short naked options at the start of the series you can pocket a large time value but the fall in premium owing to time is low
7. When you short option close to expiry the premium is low (thanks to time value) but the fall in premium is rapid

CHAPTER 15

Volatility Basics

15.1 – Background

Having understood Delta, Gamma, and Theta we are now at all set to explore one of the most interesting Option Greeks – The Vega. Vega, as most of you might have guessed is the rate of change of option premium with respect to change in volatility. But the question is – What is volatility? I have asked this question to quite a few traders and the most common answer is "Volatility is the up down movement of the stock market". If you have a similar opinion on volatility, then it is about time we fixed that :).

So here is the agenda, I suppose this topic will spill over a few chapters –

1. We will understand what volatility really means
2. Understand how to measure volatility
3. Practical Application of volatility
4. Understand different types of volatility
5. Understand Vega

So let's get started.

15.2 – Moneyball

Have you watched this Hollywood movie called 'Moneyball'? It's a real life story Billy Beane – manager of a base ball team in US. The movie is about Billy Beane and his young colleague, and how they leverage the power of statistics to identify relatively low profile but extremely talented baseball players. A method that was unheard of during his time, and a method that proved to be both innovative and disruptive.

You can watch the trailer of Moneyball here.

I love this movie, not just for Brad Pitt, but for the message it drives across on topics related to life and business. I will not get into the details now, however let me draw some inspiration from the Moneyball method, to help explain volatility :).

The discussion below may appear unrelated to stock markets, but please don't get discouraged. I can assure you that it is relevant and helps you relate better to the term 'Volatility'.

Consider 2 batsmen and the number of runs they have scored over 6 consecutive matches –

Match	Billy	Mike
1	20	45
2	23	13
3	21	18
4	24	12
5	19	26
6	23	19

You are the captain of the team, and you need to choose either Billy or Mike for the 7th match. The batsman should be dependable – in the sense that the batsman you choose should be in a position to score at least 20 runs. Whom would you choose? From my experience I have noticed that people approach this problem in one of the two ways –

1. Calculate the total score (also called **'Sigma'**) of both the batsman – pick the batsman with the highest score for next game. Or..

2. Calculate the average (also called **'Mean'**) number of scores per game – pick the batsman with better average.

Let us calculate the same and see what numbers we get –

➡ Billy's Sigma = 20 + 23 + 21 + 24 + 19 + 23 = 130

➡ Mike's Sigma = 45 + 13 + 18 + 12 + 26 + 19 = 133

So based on the sigma you are likely to select Mike. Let us calculate the mean or average for both the players and figure out who stands better –

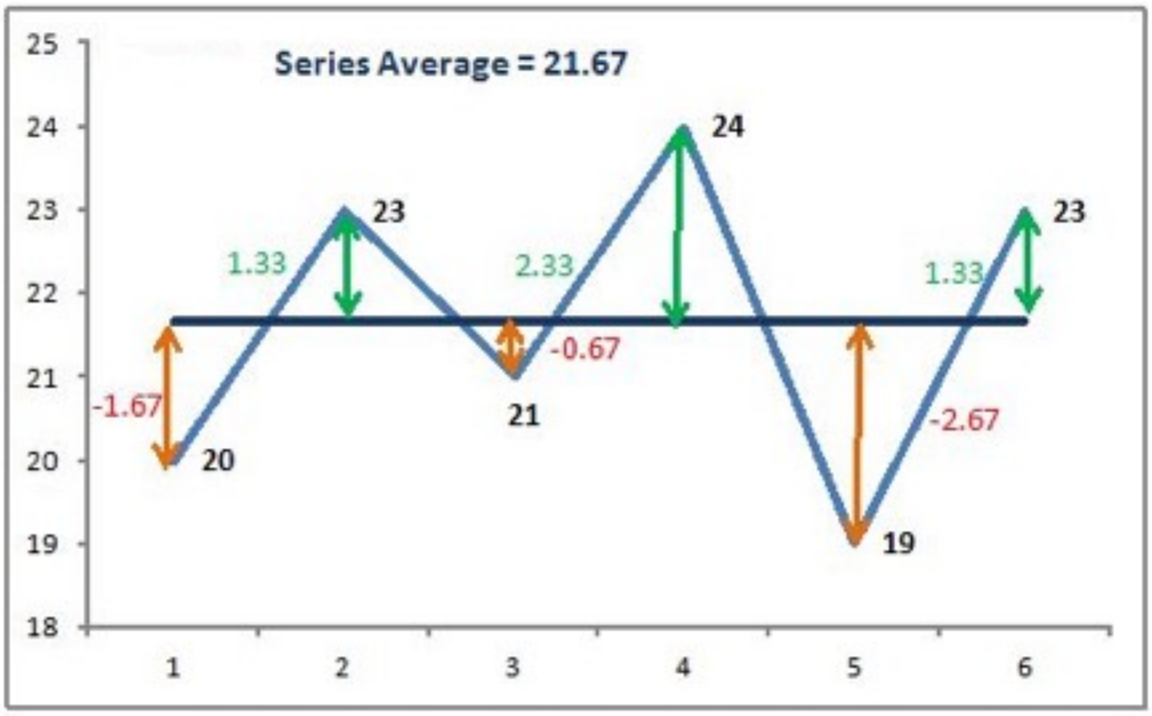
➡ Billy = 130/6 = 21.67

➡ Mike = 133/6 = 22.16

So it seems from both the mean and sigma perspective, Mike deserves to be selected. But let us not conclude that yet. Remember the idea is to select a player who can score at least 20 runs and with the information that we have now (mean and sigma) there is no way we can conclude who can score at least 20 runs. Therefore, let's do some further investigation.

To begin with, for each match played we will calculate the deviation from the mean. For example, we know Billy's mean is 21.67 and in his first match Billy scored 20 runs. Therefore deviation from mean form the 1st match is 20 – 21.67 = **– 1.67**. In other words, he scored 1.67 runs lesser than his average score. For the 2nd match it was 23 – 21.67 = **+1.33**, meaning he scored 1.33 runs more than his average score.

Here is the diagram representing the same (for Billy) –



The middle black line represents the average score of Billy, and the double arrowed vertical line represents the the deviation from mean, for each of the match played. We will now go ahead and calculate another variable called 'Variance'.

Variance is simply the **'sum of the squares of the deviation divided by the total number of observations'**. This may sound scary, but its not. We know the total number of observations in this case happens to be equivalent to the total number of matches played, hence 6.

So variance can be calculated as –

Variance = [(-1.67) ^2 + (1.33) ^2 + (-0.67) ^2 + (+2.33) ^2 + (-2.67) ^2 + (1.33) ^2] / 6
= 19.33 / 6
= **3.22**

Further we will define another variable called **'Standard Deviation' (SD)** which is calculated as –

$$std\ deviation = \sqrt{Variance}$$

So standard deviation for Billy is –

= SQRT (3.22)

= 1.79

Likewise Mike's standard deviation works out to be 11.18.

Lets stack up all the numbers (or statistics) here –

Statistics	Billy	Mike
Sigma	130	133
Mean	21.6	22.16
SD	1.79	11.18

We know what 'Mean' and 'Sigma' signifies, but what about the SD? Standard Deviation simply generalizes and represents the deviation from the average.

Here is the text book definition of SD *"In statistics, the **standard deviation** (SD, also represented by the Greek letter sigma, σ) is a measure that is used to quantify the amount of variation or dispersion of a set of data values".*

Please don't get confused between the two sigma's – the total is also called sigma represented by the Greek symbol ∑ and standard deviation is also sometimes referred to as sigma represented by the Greek symbol σ.

One way to use SD is to make a projection on how many runs Billy and Mike are likely to score in the next match. To get this projected score, you simply need to add and subtract the SD from their average.

Player	Lower Estimate	Upper Estimate
Billy	21.6 – 1.79 = 19.81	21.6 + 1.79 = 23.39
Mike	22.16 – 11.18 = 10.98	22.16 + 11.18 = 33.34

These numbers suggest that in the upcoming 7th match Billy is likely to get a score anywhere in between 19.81 and 23.39 while Mike stands to score anywhere between 10.98 and 33.34. Because Mike has a wide range, it is difficult to figure out if he is going to score at least 20 runs. He can either score 10 or 34 or anything in between.

However Billy seems to be more consistent. His range is smaller, which means he will neither be a big hitter nor a lousy player. He is expected to be a consistent and is likely to score anywhere between 19 and 23. In other words – selecting Mike over Billy for the 7th match can be **risky**.

Going back to our original question, which player do you think is more likely to score at least 20 runs? By now, the answer must be clear; it has to be Billy. Billy is consistent and less risky compared to Mike.

So in principal, we assessed the riskiness of these players by using **"Standard Deviation"**. Hence 'Standard Deviation' must represent **'Risk'**. In the stock market world, we define 'Volatility' as the riskiness of the stock or an index. Volatility is a % number as measured by **standard deviation**.

I've picked the definition of Volatility from Investopedia for you – *"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"*.

Going by the above definition, if Infosys and TCS have volatility of 25% and 45% respectively, then clearly Infosys has less risky price movements when compared to TCS.

15.3 – Some food for thought

Before I wrap this chapter, let's do some prediction –
Today's Date = 15th July 2015
Nifty Spot = 8547
Nifty Volatility = 16.5%
TCS Spot = 2585
TCS Volatility = 27%

Given this information, can you predict the likely range within which Nifty and TCS will trade 1 year from now?
Of course we can, let us put the numbers to good use –

Asset	Lower Estimate	Upper Estimate
Nifty	8547 – (16.5% * 8547) = 7136	8547 + (16.5% * 8547) = 9957
TCS	2585 – (27% * 2585) = 1887	2585 + (27% * 2585) = 3282

So the above calculations suggest that in the next 1 year, given Nifty's volatility, Nifty is likely to trade anywhere between **7136 and 9957** with all values in between having varying probability of occurrence. This means to say on 15th July 2016 the probability of Nifty to be around 7500 could be 25%, while 8600 could be around 40%.

This leads us to a very interesting platform –

1. We estimated the range for Nifty for 1 year; similarly can we estimate the range Nifty is likely to trade over the next few days or the range within which Nifty is likely to trade upto the series expiry?

  a. If we can do this, then we will be in a better position to identify options that are likely to expire worthless, meaning we could sell them today and pocket the premiums.

2. We figured the range in which Nifty is likely to trade in the next 1 year as 7136 and 9957 – but how sure are we? Is there any degree of confidence while expressing this range?

3. How do we calculate Volatility? I know we discussed the same earlier in the chapter, but is there an easier way? Hint – we could use MS Excel!

4. Given Nifty's volatility as 16.5% we calculated the range, what if the volatility changes?

Over the next few chapters we will answer all these questions and more!

Key takeaways from this chapter

1. Vega measures the rate of change of premium with respect to change in volatility
2. Volatility is not just the up down movement of markets
3. Volatility is a measure of risk
4. Volatility is estimated by standard deviation
5. Standard Deviation is the square root of variance
6. We can estimate the range of the stock price given its volatility
7. Larger the range of a stock, higher is its volatility aka risk.

CHAPTER 16

Volatility Calculation (Historical)

16.1 – Calculating Volatility on Excel

In the previous chapter, we introduced the concept of standard deviation and how it can be used to evaluate 'Risk or Volatility' of a stock. Before we move any further on this topic I would like to discuss how one can calculate volatility. Volatility data is not easily available, hence its always good to know how to calculate the same yourself.

Of course in the previous chapter we looked into this calculation (recall the Billy & Mike example), we outlined the steps as follows –

1. Calculate the average
2. Calculate the deviation – Subtract the average from the actual observation
3. Square and add up all deviations – this is called variance
4. Calculate the square root of variance – this is called standard deviation

The purpose of doing this in the previous chapter was to show you the mechanics behind the standard deviation calculation. In my opinion it is important to know what really goes beyond a formula, it only enhances your insights. In this chapter however, we will figure out an easier way to calculate standard deviation or the volatility of a given stock using MS Excel. MS Excel uses the exact same steps we outlined above, just that it happens at a click of a button.

I'll give you the border steps involved first and then elaborate on each step –

1. Download the historical data of closing prices

2. Calculate the daily returns

3. Use the STDEV function

So let us get to work straight away.

Step 1 – Download the historical closing prices

You can do this from any data source that you have. Some of the free and reliable data sources are NSE India website and Yahoo Finance.

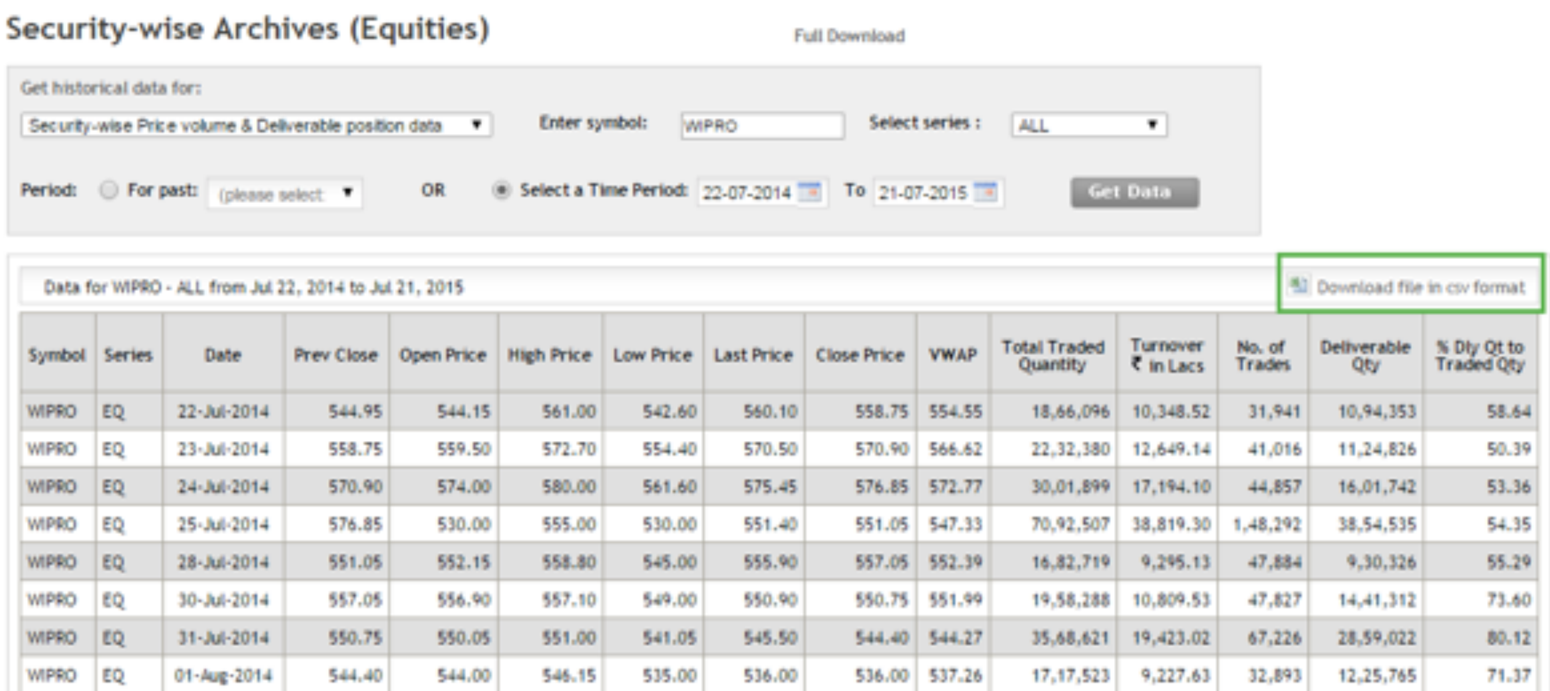
I will take the data from NSE India for now. At this point I must tell you that NSE's website is quite resourceful, and in terms of information provided, I guess NSE's website is one of the best stock exchange websites in the world.

Anyway, in this chapter let us calculate Wipro's volatility. To download the historical closing prices, visit –http://www.nseindia.com/products/content/equities/equities/equities.htm and click on historical data and select the search option.

Here is a snapshot where I have highlighted the search option –

Once you hit search, a set of fields open up, filling them up is quite self explanatory – just fill in the required details and hit 'Get Data'. Do make sure you get the data for the last 1 year. The dates that I have selected here is from 22nd July 2014 to 21st July 2015.

Once you hit 'get data', NSE's website will query your request and fetch you the required data. At this point you should see the following screen –



Symbol	Series	Date	Prev Close	Open Price	High Price	Low Price	Last Price	Close Price	VWAP	Total Traded Quantity	Turnover ₹ in Lacs	No. of Trades	Deliverable Qty	% Dly Qt to Traded Qty
WIPRO	EQ	22-Jul-2014	544.95	544.15	561.00	542.60	560.10	558.75	554.55	18,66,096	10,348.52	31,941	10,94,353	58.64
WIPRO	EQ	23-Jul-2014	558.75	559.50	572.70	554.40	570.50	570.90	566.62	22,32,380	12,649.14	41,016	11,24,826	50.39
WIPRO	EQ	24-Jul-2014	570.90	574.00	580.00	561.60	575.45	576.85	572.77	30,01,899	17,194.10	44,857	16,01,742	53.36
WIPRO	EQ	25-Jul-2014	576.85	530.00	555.00	530.00	551.40	551.05	547.33	70,92,507	38,819.30	1,48,292	38,54,535	54.35
WIPRO	EQ	28-Jul-2014	551.05	552.15	558.80	545.00	555.90	557.05	552.39	16,82,719	9,295.13	47,884	9,30,326	55.29
WIPRO	EQ	30-Jul-2014	557.05	556.90	557.10	549.00	550.90	550.75	551.99	19,58,288	10,809.53	47,827	14,41,312	73.60
WIPRO	EQ	31-Jul-2014	550.75	550.05	551.00	541.05	545.50	544.40	544.27	35,68,621	19,423.02	67,226	28,59,022	80.12
WIPRO	EQ	01-Aug-2014	544.40	544.00	546.15	535.00	536.00	536.00	537.26	17,17,523	9,227.63	32,893	12,25,765	71.37

Once you get this, click on 'Download file in CSV format' (highlighted in the green box), and that's it.

You now have the required data on Excel. Of course along with the closing prices, you have tons of other information as well. I usually like to delete all the other unwanted data and stick to just the date and closing price. This makes the sheet look clutter free and crisp.

Here is a snapshot of how my excel sheet looks at this stage –

	A	B	C
1	**Date**	**Close Price**	
2	22-Jul-14	558.75	
3	23-Jul-14	570.9	
4	24-Jul-14	576.85	
5	25-Jul-14	551.05	
6	28-Jul-14	557.05	
7	30-Jul-14	550.75	
8	31-Jul-14	544.4	
9	1-Aug-14	536	
10	4-Aug-14	548.65	
11	5-Aug-14	549.55	
12	6-Aug-14	551.4	

Do note, I have deleted all the unnecessary information. I have retained just the date and closing prices.

Step 2 – Calculate Daily Returns

We know that the daily returns can be calculated as –

Return = (Ending Price / Beginning Price) – 1

However for all practical purposes and ease of calculation, this equation can be approximated to:

Return = LN (Ending Price / Beginning Price), where LN denotes Logarithm to Base 'e', note this is also called 'Log Returns'.

Here is a snap shot showing you how I've calculated the daily log returns of WIPRO –

	A	B	C	D	E
1	**Date**	**Close Price**	**Daily Rt**		
2	22-Jul-14	558.75			
3	23-Jul-14	570.9	=LN(B3/B2)		
4	24-Jul-14	576.85	1.04%		
5	25-Jul-14	551.05	-4.58%		
6	28-Jul-14	557.05	1.08%		
7	30-Jul-14	550.75	-1.14%		
8	31-Jul-14	544.4	-1.16%		
9	1-Aug-14	536	-1.56%		
10	4-Aug-14	548.65	2.33%		
11	5-Aug-14	549.55	0.16%		
12	6-Aug-14	551.4	0.34%		
13	7-Aug-14	552.65	0.23%		

I have used the Excel function 'LN' to calculate the long returns.

Step 3 – Use the STDEV Function

Once the daily returns are calculated, you can use an excel function called 'STDEV' to calculate the standard deviation of daily returns, which if you realize is the daily Volatility of WIPRO.

Note – In order to use the STDEV function all you need to do is this –

1. Take the cursor an empty cell

2. Press '='

3. Follow the = sign by the function syntax i.e STDEV and open a bracket, hence the empty cell would look like =STEDEV(

4. After the open bracket, select all the daily return data points and close the bracket

5. Press enter

Here is the snapshot which shows the same –

	A	B	C	D	E	F	G
1	Date	Close Price	Daily Rt				
2	22-Jul-14	558.75					
3	23-Jul-14	570.9	2.15%				
4	24-Jul-14	576.85	1.04%				
5	25-Jul-14	551.05	-4.58%		Daily Volatility	=STDEV(C3:C245)	
6	28-Jul-14	557.05	1.08%				
7	30-Jul-14	550.75	-1.14%				
8	31-Jul-14	544.4	-1.16%				
9	1-Aug-14	536	-1.56%				
10	4-Aug-14	548.65	2.33%				

Once this is done, Excel will instantly calculate the daily standard deviation aka volatility of WIPRO for you. I get the answer as 0.0147 which when converted to a percentage reads as 1.47%.

This means the daily volatility of WIPRO is 1.47% !

The value we have calculated is WIPRO's daily volatility, but what about its annual volatility?

Now here is a very important convention you will have to remember – in order to convert the daily volatility to annual volatility just multiply the daily volatility number with the square root of time.

Likewise to convert the annual volatility to daily volatility, divide the annual volatility by square root of time.

So in this case we have calculated the daily volatility, and we now need WIPRO's annual volatility. We will calculate the same here –

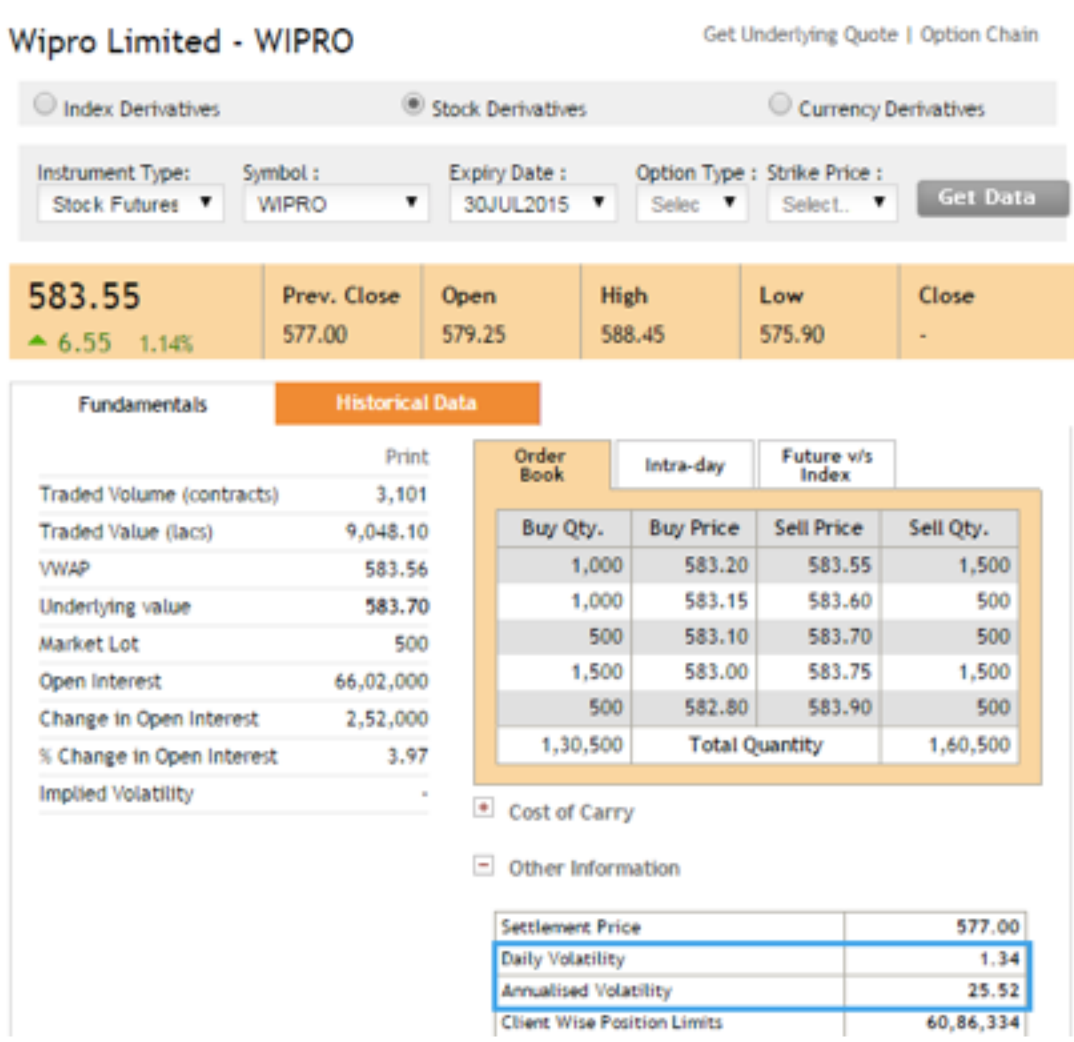
- ➡ Daily Volatility = 1.47%
- ➡ Time = 365
- ➡ Annual Volatility = 1.47% * SQRT (365)
- ➡ = 28.08%

In fact I have calculated the same on excel, have a look at the image below –

	A	B	C	D	E	F	G
1	Date	Close Price	Daily Rt				
2	22-Jul-14	558.75					
3	23-Jul-14	570.9	2.15%				
4	24-Jul-14	576.85	1.04%				
5	25-Jul-14	551.05	-4.58%		Daily Volatility	1.47%	
6	28-Jul-14	557.05	1.08%		Annual Volatility	=F5*SQRT(365)	
7	30-Jul-14	550.75	-1.14%				
8	31-Jul-14	544.4	-1.16%				
9	1-Aug-14	536	-1.56%				
10	4-Aug-14	548.65	2.33%				
11	5-Aug-14	549.55	0.16%				
12	6-Aug-14	551.4	0.34%				
13	7-Aug-14	552.65	0.23%				
14	8-Aug-14	548.05	-0.84%				
15	11-Aug-14	542.95	-0.93%				

So with this, we know WIPRO's daily volatility is 1.47% and its annual volatility is about 28%.

Lets double check these numbers with what the NSE has published on their website. NSE publishes these numbers only for F&O stocks and not other stocks. Here is the snapshot of the same -



Our calculation is pretty much close to what NSE has calculated – as per NSE's calculation Wipro's daily volatility is about 1.34% and Annualized Volatility is about 25.5%.

So why is there a slight difference between our calculation and NSE's? – One possible reason could be that we are using spot price while NSE is using Futures price. However I really don't want to get into investigating why this slight difference exists. The agenda here is to know how to calculate the volatility of the security given its daily returns.

Before we wrap up this chapter, let us just do one more calculation. Assume we directly get the annual volatility of WIPRO as 25.5%, how do we figure out its daily volatility?

Like I mentioned earlier, to convert annual volatility to daily volatility you simply have to divide the annual volatility by the square root of time, hence in this particular case –

= 25.5% / SQRT (365)

= 1.34%

So far we have understood what volatility is and how to calculate the same. In the next chapter we will understand the practical application of volatility.

Do remember we are still in the process of understanding volatility; however the final objective is to understand the option greek Vega and that really means. So please do not lose sight of our end objective.

Please click here to download the excel sheet.

Key takeaways from this chapter

1. Standard Deviation represents volatility, which in turn represents risk
2. We can use NSE website to get the daily closing prices of securities
3. Daily return can be calculated as log returns
4. Log function in excel is LN
5. Daily return formula = LN (Today's Value / Yesterday's Value) expressed as a percentage
6. Excel function to calculate volatility is STDEV
7. Standard Deviation of daily return is equivalent of daily volatility
8. To convert daily volatility to annual volatility multiply the daily volatility by the square root of time
9. Likewise to convert annual volatility to daily volatility, divide the annual volatility by the square root of time

CHAPTER 17

Volatility & Normal Distribution

17.1 – Background

In the earlier chapter we had this discussion about the range within which Nifty is likely to trade given that we know its annualized volatility. We arrived at an upper and lower end range for Nifty and even concluded that Nifty is likely to trade within the calculated range.

Fair enough, but how sure are we about this? Is there a possibility that Nifty would trade outside this range? If yes, what is the probability that it will trade outside the range and what is the probability that Nifty will trade within the range? If there is an outside range, then what are its values?

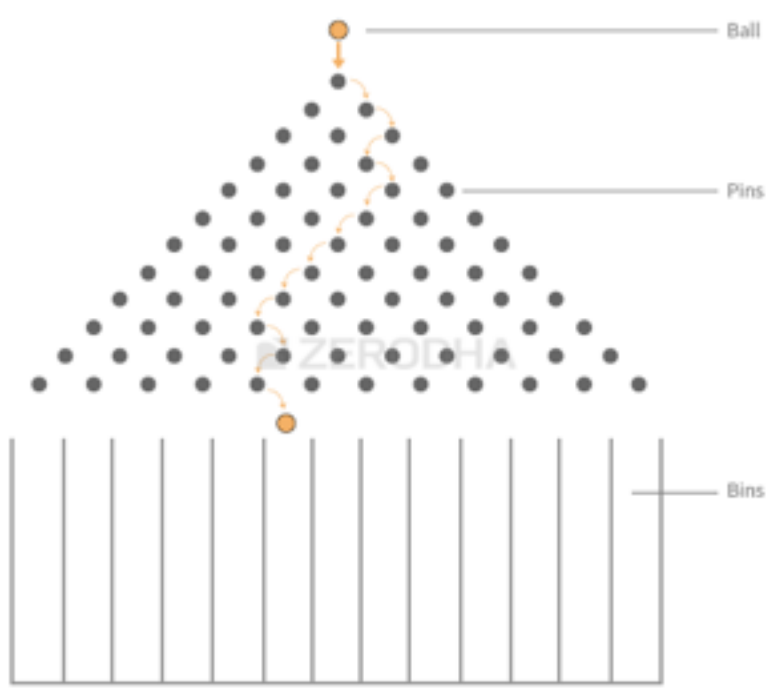
Finding answers to these questions are very important for several reasons. If not for anything it will lay down a very basic foundation to a quantitative approach to markets, which is very different from the regular fundamental and technical analysis thought process.

So let us dig a bit deeper and get our answers.

17.2 – Random Walk

The discussion we are about to have is extremely important and highly relevant to the topic at hand, and of course very interesting as well .

Have a look at the image below –



What you see is called a 'Galton Board'. A Galton Board has pins stuck to a board. Collecting bins are placed right below these pins.

The idea is to drop a small ball from above the pins. Moment you drop the ball, it encounters the first pin after which the ball can either turn left or turn right before it encounters another pin. The same procedure repeats until the ball trickles down and falls into one of the bins below.

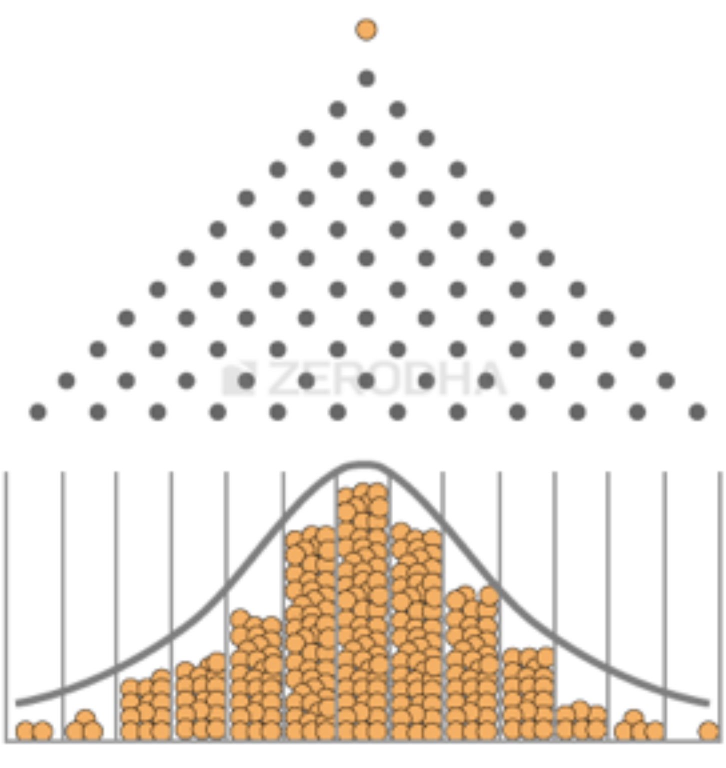
Do note, once you drop the ball from top, you cannot do anything to artificially control the path that the ball takes before it finally rests in one of the bins. The path that the ball takes is completely natural and is not predefined or controlled. For this particular reason, the path that the ball takes is called the '**Random Walk**'.

Now, can you imagine what would happen if you were to drop several such balls one after the other? Obviously each ball will take a random walk before it falls into one of the bins. However what do you think about the distribution of these balls in the bins?.

- ➡ Will they all fall in the same bin? or
- ➡ Will they all get distributed equally across the bins? or
- ➡ Will they randomly fall across the various bins?

I'm sure people not familiar with this experiment would be tempted to think that the balls would fall randomly across various bins and does not really follow any particular pattern. But this does not happen, there seems to be an order here.

Have a look at the image below –



It appears that when you drop several balls on the Galton Board, with each ball taking a random walk, they all get distributed in a particular way –

➡ Most of the balls tend to fall in the central bin

➡ As you move further away from the central bin (either to the left or right), there are fewer balls

➡ The bins at extreme ends have very few balls

A distribution of this sort is called the "**Normal Distribution**". You may have heard of the bell curve from your school days, bell curve is nothing but the normal distribution. Now here is the best part, irrespective of how many times you repeat this experiment, the balls always get distributed to form a normal distribution.

This is a very popular experiment called the Galton Board experiment; I would strongly recommend you to watch this beautiful video to understand this discussion better .Try watching this video on Youtube or enable JavaScript if it is disabled in your browser.

So why do you think we are discussing the Galton Board experiment and the Normal Distribution?

Well many things in real life follow this natural order. For example –

➡ Gather a bunch of adults and measure their weights – segregate the weights across bins (call them the weight bins) like 40kgs to 50kgs, 50kgs to 60kgs, 60kgs to 70kgs etc. Count the number of people across each bin and you end up getting a normal distribution

➡ Conduct the same experiment with people's height and you will end up getting a normal distribution

➡ You will get a Normal Distribution with people's shoe size

➡ Weight of fruits, vegetables

➡ Commute time on a given route

➡ Lifetime of batteries

This list can go on and on, however I would like to draw your attention to one more interesting variable that follows the normal distribution – the daily returns of a stock!

The daily returns of a stock or an index cannot be predicted – meaning if you were to ask me what will be return on TCS tomorrow I will not be able to tell you, this is more like the random walk that the ball takes. However if I collect the daily returns of the stock for a certain period and see the distribution of these returns – I get to see a normal distribution aka the bell curve!

To drive this point across I have plotted the distribution of the daily returns of the following stocks/indices –

➡ Nifty (index)

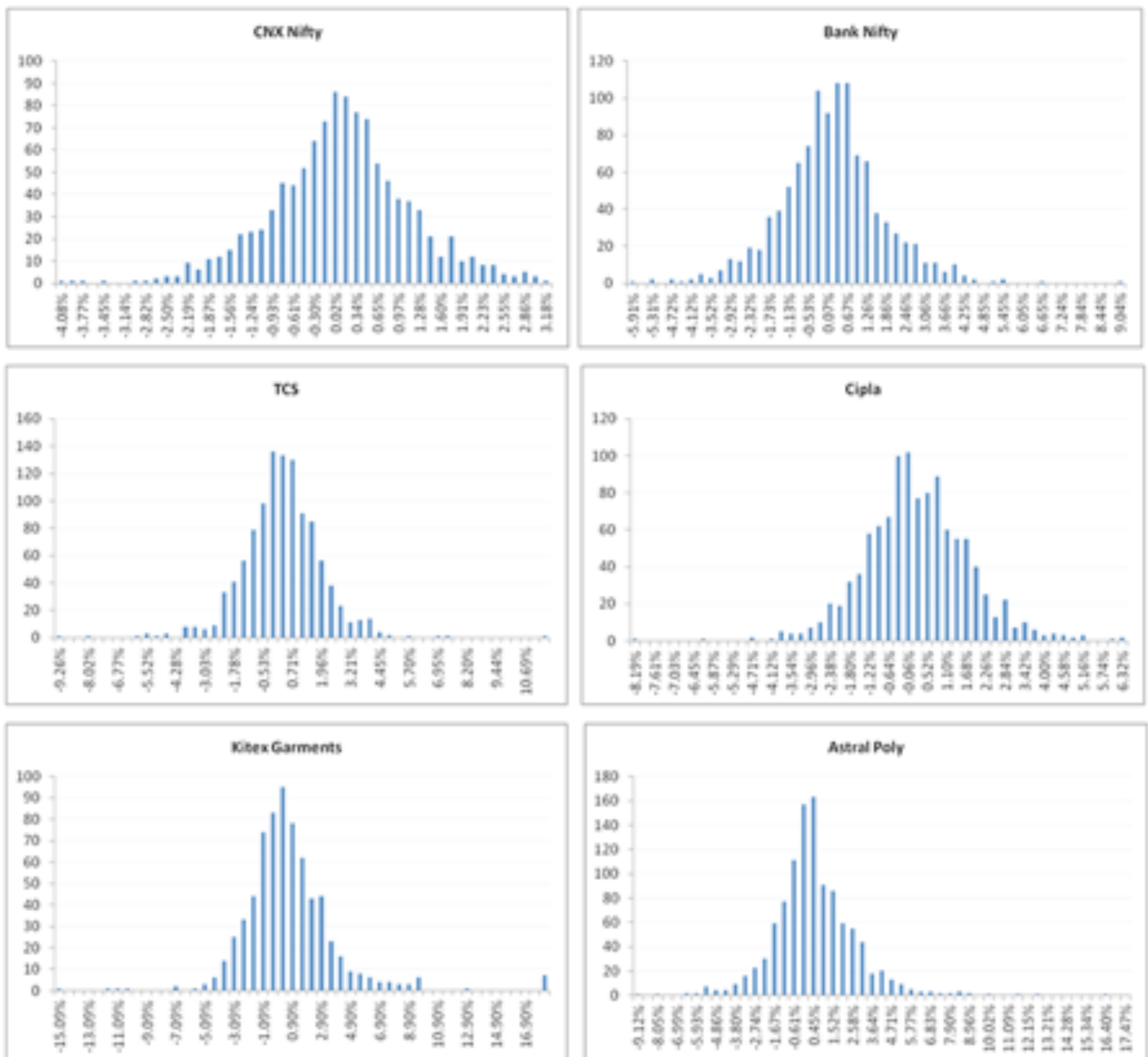
➡ Bank Nifty (index)

➡ TCS (large cap)

➡ Cipla (large cap)

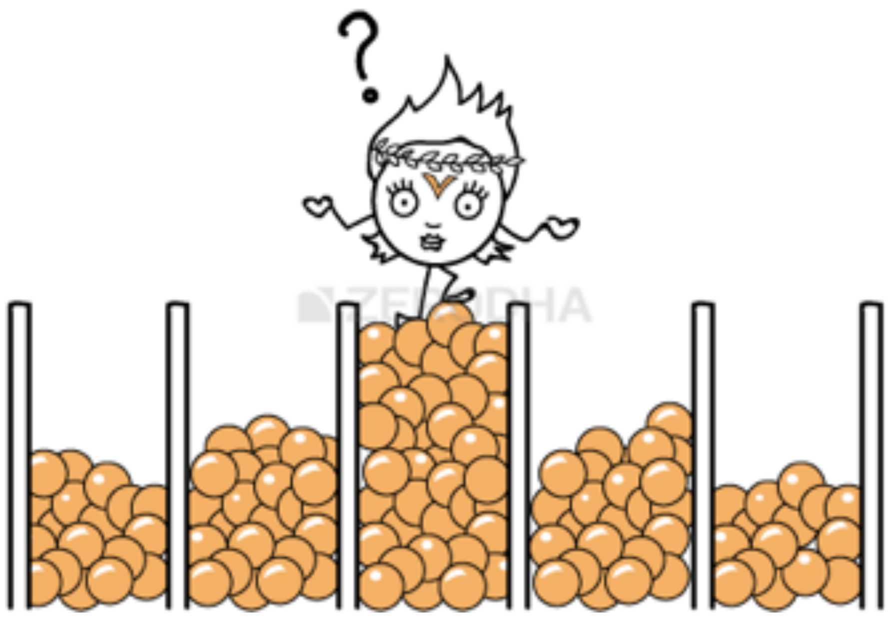
➡ Kitex Garments (small cap)

➡ Astral Poly (small cap)



As you can see the daily returns of the stocks and indices clearly follow a normal distribution.

Fair enough, but I guess by now you would be curious to know why is this important and how is it connected to Volatility? Bear with me for a little longer and you will know why I'm talking about this.



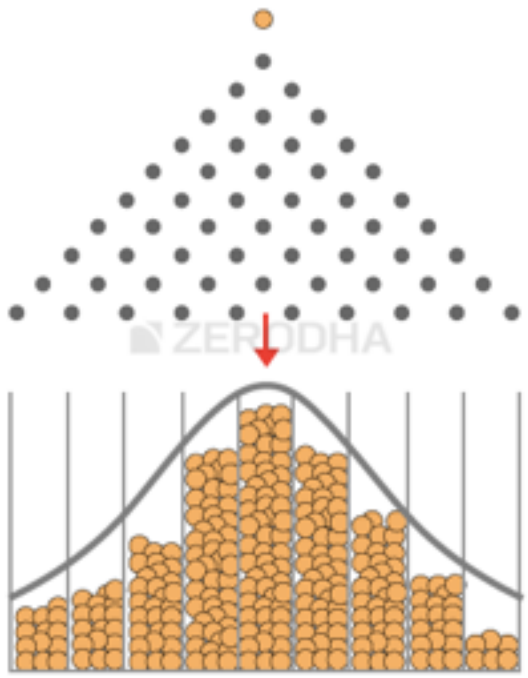
17.3 – Normal Distribution

I think the following discussion could be a bit overwhelming for a person exploring the concept of normal distribution for the first time. So here is what I will do – I will explain the concept of normal distribution, relate this concept to the Galton board experiment, and then extrapolate it to the stock markets. I hope this will help you grasp the gist better.

So besides the Normal Distribution there are other distributions across which data can be distributed. Different data sets are distributed in different statistical ways. Some of the other data distribution patterns are – binomial distribution, uniform distribution, poisson distribution, chi square distribution etc. However the normal distribution pattern is probably the most well understood and researched distribution amongst the other distributions.

The normal distribution has a set of characteristics that helps us develop insights into the data set. The normal distribution curve can be fully described by two numbers – the distribution's mean (average) and standard deviation.

The mean is the central value where maximum values are concentrated. This is the average value of the distribution. For instance, in the Galton board experiment the mean is that bin which has the maximum numbers of balls in it.



So if I were to number the bins (starting from the left) as 1, 2, 3…all the way upto 9 (right most), then the 5th bin (marked by a red arrow) is the 'average' bin. Keeping the average bin as a reference, the data is spread out on either sides of this average reference value. The way the data is spread out (dispersion as it is called) is quantified by the standard deviation (recollect this also happens to be the volatility in the stock market context).

Here is something you need to know – when someone says 'Standard Deviation (SD)' by default they are referring to the 1st SD. Likewise there is 2nd standard deviation (2SD), 3rd standard deviation (SD) etc. So when I say SD, I'm referring to just the standard deviation value, 2SD would refer to 2 times the SD value, 3 SD would refer to 3 times the SD value so on and so forth.

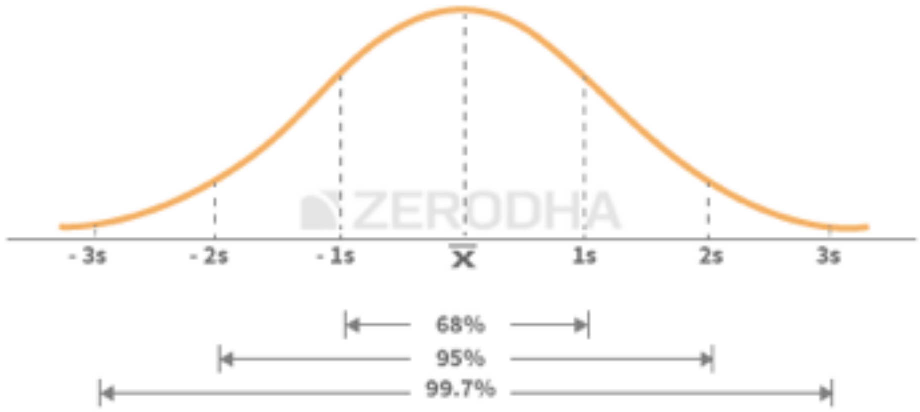
For example assume in case of the Galton Board experiment the SD is 1 and average is 5. Then,

- ➡ 1 SD would encompass bins between 4th bin (5 – 1) and 6th bin (5 + 1). This is 1 bin to the left and 1 bin to the right of the average bin
- ➡ 2 SD would encompass bins between 3rd bin (5 – 2*1) and 7th bin (5 + 2*1)
- ➡ 3 SD would encompass bins between 2nd bin (5 – 3*1) and 8th bin (5 + 3*1)

Now keeping the above in perspective, here is the general theory around the normal distribution which you should know –

- ➡ Within the 1st standard deviation one can observe 68% of the data
- ➡ Within the 2nd standard deviation one can observe 95% of the data
- ➡ Within the 3rd standard deviation one can observe 99.7% of the data

The following image should help you visualize the above –



Applying this to the Galton board experiment –

➡ Within the 1st standard deviation i.e between 4th and 6th bin we can observe that 68% of balls are collected

➡ Within the 2nd standard deviation i.e between 3rd and 7th bin we can observe that 95% of balls are collected

➡ Within the 3rd standard deviation i.e between 2nd and 8th bin we can observe that 99.7% of balls are collected

Keeping the above in perspective, let us assume you are about to drop a ball on the Galton board and before doing so we both engage in a conversation –

You – I'm about to drop a ball, can you guess which bin the ball will fall into?
Me – No, I cannot as each ball takes a random walk. However, I can predict the range of bins in which it may fall

You – Can you predict the range?
Me – Most probably the ball will fall between the 4th and the 6th bin

You – Well, how sure are you about this?
Me – I'm 68% confident that it would fall anywhere between the 4th and the 6th bin

You – Well, 68% is a bit low on accuracy, can you estimate the range with a greater accuracy?
Me – Sure, I can. The ball is likely to fall between the 3rd and 7th bin, and I'm 95% sure about this. If you want an even higher accuracy then I'd say that the ball is likely to fall between the 2nd and 8th bin and I'm 99.5% sure about this

You – Nice, does that mean there is no chance for the ball to fall in either the 1st or 10th bin?

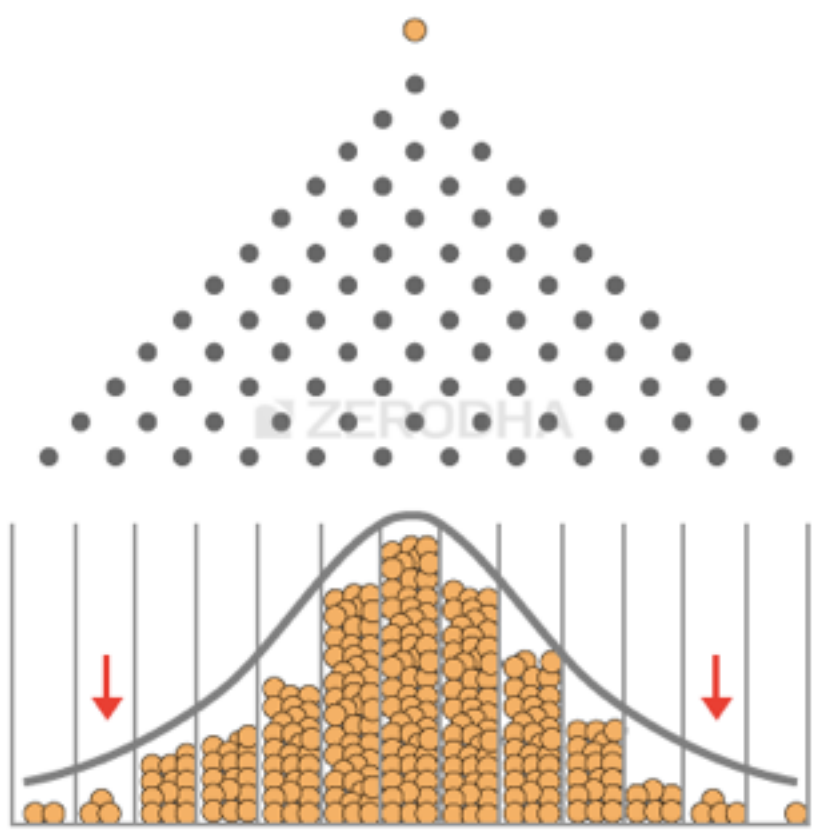
Me – Well, there is certainly a chance for the ball to fall in one of the bins outside the 3rd SD bins but the chance is very low

You – How low?

Me – The chance is as low as spotting a '**Black Swan**' in a river. Probability wise, the chance is less than 0.5%

You – Tell me more about the Black Swan

Me – Black Swan 'events' as they are called, are events (like the ball falling in 1st or 10th bin) that have a low probability of occurrence. But one should be aware that black swan events have a non-zero probability and it can certainly occur – when and how is hard to predict. In the picture below you can see the occurrence of a black swan event –

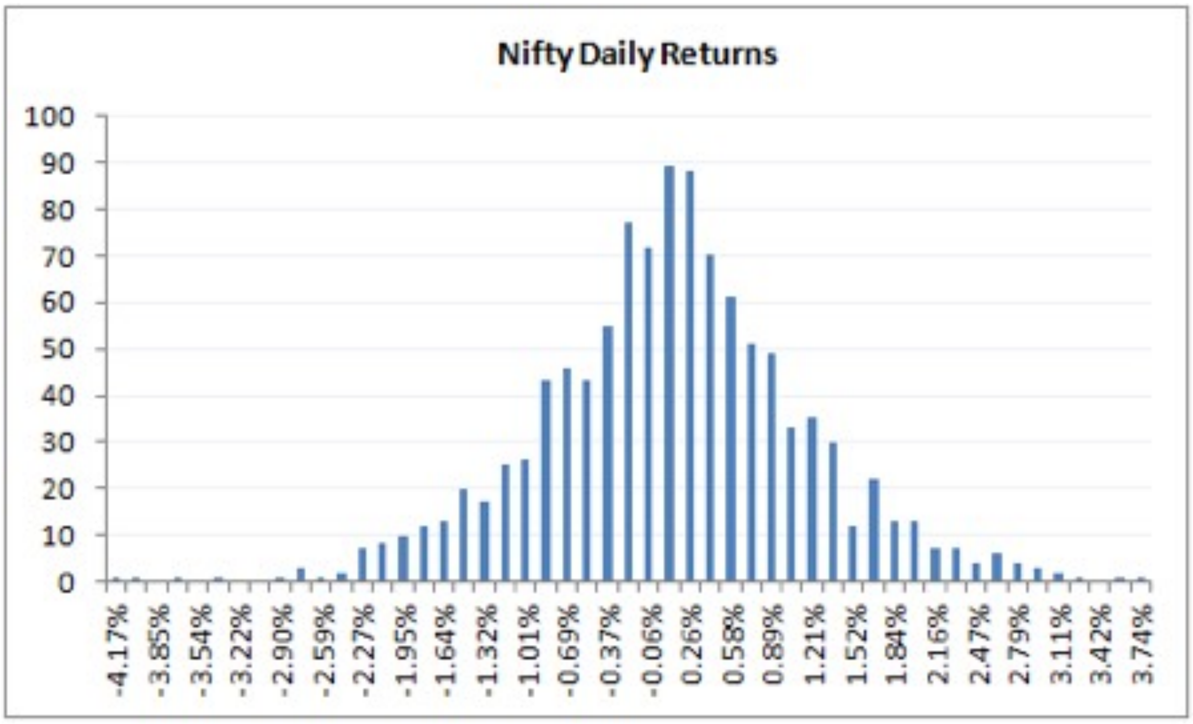


In the above picture there are so many balls that are dropped, but only a handful of them collect at the extreme ends.

17.4 – Normal Distribution and stock returns

Hopefully the above discussion should have given you a quick introduction to the normal distribution. The reason why we are talking about normal distribution is that the daily returns of the stock/indices also form a bell curve or a normal distribution. This implies that if we know the mean and standard deviation of the stock return, then we can develop a greater insight into the behavior of the stock's returns or its dispersion. For sake of this discussion, let us take up the case of Nifty and do some analysis.

To begin with, here is the distribution of Nifty's daily returns is –



As we can see the daily returns are clearly distributed normally. I've calculated the average and standard deviation for this distribution (in case you are wondering how to calculate the same, please do refer to the previous chapter). Remember to calculate these values we need to calculate the log daily returns.

- ➡ Daily Average / Mean = 0.04%
- ➡ Daily Standard Deviation / Volatility = 1.046%
- ➡ Current market price of Nifty = 8337

Do note, an average of 0.04% indicates that the daily returns of nifty are centered at 0.04%. Now keeping this information in perspective let us calculate the following things –

- ➡ The range within which Nifty is likely to trade in the next 1 year
- ➡ The range within which Nifty is likely to trade over the next 30 days.

For both the above calculations, we will use 1 and 2 standard deviation meaning with 68% and 95% confidence.

Solution 1 – (Nifty's range for next 1 year)

Average = 0.04%
SD = 1.046%

Let us convert this to annualized numbers –

Average = 0.04*252 = 9.66%
SD = 1.046% * Sqrt (252) = 16.61%

So with 68% confidence I can say that the value of Nifty is likely to be in the range of –

= Average + 1 SD (Upper Range) and Average – 1 SD (Lower Range)
= 9.66% + 16.61% = **26.66%**
= 9.66% – 16.61% = **-6.95%**

Note these % are log percentages (as we have calculated this on log daily returns), so we need to convert these back to regular %, we can do that directly and get the range value (w.r.t to Nifty's CMP of 8337) –

Upper Range
= 8337 *exponential (26.66%)
= **10841**

And for lower range –

= 8337 * exponential (-6.95%)
= **7777**

The above calculation suggests that Nifty is likely to trade somewhere between 7777 and 10841. How confident I am about this? – Well as you know I'm 68% confident about this.

Let us increase the confidence level to 95% or the 2nd standard deviation and check what values we get –

Average + 2 SD (Upper Range) and Average – 2 SD (Lower Range)
= 9.66% + 2* 16.61% = **42.87**%
= 9.66% – 2* 16.61% = **-23.56**%

Hence the range works out to –

Upper Range
= 8337 *exponential (42.87%)
= **12800**

And for lower range –

= 8337 * exponential (-23.56%)
= **6587**

The above calculation suggests that with 95% confidence Nifty is likely to trade anywhere in the range of 6587 and 12800 over the next one year. Also as you can notice when we want higher accuracy, the range becomes much larger.

I would suggest you do the same exercise for 99.7% confidence or with 3SD and figure out what kind of range numbers you get.

Now, assume you do the range calculation of Nifty at 3SD level and get the lower range value of Nifty as 5000 (I'm just quoting this as a place holder number here), does this mean Nifty cannot go below 5000? Well it certainly can but the chance of going below 5000 is low, and if it really does go below 5000 then it can be termed as a black swan event. You can extend the same argument to the upper end range as well.

Solution 2 – (Nifty's range for next 30 days)

We know the daily mean and SD –

Average = 0.04%
SD = 1.046%

Since we are interested in calculating the range for next 30 days, we need to convert the same for the desired time period –

Average = 0.04% * 30 = 1.15%
SD = 1.046% * sqrt (30) = 5.73%

So with 68% confidence I can say that, the value of Nifty over the next 30 days is likely to be in the range of –

= Average + 1 SD (Upper Range) and Average – 1 SD (Lower Range)
= 1.15% + 5.73% = **6.88%**
= 1.15% – 5.73% = – **4.58%**

Note these % are log percentages, so we need to convert them back to regular %, we can do that directly and get the range value (w.r.t to Nifty's CMP of 8337) –

= 8337 *exponential (6.88%)
= **8930**

And for lower range –

= 8337 * exponential (-4.58%)
= **7963**

The above calculation suggests that with 68% confidence level I can estimate Nifty to trade somewhere between 8930 and 7963 over the next 30 days.

Let us increase the confidence level to 95% or the 2nd standard deviation and check what values we get –

Average + 2 SD (Upper Range) and Average – 2 SD (Lower Range)
= 1.15% + 2* 5.73% = 12.61%
= 1.15% – 2* 5.73% = -10.31%

Hence the range works out to –

= 8337 *exponential (12.61%)
= **9457** (Upper Range)

And for lower range –

= 8337 * exponential (-10.31%)
= **7520**

I hope the above calculations are clear to you. You can also download the MS excel that I've used to make these calculations.

Of course you may have a very valid point at this stage – normal distribution is fine, but how do I get to use the information to trade? I guess as such this chapter is quite long enough to accommodate more concepts. Hence we will move the application part to the next chapter. In the next chapter we will explore the applications of standard deviation (volatility) and its relevance to trading. We will discuss two important topics in the next chapter (1) How to select strikes that can be sold/written using normal distribution and (2) How to set up stoploss using volatility.

Of course, do remember eventually the idea is to discuss Vega and its effect on options premium.

Key takeaways from this chapter

1. The daily returns of the stock is a random walk, highly difficult to predict
2. The returns of the stock is normally distributed or rather close to normal distribution
3. In a normal distribution the data is centered around the mean and the dispersion is measured by the standard deviation
4. Within 1 SD we can observe 68% of the data
5. Within 2 SD we can observe 95% of the data
6. Within 3 SD we can observe 99.5% of the data
7. Events occurring outside the 3rd standard deviation are referred to as Black Swan events
8. Using the SD values we can calculate the upper and lower value of stocks/indices

CHAPTER 18

Volatility Applications

18.1 – Striking it right

The last couple of chapters have given a basic understanding on volatility, standard deviation, normal distribution etc. We will now use this information for few practical trading applications. At this stage I would like to discuss two such applications –

1. Selecting the right strike to short/write
2. Calculating the stoploss for a trade

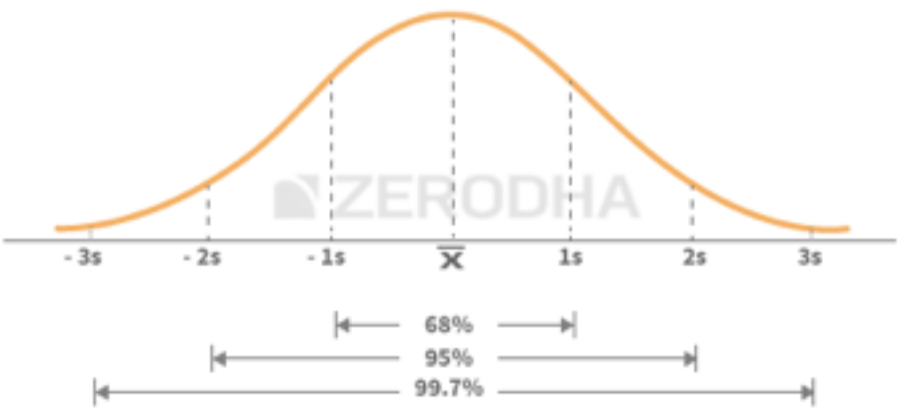
However at a much later stage (in a different module altogether) we will explore the applications under a different topic – 'Relative value Arbitrage (Pair Trading) and Volatility Arbitrage'. For now we will stick to trading options and futures.

So let's get started.

One of the key challenges an option writer always faces is to select the right strike so that he can write that option, collect the premium, and not really be worried about the possibility of the spot moving against him. Of course, the worry of spot moving against the option writer will always exist, however a diligent trader can minimize this.

Normal Distribution helps the trader minimize this worry and increase his confidence while writing options.

Let's have a quick recap –



The bell curve above suggests that with reference to the mean (average) value –

1. 68% of the data is clustered around mean within the 1st SD, in other words there is a 68% chance that the data lies within the 1st SD
2. 95% of the data is clustered around mean within the 2nd SD, in other words there is a 95% chance that the data lies within the 2nd SD
3. 99.7% of the data is clustered around mean within the 3rd SD, in other words there is a 99.7% chance that the data lies within the 3rd SD

Since we know that Nifty's daily returns are normally distributed, the above set of properties is applicable to Nifty. So what does it mean?

This means, if we know Nifty's mean and SD then we can pretty much make an 'educated guess' about the range within which Nifty is likely to trade over the selected time frame. Take this for example –

- ➡ Date = 11th August 2015
- ➡ Number of days for expiry = 16
- ➡ Nifty current market price = 8462
- ➡ Daily Average Return = 0.04%
- ➡ Annualized Return = 14.8%
- ➡ Daily SD = 0.89%
- ➡ Annualized SD = 17.04%

Given this I would now like to identify the range within which Nifty will trade until expiry i.e 16 days from now –

16 day SD = Daily SD *SQRT (16)
= 0.89% * SQRT (16)
= **3.567%**
16 day average = Daily Avg * 16
= 0.04% * 16 = **0.65%**

These numbers will help us calculate the upper and lower range within which Nifty is likely to trade over the next 16 days –

Upper Range = 16 day Average + 16 day SD

= 0.65% + 3.567%

= 4.215%, to get the upper range number –

= 8462 * (1+4.215%)

= **8818**

Lower Range = 16 day Average – 16 day SD

= 0.65% – 3.567%

= 2.920% to get the lower range number –

= 8462 * (1 – 2.920%)

= **8214**

The calculation suggests that Nifty is likely to trade anywhere in the region of **8214 to 8818**. How sure are we about this, well we know that there is a 68% probability for this calculation to work in our favor. In other words there is 32% chance for Nifty to trade outside 8214 and 8818 range. This also means all strikes outside the calculated range 'may' go worthless.

Hence –

➡ You can sell all call options above 8818 and collect the premiums because they are likely to expire worthless

➡ You can sell all put options below 8214 and collect the premiums because they are likely to expire worthless

Alternatively if you were thinking of buying Call options above 8818 or Put options below 8214 you may want to think twice, as you now know that there is a very little chance for these options to expire in the money, hence it makes sense to avoid buying these strikes.

Here is the snapshot of all Nifty Call option strikes above 8818 that you can choose to write (short) and collect premiums –

CALLS											
Chart	OI	Chng in OI	Volume	IV	LTP	Net Chng	Bid Qty	Bid Price	Ask Price	Ask Qty	Strike Price
	4,911,450	-326,550	457,884	13.21	11.90	-3.70	200	11.85	12.00	75	8800.00
	341,550	7,025	4,628	13.13	7.45	-2.95	50	7.05	7.65	25	8850.00
	2,715,900	93,900	246,413	13.25	4.85	-1.70	75	4.85	4.90	12,150	8900.00
	64,200	-2,150	981	13.77	3.65	-0.35	25	3.25	4.20	475	8950.00
	3,846,350	-62,000	232,387	13.99	2.45	-0.70	3,825	2.45	2.50	13,800	9000.00
	2,100	25	27	14.23	1.65	-1.35	25	0.65	2.90	3,900	9050.00
	808,025	-9,275	23,663	15.00	1.45	-0.25	850	1.45	1.55	1,000	9100.00
	2,525	-75	80	16.10	1.50	-0.10	8,000	0.15	2.00	1,500	9150.00
	627,175	60,500	10,179	16.70	1.25	-	8,500	1.25	1.30	400	9200.00
	-	-	-	-	-	-	16,000	0.10	-	-	9250.00
	368,650	29,475	8,245	18.14	1.00	0.15	1,700	0.95	1.00	8,975	9300.00
	-	-	-	-	-	-	15,000	0.05	-	-	9350.00
	140,900	-2,775	1,895	19.48	0.80	0.25	1,000	0.60	0.80	6,625	9400.00
	-	-	-	-	-	-	10,000	0.05	-	-	9450.00
	302,475	55,925	6,155	21.42	0.85	0.35	5,325	0.85	0.90	3,000	9500.00
	-	-	-	-	-	-	10,000	0.05	-	-	9550.00
	10,575	-	-	-	0.40	-	100	0.35	0.55	600	9600.00
	-	-	-	-	-	-	10,000	0.05	-	-	9650.00
	4,875	500	29	21.55	0.20	-0.35	100	0.20	0.40	150	9700.00

If I were to personally select a strike today it would be either 8850 or 8900 or probably both and collect Rs.7.45 and Rs.4.85 in premium respectively. The reason to select these strikes is simple – I see an acceptable balance between risk (1 SD away) and reward (7.45 or 4.85 per lot).

I'm certain many of you may have this thought – if I were to write the 8850 Call option and collect Rs.7.45 as premium, it does not really translate to any meaningful amount. After all, at Rs.7.45 per lot it translates to –

= 7.45 * 25 (lot size)

= Rs.186.25

Well, this is exactly where many traders miss the plot. I know many who think about the gains or loss in terms of absolute value and not really in terms of return on investment.

Think about it, margin amount required to take this trade is roughly Rs.12,000/-. If you are not sure about the margin requirement then I would suggest you use Zerodha's margin calculator.

The premium amount of Rs.186.25/- on a margin deposit of Rs.12,000/- works out to a return of 1.55%, which by any stretch on imagination is not a bad return, especially for a 16 day holding period! If you can consistently achieve this every month, then we are talking about a return of over 18% annualized just by means of option writing.

I personally use this strategy to write options and I'd like to share some of my thoughts regarding this –

Put Options – I don't like to short PUT options for the simple reason that panic spreads faster than greed. If there is panic in the market, the fall in market can be much quicker than you can imagine. Hence even before you can realize the OTM option that you have written can soon become ATM or ITM. Therefore it is better to avoid than regret.

Call Options – You inverse the above point and you will understand why writing call options are better than writing put options. For example in the Nifty example above, for the 8900 CE to become ATM or ITM Nifty has to move 438 points over 16 days. For this to happen, there has to be excess greed in the market…and like I said earlier a 438 up move takes a bit longer than 438 down move. Therefore my preference to short only call options.

Strike identification – I do the whole exercise of identifying the strike (SD, mean calculation, converting the same w.r.t to number days to expiry, selecting appropriate strike only the week before expiry and not before that. The timing here is deliberate

Timing – I prefer to short options only on the last Friday before the expiry week. For example given the August 2015 series expiry is on 27th, I'd short the call option only on 21st August around the closing. Why do I do this? This is to mainly ensure that theta works in my favor. Remember the 'time decay' graph we discussed in the theta chapter? The graph makes it amply evident that theta kicks in full force as we approach expiry.

Premium Collected – Because I write call options very close to expiry, the premiums are invariably low. The premium that I collect is around Rs.5 or 6 on Nifty Index, translating to about 1.0% return. But then I find the trade quite comforting for two reasons – (1) For the trade to work against me Nifty has to move 1 SD over 4 days, something that does not happen frequently (2) Theta works in my favor, the premiums erode much faster during the last week of expiry favoring the option seller

Why bother ? – Most of you may have this thought that the premiums are so low, why should I even bother? Honestly I too had this thought initially; however over time I have realized that trades with the following characteristics makes sense to me –

- ➡ Visibility on risk and reward – both should be quantifiable
- ➡ If a trade is profitable today then I should be able to replicate the same again tomorrow
- ➡ Consistency in finding the opportunities
- ➡ Assessment of worst case scenarios

This strategy ticks well on all counts above, hence my preference.

SD consideration – When I'm writing options 3-4 days before expiry I prefer to write 1 SD away, however for whatever reason when I'm writing the option much earlier then I prefer to go 2 SD away. Remember higher the SD consideration, higher is the confidence level but lower is the premium that you can collect. Also, as a thumb rule I never write options when there is more than 15 days for expiry.

Events – I avoid writing options whenever there are important market events such as monetary policy, policy decision, corporate announcement etc. This is because the markets tend to react sharply to events and therefore a good chance of getting caught on the wrong side. Hence it is better safe than sorry.

Black Swan – I'm completely aware that despite all the precaution, markets can move against me and I could get caught on the wrong side. The price you pay for getting caught on the wrong side, especially for this trade is huge. Imagine you collect 5 or 6 points as premium but if you are caught on the wrong side you end up paying 15 or 20 points or more. So all the small profits you made over 9 to 10 months is given away in 1 month. In fact the legendary Satyajit Das in his highly insightful book "Traders, Guns, and Money" talks about option writing as "eating like a hen but shitting like an elephant'.

The only way to make sure you minimize the impact of a black swan event is to be completely aware that it can occur anytime after you write the option. So here is my advice to you in case you decide to adopt this strategy – track the markets and gauge the market sentiment all along. The moment you sense things are going wrong be quick to exit the trade.

Success Ratio – Option writing keeps you on the edge of the seat. There are times when you feel that markets are going against you (fear of black swan creeps in) but only to cool off eventually. When you write options such roller coaster feelings are bound to emerge. The worst part is that during this roller coaster ride you may be forced to believe that the market is going against you (false signal) and hence you get out of a potentially profitable trade.

In fact there is a very thin line between a false signal and an actual black swan event. The way to overcome this is by developing conviction in your trades. Unfortunately I cannot teach you conviction; you will have to develop that on your own J. However your conviction improves as and when you do more of these trades (and all trades should be backed by sound reasoning and not blind guesses).

Also, I personally get out of the trade when the option transitions from OTM to ATM.

Expenses – The key to these trades is to keep your expense to bear minimum so that you can retain maximum profits for yourself. The expenses include brokerage and applicable charges. If you short 1 lot of Nifty options and collect Rs.7 as premium then you will have to let go few points as expense. If you are trading with Zerodha, your expense will be around 1.95 for 1 lot. The higher the number of lots the lesser is your expense. So if I were trading 10 lots (with Zerodha) instead of 1, my expense drastically comes down to 0.3 points. You can use Zerodha's brokerage calculator to get the details.

The cost varies broker to broker so please do make sure your broker is not greedy by charging you ridiculous brokerage fees. Even better, if you are not with Zerodha, it is about time you join us and become a part of our beautiful family :)

Capital Allocation – An obvious question you might have at this stage – how much money do I deploy to this trade? Do I risk all my capital or only a certain %? If it's a %, then how much would it be? There is no straight forward answer to this; hence I'll take this opportunity to share my asset allocation technique.

I'm a complete believer in equities as an asset class, so this rules out investment in Gold, Fixed Deposit, and Real Estate for me. 100% of my capital (savings) is invested in equity and equity based products. However it is advisable for any individual to diversify capital across multiple asset classes.

So within Equity, here is how I split my money –

➡ 35% of my money is invested in equity based mutual funds via SIP (systematic investment plan) route. I have further divided this across 4 funds.

➡ 40% of my capital in an equity portfolio of about 12 stocks. I consider both mutual funds and equity portfolio as long term investments (5 years and beyond).

➡ 25% is earmarked for short term strategies.

The short term strategies include a bunch of trading strategies such as –

➡ Momentum based swing trades (futures)

➡ Overnight futures/options/stock trades

➡ Intraday trades

➡ Option writing

I make sure that I do not expose more than 35% of the 25% capital for any particular strategy. Just to make it more clear, assume I have Rs.500,000/- as my capital, here is how I would split my money –

➡ 35% of Rs.500,000/- i.e Rs.175,000/- goes to Mutual Funds

➡ 40% of Rs.500,000/- i.e Rs.200,000/- goes to equity portfolio

➡ 25% of Rs.500,000/- i.e Rs.125,000/- goes to short term trading

   ○ 35% of Rs.125,000/- i.e Rs.43,750/- is the maximum I would allocate per trade

   ○ Hence I will not short more than 4 lots of options

   ○ 43,750/- is about 8.75% of the overall capital of Rs.500,000/-

So this self mandated rule ensures that I do not expose more than 9% of my over all capital to any particular short term strategies including option writing.

Instruments – I prefer running this strategy on liquid stocks and indices. Besides Nifty and Bank Nifty I run this strategy on SBI, Infosys, Reliance, Tata Steel, Tata Motors, and TCS. I rarely venture outside this list.

So here is what I would suggest you do. Run the exercise of calculating the SD and mean for Nifty, Bank Nifty on the morning of August 21st (5 to 7 days before expiry). Identify strikes that are 1 SD away from the market price and write them virtually. Wait till the expiry and experience how this trade goes. If you have the bandwidth you can run this across all the stocks that I've mentioned. Do this diligently for few expiries before you can deploy capital.

Lastly, as a standard disclaimer I have to mention this – the thoughts expressed above suits my risk reward temperament, which could be very different from yours. Everything that I mentioned here comes from my own personal trading experience, these are not standard practices.

I would suggest you note these points, understand your own risk-reward temperament, and calibrate your strategy. Hopefully the pointers here should help you develop that orientation.

This is quite contradicting to this chapter but I have to recommend you to read Nassim Nicholas Taleb's "Fooled by Randomness" at this point. The book makes you question and rethink everything that you do in markets (and life in general). I think just being completely aware of what Taleb writes in his book along with the actions you take in markets puts you in a completely different orbit.

18.2 – Volatility based stoploss

The discussion here is a digression from Options, in fact this would have been more apt in the futures trading module, but I think we are at the right stage to discuss this topic.

The first thing you need to identify before you initiate any trade is to identify the stop-loss (SL) price for the trade. As you know, the SL is a price point beyond which you will not take any further losses. For example, if you buy Nifty futures at 8300, you may identify 8200 as your stop-loss level; you will be risking 100 points on this particular trade. The moment Nifty falls below 8200, you exit the trade taking the loss. The question however is – how to identify the appropriate stop-loss level?

One standard approach used by many traders is to keep a standard pre-fixed percentage stop-loss. For example one could have a 2% stop-loss on every trade. So if you are to buy a stock at Rs.500, then your stop-loss price is Rs.490 and you risk Rs.10 (2% of Rs.500) on this trade. The problem with this approach lies in the rigidity of the practice. It does not account for the daily noise / volatility of the stock. For example the nature of the stock could be such that it could swing about 2-3% on a daily basis. As a result you could be right about the direction of the trade but could still hit a 'stop-loss'. More often than not, you would regret keeping such tight stops.

An alternate and effective method to identify a stop-loss price is by estimating the stock's volatility. Volatility accounts for the daily 'expected' fluctuation in the stock price. The advantage with this approach is that the daily noise of the stock is factored in. Volatility stop is strategic as it allows us to place a stop at the price point which is outside the normal expected volatility of the stock. Therefore a volatility SL gives us the required logical exit in case the trade goes against us.

Let's understand the implementation of the volatility based SL with an example.

This is the chart of Airtel forming a bullish harami, people familiar with the pattern would immediately recognize this is an opportunity to go long on the stock, keeping the low of the previous day (also coinciding with a support) as the stoploss. The target would be the immediate resistance – both S&R points are marked with a blue line. Assume you expect the trade to materialize over the next 5 trading sessions. The trade details are as follows –

- ➡ Long @ 395
- ➡ Stop-loss @ 385
- ➡ Target @ 417
- ➡ Risk = 395 – 385 = 10 or about 2.5% below entry price
- ➡ Reward = 417 – 385 = 32 or about 8.1% above entry price
- ➡ Reward to Risk Ratio = 32/10 = 3.2 meaning for every 1 point risk, the expected reward is 3.2 point

This sounds like a good trade from a risk to reward perspective. In fact I personally consider any short term trade that has a Reward to Risk Ratio of 1.5 as a good trade. However everything hinges upon the fact that the stoploss of 385 is sensible.

Let us make some calculations and dig a little deeper to figure out if this makes sense –

Step 1: Estimate the daily volatility of Airtel. I've done the math and the daily volatility works out to 1.8%

Step 2: Convert the daily volatility into the volatility of the time period we are interested in. To do this, we multiply the daily volatility by the square root of time. In our example, our expected holding period is 5 days, hence the 5 day volatility is equal to 1.8%*Sqrt(5). This works out to be about 4.01%.

Step 3. Calculate the stop-loss price by subtracting 4.01% (5 day volatility) from the expected entry price. 395 – (4.01% of 395) = 379. The calculation above indicates that Airtel can swing from 395 to 379 very easily over the next 5 days. This also means, a stoploss of 385 can be easily knocked down. So the SL for this trade has be a price point below 379, lets say 375, which is 20 points below the entry price of 395.

Step 4 : With the new SL, the RRR works out to 1.6 (32/20), which still seems ok to me. Hence I would be happy to initiate the trade.

Note : In case our expected holding period is 10 days, then the 10 day volatility would be 3.01*sqrt(10) so on and so forth.

Pre-fixed percentage stop-loss does not factor in the daily fluctuation of the stock prices. There is a very good chance that the trader places a premature stop-loss, well within the noise levels of the stock. This invariably leads to triggering the stop-loss first and then the target.

Volatility based stop-loss takes into account all the daily expected fluctuation in the stock prices. Hence if we use a stocks volatility to place our stop-loss, then we would be factoring in the noise component and in turn placing a more relevant stop loss.

Key takeaways from this chapter

1. You can use SD to identify strikes that you can write
2. Avoid shorting PUT options
3. Strikes 1 SD away offers 68% flexibility, if you need higher flexibility you could opt for 2SD
4. Higher the SD, higher is the range, and lower is the premium collected
5. Allocate capital based on your belief in asset classes. It is always advisable to invest across asset classes
6. It always makes sense to place SL based on daily volatility of the stock

CHAPTER 19

Vega

19.1 – Volatility Types

The last few chapters have laid a foundation of sorts to help us understand Volatility better. We now know what it means, how to calculate the same, and use the volatility information for building trading strategies. It is now time to steer back to the main topic – Option Greek and in particular the 4th Option Greek "Vega". Before we start digging deeper into Vega, we have to discuss one important topic – Quentin Tarantino :) .

I'm huge fan of Quentin Tarantino and his movies. For people not familiar with Quentin Tarantino let me tell you, he is one of the most talented directors in Hollywood. He is the man behind super cult flicks such as Pulp Fiction, Kill Bill, Reservoir Dogs, Django Unchained etc. If you've not watched his movies, I'd suggest you do, you may just love these movies as much as I do.

It is a known fact that when Quentin Tarantino directs a movie, he keeps all the production details under wraps until the movies trailer hits the market. Only after the trailer is out people get to know the name of movie, star cast details, brief story line, movie location etc. However, this is not the case with the movie he is directing these days, titled "The Hateful Eight", due to be released in December 2015. Somehow everything about 'The Hateful Eight' – the star cast, storyline, location etc is leaked, hence people already know what to expect from Tarantino. Now given that most of the information about the movie is already known, there are wild speculations about the box office success of his upcoming movie.

We could do some analysis on this –

1. **Past movies** – We know almost all of Tarantino's previous movies were successful. Based on his past directorial performance we can be reasonably certain that 'The Hateful Eight' is likely to be a box office hit
2. **Movie Analyst's forecast** – There are these professional Hollywood movie analysts, who understand the business of cinema very well. Some of these analysts are forecasting that 'The Hateful Eight' may not do well (unlike his previous flicks) as most of the details pertaining to the movie is already, failing to enthuse the audience

3. **Social Media** – If you look at the discussions on 'The Hateful Eight' on social media sites such as Twitter and Facebook, you'd realize that a lot of people are indeed excited about the movie, despite knowing what to expect from the movie. Going by the reactions on Social Media, 'The Hateful Eight' is likely to be a hit.

4. **The actual outcome** – Irrespective of what really is being expected, once the movie is released we would know if the movie is a hit or a flop. Of course this is the final verdict for which we have to wait till the movie is released.

Tracking the eventual fate of the movie is not really our concern, although I'm certainly going to watch the movie .

Given this, you may be wondering why we are even discussing Quentin Tarantino in a chapter concerning Options and Volatility! Well this is just my attempt (hopefully not lame) to explain the different types of volatility that exist – Historical Volatility, Forecasted Volatility, and Implied Volatility. So let's get going.

Historical Volatility is similar to us judging the box office success of 'The Hateful Eight' based on Tarantino's past directorial ventures. In the stock market world, we take the past closing prices of the stock/index and calculate the historical volatility. Do recall, we discussed the technique of calculating the historical volatility in Chapter 16. Historical volatility is very easy to calculate and helps us with most of the day to day requirements – for instance historical volatility can 'somewhat' be used in the options calculator to get a 'quick and dirty' option price (more on this in the subsequent chapters).

Forecasted Volatility is similar to the movie analyst attempting to forecast the fate of 'The Hateful Eight'. In the stock market world, analysts forecast the volatility. Forecasting the volatility refers to the act of predicting the volatility over the desired time frame.

However, why would you need to predict the volatility? Well, there are many option strategies, the profitability of which solely depends on your expectation of volatility. If you have a view of volatility – for example you expect volatility to increase by 12.34% over the next 7 trading sessions, then you can set up option strategies which can profit this view, provided the view is right.

Also, at this stage you should realize – to make money in the stock markets it is NOT necessary to have a view on the direction on the markets. The view can be on volatility as well. Most of the professional options traders trade based on volatility and not really the market direction. I have to mention this – many traders find forecasting volatility is far more efficient than forecasting market direction.

Now clearly having a mathematical/statistical model to predict volatility is much better than arbitrarily declaring "I think the volatility is going to shoot up". There are a few good statistical models such as 'Generalized AutoRegressive Conditional Heteroskedasticity (GARCH) Process'. I know it sounds spooky, but that's what it's called. There are several GARCH processes to forecast volatility, if you are venturing into this arena, I can straightaway tell you that GARCH (1,1) or GARCH (1,2) are better suited processes for forecasting volatility.

Implied Volatility (IV) is like the people's perception on social media. It does not matter what the historical data suggests or what the movie analyst is forecasting about 'The Hateful Eight'. People seem to be excited about the movie, and that is an indicator of how the movie is likely to fare. Likewise the implied volatility represents the market participant's expectation on volatility. So on one hand we have the historical and forecasted volatility, both of which are sort of 'manufactured' while on the other hand we have implied volatility which is in a sense 'consensual'. Implied volatility can be thought of as consensus volatility arrived amongst all the market participants with respect to the expected amount of underlying price fluctuation over the remaining life of an option. Implied volatility is reflected in the price of the premium.

For this reason amongst the three different types of volatility, the IV is usually more valued.

You may have heard or noticed India VIX on NSE website, India VIX is the official 'Implied Volatility' index that one can track. India VIX is computed based on a mathematical formula, here is a whitepaper which explains how India VIX is calculated –

If you find the computation a bit overwhelming, then here is a quick wrap on what you need to know about India VIX (*I have reproduced some of these points from the NSE's whitepaper*) –

1. NSE computes India VIX based on the order book of Nifty Options

2. The best bid-ask rates for near month and next-month Nifty options contracts are used for computation of India VIX

3. India VIX indicates the investor's perception of the market's volatility in the near term (next 30 calendar days)

4. Higher the India VIX values, higher the expected volatility and vice-versa

5. When the markets are highly volatile, market tends to move steeply and during such time the volatility index tends to rise

6. Volatility index declines when the markets become less volatile. Volatility indices such as India VIX are sometimes also referred to as the 'Fear Index', because as the volatility index rises, one should become careful, as the markets can move steeply into any direction. Investors use volatility indices to gauge the market volatility and make their investment decisions

7. Volatility Index is different from a market index like NIFTY. NIFTY measures the direction of the market and is computed using the price movement of the underlying stocks whereas India VIX measures the expected volatility and is computed using the order book of the underlying NIFTY options. While Nifty is a number, India VIX is denoted as an annualized percentage

Further, NSE publishes the implied volatility for various strike prices for all the options that get traded. You can track these implied volatilities by checking the option chain. For example here is the option chain of Cipla, with all the IV's marked out.

Option Chain (Equity Derivatives)

Underlying Stock: **CIPLA 667.75** As on Aug 28, 2015 11:41:39 IST

View Options Contracts for: Select Index OR Search for an underlying stock: GO Filter by: Expiry Date 24SEP2015 Futures contracts

CALLS												PUTS										
Chart	OI	Chng in OI	Volume	IV	LTP	Net Chng	Bid Qty	Bid Price	Ask Price	Ask Qty	Strike Price	Bid Qty	Bid Price	Ask Price	Ask Qty	Net Chng	LTP	IV	Volume	Chng in OI	OI	Chart
	-	-	-	-	-	-	-	-	-	-	420.00	-	-	1.00	500	-	-	-	-	-	-	
	-	-	-	-	-	-	-	-	-	-	440.00	-	-	1.00	500	-	-	-	-	-	-	
	-	-	-	-	-	-	-	-	-	-	460.00	-	-	1.00	500	-	-	-	-	-	-	
	-	-	-	-	-	-	-	-	-	-	480.00	-	-	1.00	500	-	-	-	-	-	-	
	-	-	-	-	-	-	-	-	-	-	500.00	-	-	1.00	500	-	-	-	-	-	-	
	-	-	-	-	-	-	3,500	144.65	152.05	3,500	520.00	-	-	6.95	500	-	-	-	-	-	1,000	
	-	-	-	-	-	-	3,500	126.25	132.90	3,500	540.00	10,000	0.35	2.65	10,500	-	-	-	-	-	5,000	
	-	-	-	-	-	-	3,500	107.65	113.40	3,500	560.00	10,500	0.40	2.95	10,500	-	-	-	-	-	-	
	-	-	-	-	-	-	5,500	88.65	96.10	5,500	580.00	3,000	2.80	3.75	17,000	-3.35	2.50	39.40	9	-	13,500	
	2,500	-	1	52.80	83.35	13.65	3,500	64.85	76.40	500	600.00	4,500	4.75	5.05	6,000	-1.50	4.95	39.53	86	20,000	56,500	
	11,000	-	1	44.29	64.00	8.00	3,000	50.05	59.60	3,500	620.00	2,000	8.20	8.65	7,000	-1.85	8.50	38.89	123	-4,500	49,000	
	61,000	-	4	31.71	42.50	1.00	2,500	43.10	45.15	10,000	640.00	500	13.55	13.75	500	-2.70	13.25	38.26	140	16,500	47,000	
	73,500	-1,500	124	34.08	31.45	1.90	1,000	31.30	31.85	500	660.00	500	21.00	21.45	3,500	-3.40	20.75	37.23	114	18,500	60,500	
	149,000	81,500	377	35.18	21.80	0.80	500	21.45	21.95	1,000	680.00	1,000	30.70	31.30	1,000	-4.00	31.00	37.61	32	2,500	25,000	
	275,000	36,500	478	34.78	14.50	0.25	500	14.20	14.65	3,500	700.00	7,500	41.40	46.45	13,000	-3.85	43.65	38.24	3	-	40,000	
	93,000	16,000	109	35.34	9.45	0.20	3,000	9.00	9.35	1,000	720.00	7,000	55.25	60.10	6,500	-	-	-	-	-	16,000	
	141,500	34,000	132	35.67	5.90	-0.40	1,000	5.70	6.10	10,000	740.00	1,000	59.50	83.30	1,000	-	-	-	-	-	6,000	
	73,500	2,000	19	36.07	3.60	-0.70	3,000	3.40	3.65	5,000	760.00	500	88.35	93.70	500	-	-	-	-	-	90,500	
	13,500	-	2	36.08	2.05	-1.70	4,500	2.05	3.45	12,000	780.00	3,500	106.95	113.40	3,000	-	-	-	-	-	-	
	22,000	3,000	9	39.37	1.75	-0.45	500	1.55	2.65	10,000	800.00	1,000	109.25	134.05	2,000	-	-	-	-	-	1,000	
	5,500	-	-	-	-	-	500	1.35	2.15	10,000	820.00	2,000	144.75	152.20	2,000	-	-	-	-	-	-	
	4,000	-	2	47.26	1.65	-	500	0.60	2.30	10,000	840.00	-	-	-	-	-	-	-	-	-	-	
Total	925,000																				411,000	Total

The Implied Volatilities can be calculated using a standard options calculator. We will discuss more about calculating IV, and using IV for setting up trades in the subsequent chapters. For now we will now move over to understand Vega.

Realized Volatility is pretty much similar to the eventual outcome of the movie, which we would get to know only after the movie is released. Likewise the realized volatility is looking back in time and figuring out the actual volatility that occurred during the expiry series. Realized volatility matters especially if you want to compare today's implied volatility with respect to the historical implied volatility. We will explore this angle in detail when we take up "Option Trading Strategies".

19.2 – Vega

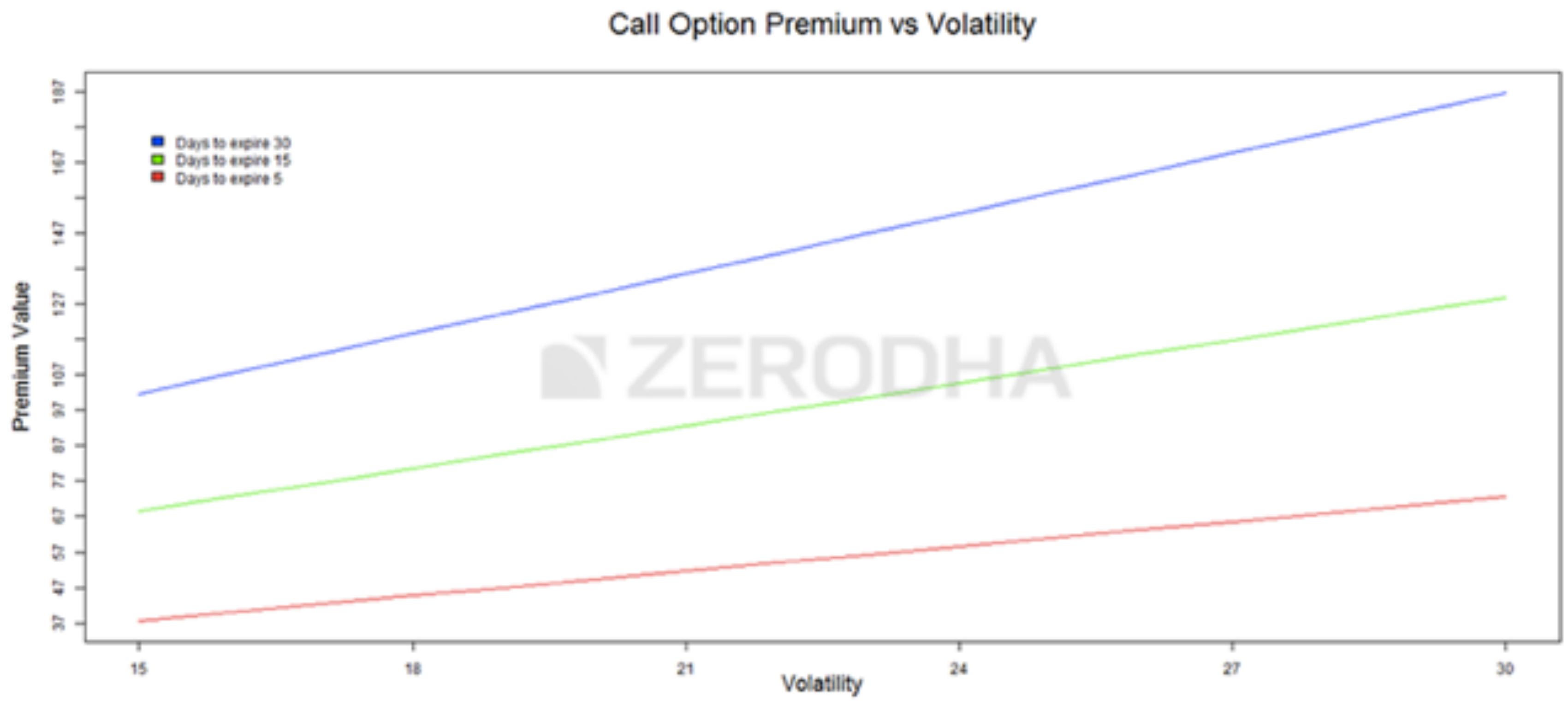
Have you noticed this – whenever there are heavy winds and thunderstorms, the electrical voltage in your house starts fluctuating violently, and with the increase in voltage fluctuations, there is a chance of a voltage surge and therefore the electronic equipments at house may get damaged.

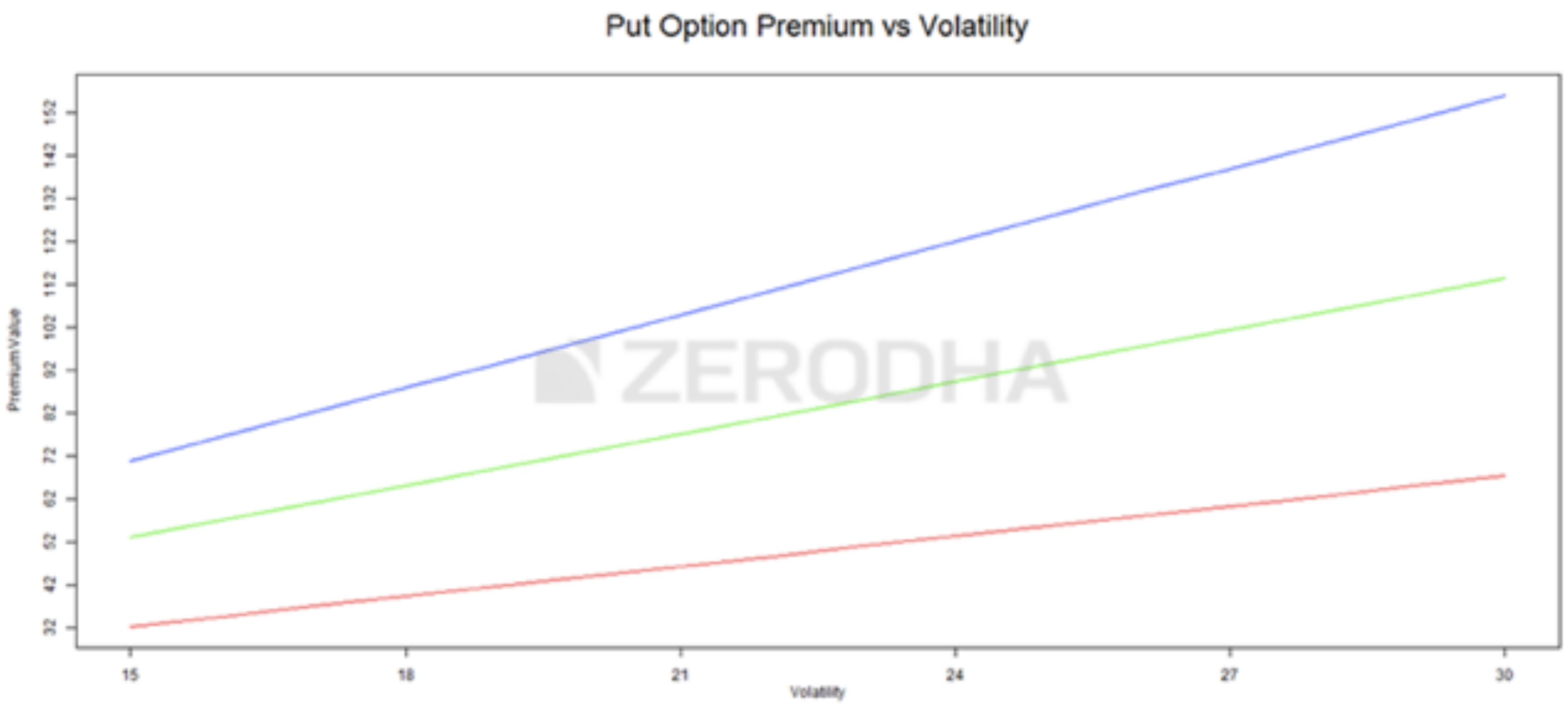
Similarly, when volatility increases, the stock/index price starts swinging heavily. To put this in perspective, imagine a stock is trading at Rs.100, with increase in volatility, the stock can start moving anywhere between 90 and 110. So when the stock hits 90, all PUT option writers start sweating as the Put options now stand a good chance of expiring in the money. Similarly, when the stock hits 110, all CALL option writers would start panicking as all the Call options now stand a good chance of expiring in the money.

Therefore irrespective of Calls or Puts when volatility increases, the option premiums have a higher chance to expire in the money. Now, think about this – imagine you want to write 500 CE options when the spot is trading at 475 and 10 days to expire. Clearly there is no intrinsic value but there is some time value. Hence assume the option is trading at Rs.20. Would you mind writing the option? You may write the options and pocket the premium of Rs.20/- I suppose. However, what if the volatility over the 10 day period is likely to increase – maybe election results or corporate results are scheduled at the same time. Will you still go ahead and write the option for Rs.20? Maybe not, as you know with the increase in volatility, the option can easily expire 'in the money' hence you may lose all the premium money you have collected. If all option writers start fearing the volatility, then what would compel them to write options? Clearly, a higher premium amount would. Therefore instead of Rs.20, if the premium was 30 or 40, you may just think about writing the option I suppose.

In fact this is exactly what goes on 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'. But nonetheless, fear too can be overcome for a price, 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 graphs below emphasizes the same point –





X axis represents Volatility (in %) and Y axis represents the premium value in Rupees. Clearly, as we can see, when the volatility increases, the premiums also increase. This holds true for both call and put options. The graphs here go a bit further, it shows you the behavior of option premium with respect to change in volatility and the number of days to expiry.

Have a look at the first chart (CE), the blue line represents the change in premium with respect to change in volatility when there is 30 days left for expiry, likewise the green and red line represents the change in premium with respect to change in volatility when there is 15 days left and 5 days left for expiry respectively.

Keeping this in perspective, here are a few observations (observations are common for both Call and Put options) –

1. Referring to the Blue line – when there are 30 days left for expiry (start of the series) and the volatility increases from 15% to 30%, the premium increases from 97 to 190, representing about 95.5% change in premium

2. Referring to the Green line – when there are 15 days left for expiry (mid series) and the volatility increases from 15% to 30%, the premium increases from 67 to 100, representing about 50% change in premium

3. Referring to the Red line – when there are 5 days left for expiry (towards the end of series) and the volatility increases from 15% to 30%, the premium increases from 38 to 56, representing about 47% change in premium

Keeping the above observations in perspective, we can make few deductions –

1. The graphs above considers a 100% increase of volatility from 15% to 30% and its effect on the premiums. The idea is to capture and understand the behavior of increase in volatility with respect to premium and time. Please be aware that observations hold true even if the volatility moves by smaller amounts like maybe 20% or 30%, its just that the respective move in the premium will be proportional

2. The effect of Increase in volatility is maximum when there are more days to expiry – this means if you are at the start of series, and the volatility is high then you know premiums are plum. Maybe a good idea to write these options and collect the premiums – invariably when volatility cools off, the premiums also cool off and you could pocket the differential in premium

3. When there are few days to expiry and the volatility shoots up the premiums also goes up, but not as much as it would when there are more days left for expiry. So if you are a wondering why your long options are not working favorably in a highly volatile environment, make sure you look at the time to expiry

So at this point one thing is clear – with increase in volatility, the premiums increase, but the question is 'by how much?'. This is exactly what the Vega tells us.

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. For example – if the option has a vega of 0.15, then for each % change in volatility, the option will gain or lose 0.15 in its theoretical value.

19.3 – Taking things forward

It is now perhaps time to revisit the path this module on Option Trading has taken and will take going forward (over the next few chapters).

We started with the basic understanding of the options structure and then proceeded to understand the Call and Put options from both the buyer and sellers perspective. We then moved forward to understand the moneyness of options and few basic technicalities with respect to options.

We further understood option Greeks such as the Delta, Gamma, Theta, and Vega along with a mini series of Normal Distribution and Volatility.

At this stage, our understanding on Greeks is one dimensional. For example we know that as and when the market moves the option premiums move owing to delta. But in reality, there are several factors that works simultaneously – on one hand we can have the markets moving heavily, at the same time volatility could be going crazy, liquidity of the options getting sucked in and out, and all of this while the clock keeps ticking. In fact this is exactly what happens on an everyday basis in markets. This can be a bit overwhelming for newbie traders. It can be so overwhelming that they quickly rebrand the markets as 'Casino'. So the next time you hear someone say such a thing about the markets, make sure you point them to Varsity .

Anyway, the point that I wanted to make is that all these Greeks manifest itself on the premiums and therefore the premiums vary on a second by second basis. So it becomes extremely important for the trader to fully understand these 'inter Greek' interactions of sorts. This is exactly what we will do in the next chapter. We will also have a basic understanding of the Black & Scholes options pricing formula and how to use the same.

19.4 – Flavors of Inter Greek Interactions

(The following article was featured in Business Line dated 31st August 2015)

Here is something that happened very recently. By now everyone remotely connected with the stock market would know that on 24th August 2015, the Indian markets declined close to 5.92% making it one of the worse single day declines in the history of Indian stock markets. None of the front line stocks survived the onslaught and they all declined by 8-10%. Panic days such as these are a common occurrence in the equity markets.

However something unusual happened in the options markets on 24th August 2015, here are some data points from that day –

Nifty declined by 4.92% or about 490 points –

India VIX shot up by 64% –

But Call option Premiums shot up!

CALLS

Chart	OI	Chng in OI	Volume	IV	LTP	Net Chng	Bid Qty	Bid Price	Ask Price	Ask Qty	Strike Price
	649,550	589,000	78,489	41.16	124.00	-384.05	25	120.00	122.80	225	7800.00
	54,525	54,525	4,695	38.65	93.00	-626.70	100	87.00	97.45	25	7850.00
	1,731,975	1,699,700	400,842	37.01	68.20	-340.35	500	68.15	70.95	25	7900.00
	230,100	230,100	33,125	36.39	50.00	-595.70	450	48.00	54.00	25	7950.00
	2,979,675	2,380,600	1,307,486	35.64	35.10	-279.40	175	35.90	36.00	25	8000.00
	227,375	227,325	103,476	35.64	25.00	-206.35	500	25.10	27.40	100	8050.00
	2,575,900	2,349,500	1,580,769	36.66	19.00	-194.85	50	17.50	19.00	1,250	8100.00
	281,575	279,575	130,309	37.35	14.00	-151.85	4,750	14.00	17.95	75	8150.00
	2,082,550	1,290,650	1,312,397	38.60	10.90	-120.15	8,175	10.00	10.90	125	8200.00
	358,250	-140,100	132,788	40.23	8.90	-84.05	100	7.55	8.90	600	8250.00
	3,013,450	572,175	1,018,877	41.18	6.80	-59.75	1,050	6.80	6.95	600	8300.00
	691,975	-263,075	131,965	43.65	6.25	-36.55	425	6.25	6.85	975	8350.00
	4,566,500	409,500	769,050	45.63	5.50	-23.00	625	5.20	5.50	1,575	8400.00
	447,450	-321,625	67,768	47.18	4.65	-12.65	250	4.55	5.00	1,500	8450.00
	4,400,150	-1,167,125	538,360	48.37	3.80	-7.25	3,075	3.80	3.90	900	8500.00
	493,825	-207,200	37,824	51.91	4.15	-2.35	125	3.85	4.15	400	8550.00
	4,457,925	-1,129,725	180,365	52.69	3.30	-0.85	9,125	3.25	3.30	2,350	8600.00
	510,450	-88,250	9,539	55.09	3.20	0.25	500	3.15	3.50	6,900	8650.00
	3,222,450	-843,875	85,100	56.56	2.80	0.55	725	2.80	3.00	8,175	8700.00
	285,500	-47,025	8,403	59.71	3.00	0.90	4,000	2.75	3.50	5,000	8750.00
	3,873,075	-524,150	80,703	60.28	2.40	0.90	550	2.10	2.50	600	8800.00
	322,525	-13,800	5,361	64.10	2.80	0.95	1,500	2.35	2.95	1,000	8850.00
	2,055,700	-245,275	92,181	66.22	2.70	1.30	1,300	2.50	2.70	3,575	8900.00
	49,050	-725	278	67.72	2.45	0.95	1,000	2.05	2.45	150	8950.00
	2,827,775	-334,950	45,123	69.89	2.40	1.15	475	2.05	2.35	75	9000.00
	2,125	-75	605	72.63	2.50	2.00	1,050	0.55	2.00	50	9050.00
	506,125	-30,350	4,898	73.25	2.10	1.15	4,000	2.00	2.20	500	9100.00
	2,500	-	2	75.05	2.00	1.40	1,850	1.00	2.00	1,475	9150.00
	462,650	-39,400	3,531	75.16	1.60	0.60	4,400	1.60	1.80	1,150	9200.00
	-	-	601	68.04	0.50	-86.10	1,000	0.40	-	-	9250.00
	297,000	-7,850	898	72.43	0.70	0.05	900	0.60	1.95	800	9300.00

PUTS

Strike Price	Bid Qty	Bid Price	Ask Price	Ask Qty	Net Chng	LTP	IV	Volume	Chng in OI	OI	Chart
7800.00	29,750	125.00	131.75	100	122.75	125.00	46.99	1,358,733	429,375	2,705,650	
7850.00	25	141.00	156.00	50	130.15	131.65	40.11	34,541	55,575	65,800	
7900.00	25	169.50	171.90	500	165.00	168.35	42.77	1,419,535	-843,325	2,450,450	
7950.00	200	196.55	210.00	50	191.60	196.00	40.95	68,931	-45,700	97,450	
8000.00	975	232.70	237.70	500	226.30	232.70	41.41	1,229,357	-1,993,950	2,519,975	
8050.00	400	272.15	277.40	50	264.40	272.95	42.37	33,911	-37,250	128,750	
8100.00	1,950	314.00	319.00	500	301.70	314.05	42.77	548,461	-1,510,975	1,509,500	
8150.00	50	360.00	375.60	175	357.80	375.50	53.37	37,710	-275,275	314,675	
8200.00	50	406.00	414.75	250	386.25	414.25	51.82	409,501	-2,586,900	2,838,225	
8250.00	750	451.40	476.20	100	423.05	463.50	55.63	45,496	-458,850	379,325	
8300.00	1,000	505.00	510.85	25	446.60	506.90	55.36	259,504	-1,795,350	3,000,750	
8350.00	400	538.00	679.10	2,000	451.75	545.75	49.86	18,306	-65,100	215,425	
8400.00	25	598.15	601.00	150	478.85	598.15	55.68	103,542	-563,175	1,320,825	
8450.00	25	637.65	660.00	25	489.40	650.00	60.91	3,056	-24,150	69,825	
8500.00	25	692.00	702.30	1,250	501.30	702.25	66.45	48,626	-371,025	1,140,300	
8550.00	25	740.00	758.35	25	509.75	760.00	76.49	3,980	-50,425	99,800	
8600.00	75	792.55	800.00	50	506.45	796.60	67.47	14,005	-149,725	629,275	
8650.00	100	814.00	985.95	25	512.00	850.00	74.43	63	-1,000	13,225	
8700.00	25	893.65	913.25	500	511.30	901.45	79.20	3,538	-41,800	182,450	
8750.00	25	881.00	1,086.95	2,000	445.20	870.70	-	21	-300	1,350	
8800.00	25	991.65	1,003.85	25	508.85	1,000.00	84.07	2,689	-32,125	208,425	
8850.00	1,000	631.50	-	-	-	598.50	-	-	-	1,550	
8900.00	500	681.50	1,100.00	25	498.85	1,095.00	83.85	444	-6,375	107,675	
8950.00	1,000	731.00	-	-	-	419.00	-	-	-	225	
9000.00	25	1,189.40	1,194.00	25	505.65	1,193.90	87.97	2,463	-11,100	506,825	
9050.00	1,000	827.25	-	-	-	-	-	-	-	-	
9100.00	25	1,075.00	1,444.85	2,000	497.95	1,287.20	79.10	92	-600	88,750	
9150.00	1,000	923.15	-	-	-	-	-	-	-	-	
9200.00	1,000	1,250.50	-	-	377.30	1,276.40	-	153	-2,775	45,650	
9250.00	1,000	1,023.10	-	-	-	-	-	-	-	-	
9300.00	1,000	1,073.20	1,652.65	2,000	465.85	1,457.85	-	34	-275	56,600	

Traders familiar with options would know that the call option premiums decline when market declines. In fact most of the call option premiums (strikes below 8600) did decline in value but option strikes above 8650 behaved differently – their premium as opposed to the general expectation did not decline, rather increased by 50-80%. This move has perplexed many traders, with many of the traders attributing this move to random theories such as rate rigging, market manipulation, technological inefficiency, liquidity issues etc. But I suspect any of this is true; in fact this can be explained based on the option theory logic.

We know that option premiums are influenced by sensitivity factors aka the Option Greeks. Delta as we know captures the sensitivity of options premium with respect to the movement of the underlying. Here is a quick recap – if the Delta of a particular call option is 0.75, then for every 1 point increase/decrease in the underlying the premium is expected to increase/decrease by 0.75 points. On 24th August, Nifty declined by 490 points, so all call options which had 'noticeable Delta' (like 0.2, 0.3, 0.6 etc) declined. Typically 'in the money' options (as on 24th Aug, all strike below 8600) tend to have noticeable Delta, therefore all their premiums declined with the decline in the underlying.

'Out of the money' options usually have a very low delta like 0.1 or lower. This means, irrespective of the move in the underlying the moment in the option premium will be very restrictive. As on August 24th, all options above 8600 were 'out of the money' options with low delta values. Hence irrespective of the massive fall in the market, these call options did not lose much premium value.

The above explains why certain call options did not lose value, but why did the premiums go up? The answer to this is lies in Vega – the option Greek which captures the sensitivity of market volatility on options premiums.

With increase in volatility, the Vega of an option increases (irrespective of calls and puts), and with increase in Vega, the option premium tends to increase. On 24th August the volatility of Indian markets shot up by 64%. This increase in volatility was totally unexpected by the market participants. With the increase in volatility, the Vega of all options increases, thereby their respective premiums also increased. The effect of Vega is particularly high for 'Out of the money' options. So on one hand the low delta value of 'out of the money' call options prevented the option premiums from declining while on the other hand, high Vega value increased the option premium for these out of the money options.

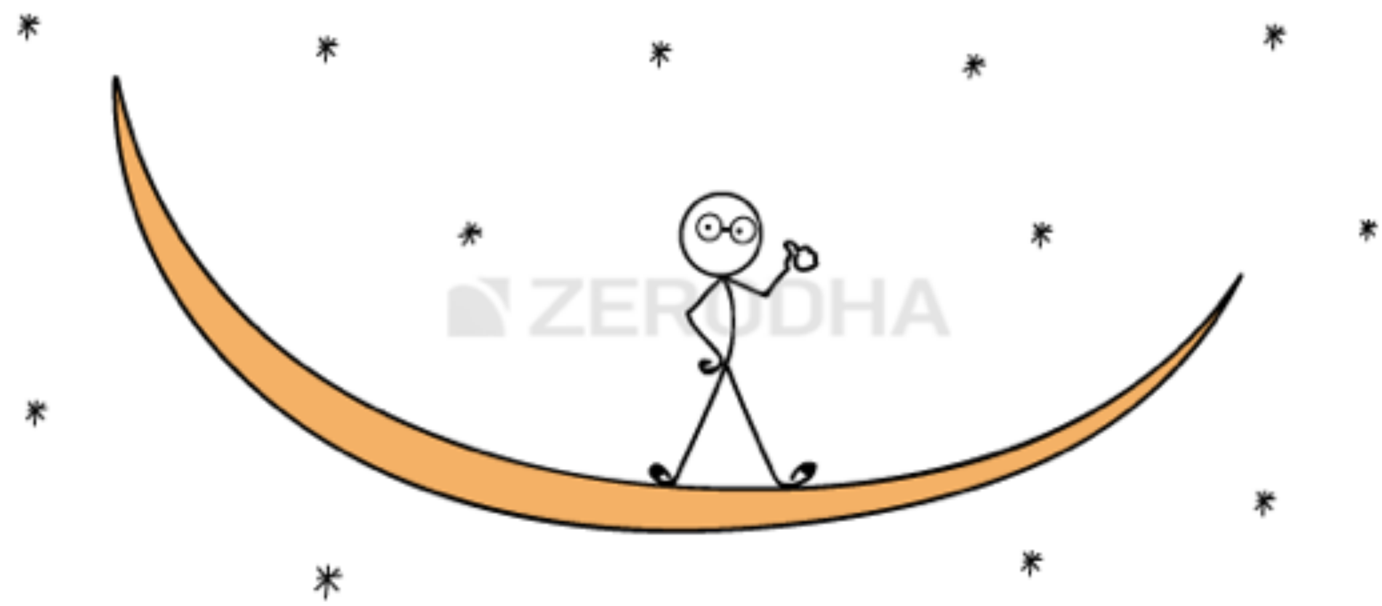
Hence on 24th August 2015 we got to witness the unusual – call option premium increasing 50 – 80% on a day when markets crashed 5.92%.

Key takeaways from this chapter

1. Historical Volatility is measured by the closing prices of the stock/index
2. Forecasted Volatility is forecasted by volatility forecasting models
3. Implied Volatility represents the market participants expectation of volatility
4. India VIX represents the implied volatility over the next 30 days period
5. Vega measures the rate of change of premium with respect to change in volatility
6. All options increase in premium when volatility increases
7. The effect of volatility is highest when there are more days left for expiry

CHAPTER 20

Greek Interactions



20.1 – Volatility Smile

We had briefly looked at inter Greek interactions in the previous chapter and how they manifest themselves on the options premium. This is an area we need to explore in more detail, as it will help us select the right strikes to trade. However before we do that we will touch upon two topics related to volatility called 'Volatility Smile' and 'Volatility Cone'.

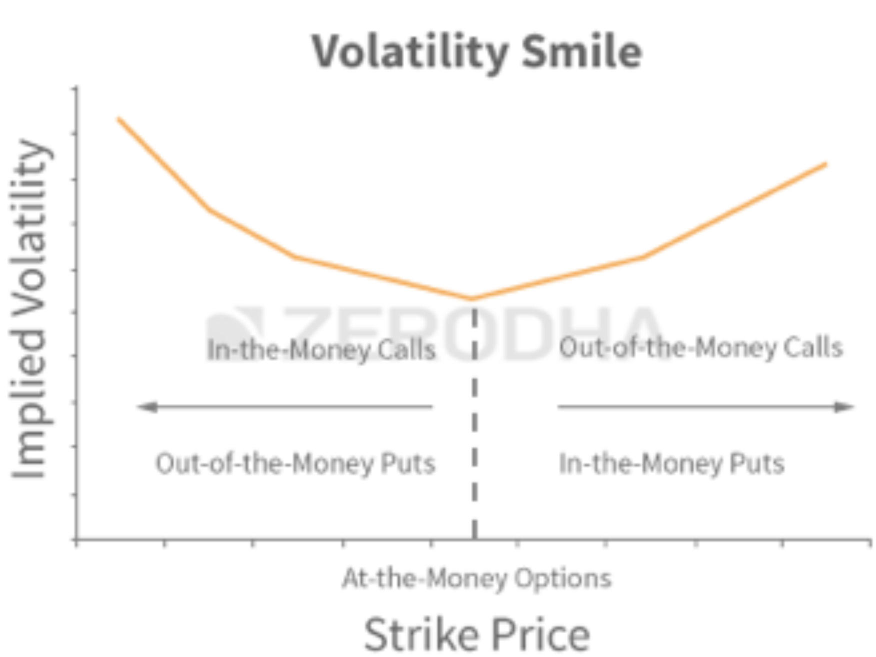
Volatility Smile is an interesting concept, something that I consider 'good to know' kind of concept. For this reason I will just touch upon this and not really dig deeper into it.

Theoretically speaking, all options of the same underlying, expiring on the same expiry day should display similar 'Implied Volatilities' (IV). However in reality this does not happen.

Have a look at this image –

CALLS												PUTS										
Chart	OI	Chng in OI	Volume	IV	LTP	Net Chng	Bid Qty	Bid Price	Ask Price	Ask Qty	Strike Price	Bid Qty	Bid Price	Ask Price	Ask Qty	Net Chng	LTP	IV	Volume	Chng in OI	OI	Chart
	-	-	-	-	-	-	-	-	-	-	180.00	7,000	1.10	1.20	12,000	0.50	1.15	69.74	44	18,000	31,000	
	-	-	-	-	-	-	-	-	-	-	185.00	5,000	1.45	1.55	8,000	0.70	1.50	67.69	5	4,000	7,000	
	-	-	-	-	-	-	1,000	34.05	41.00	1,000	190.00	11,000	1.90	1.95	5,000	0.90	2.00	66.22	148	-5,000	225,000	
	2,000	-	-	-	-	-	1,000	27.55	44.85	1,000	195.00	27,000	2.40	4.45	120,000	0.60	2.45	63.18	24	-	13,000	
	9,000	7,000	8	53.81	29.00	-8.00	1,000	27.65	29.50	3,000	200.00	4,000	3.25	3.35	21,000	1.25	3.30	62.72	852	188,000	620,000	
	5,000	-	-	-	-	-	1,000	21.00	29.05	2,000	205.00	19,000	4.20	4.30	15,000	1.60	4.30	61.44	301	-3,000	99,000	
	32,000	12,000	19	54.78	21.50	-6.90	15,000	20.35	22.85	16,000	210.00	6,000	5.45	5.55	16,000	1.95	5.50	60.02	936	147,000	774,000	
	1,000	-	-	-	-	-	15,000	15.15	21.00	15,000	215.00	4,000	7.00	7.10	19,000	2.55	7.10	59.14	804	31,000	215,000	
	73,000	43,000	87	51.57	15.10	-4.40	11,000	14.40	15.15	4,000	220.00	17,000	8.75	8.90	12,000	2.90	8.75	58.30	2,224	201,000	1,522,000	
	99,000	93,000	142	51.53	11.90	-3.65	12,000	11.75	12.20	8,000	225.00	3,000	10.90	11.05	7,000	3.60	11.00	56.93	563	48,000	399,000	
	962,000	448,000	2,078	51.18	9.70	-3.05	10,000	9.55	9.70	10,000	230.00	2,000	13.45	13.65	9,000	4.00	13.50	57.15	1,130	-101,000	996,000	
	347,000	-103,000	820	51.78	7.65	-2.60	19,000	7.55	7.70	5,000	235.00	1,000	16.40	16.70	5,000	4.70	16.65	54.86	187	-29,000	267,000	
	2,088,000	279,000	2,491	52.04	6.00	-2.20	17,000	5.95	6.05	13,000	240.00	3,000	19.70	20.05	11,000	5.15	19.80	57.19	415	-162,000	822,000	
	621,000	49,000	618	51.80	4.65	-1.85	3,000	4.60	4.75	15,000	245.00	17,000	22.15	23.60	10,000	5.75	23.55	57.48	94	-23,000	421,000	
	3,101,000	-97,000	2,277	52.36	3.60	-1.60	4,000	3.55	3.60	10,000	250.00	2,000	27.10	27.80	8,000	5.30	27.25	56.98	151	-37,000	880,000	
	695,000	10,000	410	52.53	2.75	-1.30	13,000	2.70	2.80	20,000	255.00	1,000	31.15	32.20	9,000	8.80	33.35	69.77	13	-9,000	96,000	
	3,207,000	-136,000	1,647	53.25	2.10	-1.00	24,000	2.05	2.10	2,000	260.00	1,000	35.45	36.00	1,000	8.50	36.00	57.27	17	-7,000	311,000	
	518,000	-22,000	224	53.67	1.60	-0.80	1,000	1.60	1.65	15,000	265.00	3,000	38.00	41.60	7,000	12.95	44.00	85.69	1	-	17,000	
	2,299,000	-70,000	1,031	53.94	1.20	-0.65	28,000	1.20	1.25	72,000	270.00	2,000	44.50	45.20	4,000	6.55	45.65	68.76	8	-3,000	505,000	
	602,000	-6,000	121	55.61	1.00	-0.45	1,000	0.95	1.00	8,000	275.00	2,000	48.40	50.75	6,000	9.60	49.60	64.45	2	-2,000	26,000	
	2,633,000	-101,000	995	55.88	0.75	-0.40	79,000	0.70	0.75	1,000	280.00	1,000	52.65	54.70	3,000	7.15	55.15	74.12	4	-1,000	286,000	
	388,000	32,000	103	56.90	0.60	-0.35	10,000	0.55	0.60	5,000	285.00	-	-	-	-	-	-	-	-	-	31,000	
	1,005,000	-125,000	301	58.29	0.50	-0.25	86,000	0.45	0.55	111,000	290.00	4,000	62.60	64.95	5,000	6.15	64.00	70.67	2	-1,000	110,000	
	128,000	11,000	36	59.18	0.40	-0.20	14,000	0.35	0.45	27,000	295.00	4,000	67.15	70.15	4,000	-	-	-	-	-	-	
	2,387,000	-5,000	300	62.23	0.40	-0.10	235,000	0.35	0.40	314,000	300.00	4,000	71.90	-	-	4.95	71.35	-	2	2,000	93,000	
	42,000	-9,000	15	60.59	0.25	-0.05	23,000	0.20	0.30	13,000	305.00	-	-	-	-	-	-	-	-	-	1,000	
	330,000	4,000	36	63.34	0.25	-0.10	71,000	0.20	0.25	10,000	310.00	-	-	-	-	-	-	-	-	-	24,000	
	29,000	-7,000	8	61.54	0.15	-0.10	10,000	0.15	0.20	38,000	315.00	3,000	85.95	90.55	3,000	-	-	-	-	-	-	
	218,000	4,000	28	66.54	0.20	-	7,000	0.15	0.20	69,000	320.00	-	-	-	-	-	-	-	-	-	10,000	

This is the option chain of SBI as of 4th September 2015. SBI is trading around 225, hence the 225 strike becomes 'At the money' option, and the same is highlighted with a blue band. The two green bands highlight the implied volatilities of all the other strikes. Notice this – as you go away from the ATM option (for both Calls and Puts) the implied volatilities increase, in fact further you move from ATM, the higher is the IV. You can notice this pattern across all the different stocks/ indices. Further you will also observe that the implied volatility of the ATM option is the lowest. If you plot a graph of all the options strikes versus their respective implied volatility you will get to see a graph similar to the one below –



The graph appears like a pleasing smile; hence the name 'Volatility Smile' :)

20.2 – Volatility Cone

(*All the graphs in this chapter and in this section on Volatility Cone has been authored by* Prakash Lekkala)

So far we have not touched upon an option strategy called 'Bull Call Spread', but for the sake of this discussion I will make an assumption that you are familiar with this strategy.

For an options trader, implied volatility of the options greatly affects the profitability. Consider this – you are bullish on stock and want to initiate an option strategy such as a Bull Call Spread. If you initiate the trade when the implied volatility of options is high, then you will have to incur high upfront costs and lower profitability potential. However if you initiate the position when the option implied volatility is low, your trading position will incur lower costs and higher potential profit.

For instance as of today, Nifty is trading at 7789. Suppose the current implied volatility of option positions is 20%, then a 7800 CE and 8000 CE bull call spread would cost 72 with a potential profit of 128. However if the implied volatility is 35% instead of 20%, the same position would cost 82 with potential profit of 118. Notice with higher volatility a bull call spread not only costs higher but the profitability greatly reduces.

So the point is for option traders , it becomes extremely crucial to assess the level of volatility in order to time the trade accordingly. Another problem an option trader has to deal with is, the selection of the underlying and the strike (particularly true if your strategies are volatility based).

For example – Nifty ATM options currently have an IV of ~25%, whereas SBI ATM options have an IV of ~52%, given this should you choose to trade Nifty options because IV is low or should you go with SBI options?

This is where the Volatility cone comes handy – it addresses these sorts of questions for Option traders. Volatility Cone helps the trader to evaluate the costliness of an option i.e. identify options which are trading costly/cheap. The good news is, you can do it not only across different strikes of a security but also across different securities as well.

Let's figure out how to use the Volatility Cone.

Below is a Nifty chart for the last 15 months. The vertical lines mark the expiry dates of the derivative contracts, and the boxes prior to the vertical lines mark the price movement of Nifty 10 days prior to expiry.

If you calculate the Nifty's realized volatility in each of the boxes, you will get the following table –

Expiry Date	Annualized realized volatility
Jun-14	41%
Jul-14	38%
Aug-14	33%
Sep-14	28%
Oct-14	28%
Nov-14	41%
Dec-14	26%

Expiry Date	Annualized realized volatility
Jan-15	22%
Feb-15	56%
Mar-15	19%
Apr-15	13%
May-15	34%
Jun-15	17%
Jul-15	41%
Aug-15	21%

From the above table we can observe that Nifty's realized volatility has ranged from a maximum of 56% (Feb 2015) to a minimum of 13% (April 2015).

We can also calculate mean and variance of the realized volatility, as shown below –

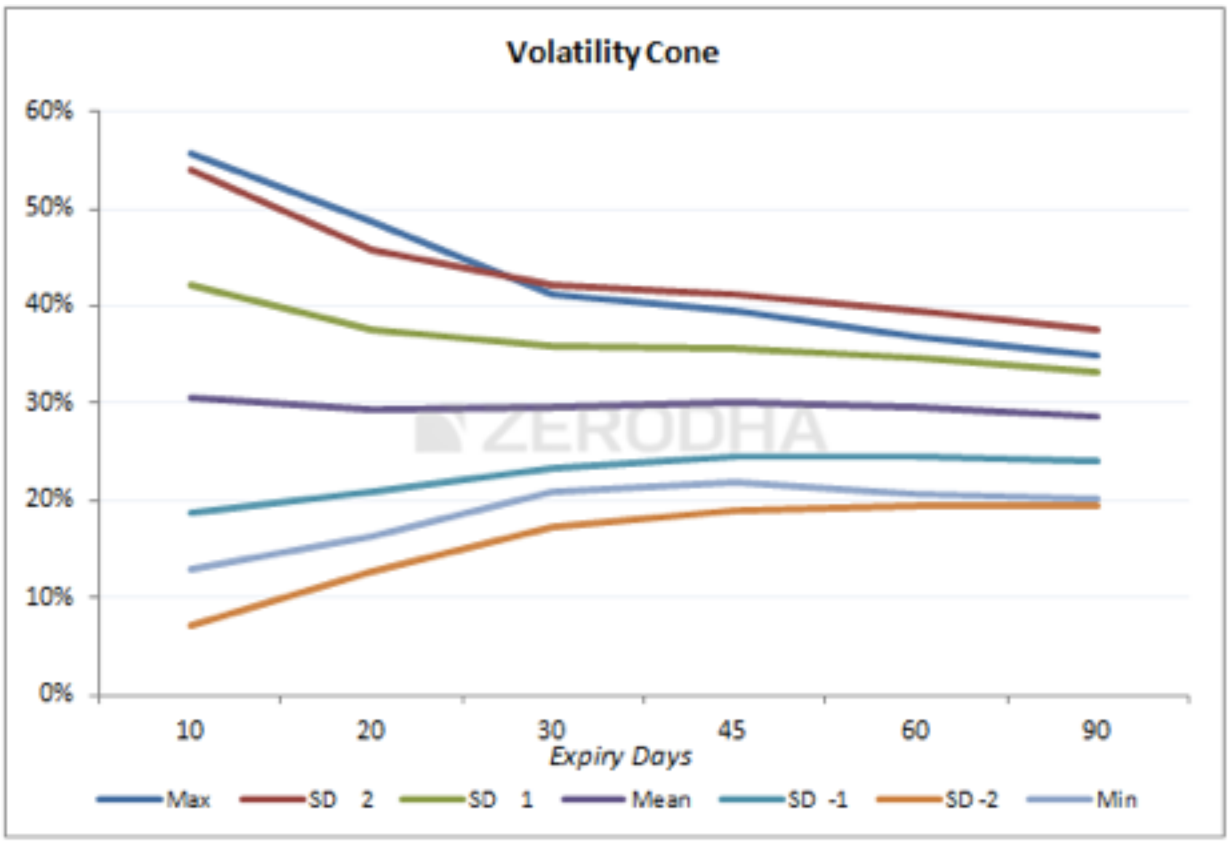
Particulars	Details
Maximum Volatility	56%
+2 Standard Deviation (SD)	54%
+1 Standard Deviation (SD)	42%
Mean/ Average Volatility	31%
-1 Standard Deviation (SD)	19%
-2 Standard Deviation (SD)	7%
Minimum Volatility	13%

If we repeat this exercise for 10, 20, 30, 45, 60 & 90 day windows, we would get a table as follows –

Days to Expiry	10	20	30	45	60	90
Max	56%	49%	41%	40%	37%	35%
+2 SD	54%	46%	42%	41%	40%	38%

Days to Expiry	10	20	30	45	60	90
+1 SD	42%	38%	36%	36%	35%	33%
Mean/Average	30%	29%	30%	30%	30%	29%
-1 SD	19%	21%	23%	24%	24%	24%
-2 SD	7%	13%	17%	19%	19%	19%
Min	13%	16%	21%	22%	21%	20%

The graphical representation of the table above would look like a cone as shown below, hence the name 'Volatility Cone' –

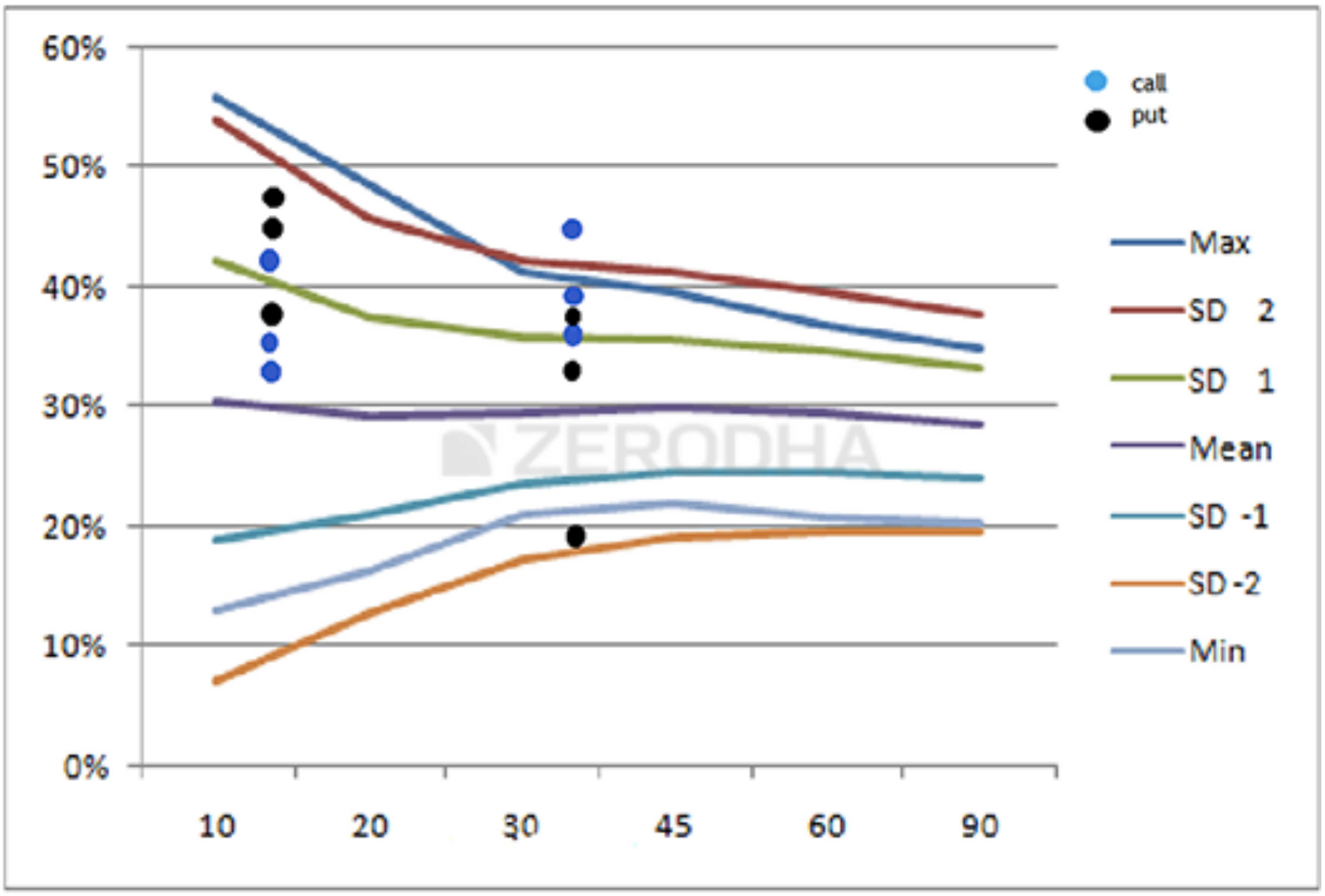


The way to read the graph would be to first identify the 'Number of days to Expiry' and then look at all the data points that are plotted right above it. For example if the number of days to expiry is 30, then observe the data points (representing realized volatility) right above it to figure out the 'Minimum, -2SD, -1 SD, Average implied volatility etc'. Also, do bear in mind; the 'Volatility Cone' is a graphical representation on the 'historical realized volatility'.

Now that we have built the volatility cone, we can plot the current day's implied volatility on it. The graph below shows the plot of Nifty's near month (September 2015) and next month (October 2015) implied volatility on the volatility cone.

Each dot represents the implied volatility for an option contract – blue are for call options and black for put options.

For example starting from left, look at the first set of dots – there are 3 blue and black dots. Each dot represents an implied volatility of an option contract – so the first blue dot from bottom could be the implied volatility of 7800 CE, above that it could be the implied volatility of 8000 CE and above that it could be the implied volatility of 8100 PE etc.



Do note the first set of dots (starting form left) represent near month options (September 2015) and are plotted at 12 on x-axis, i.e. these options will expire 12 days from today. The next set of dots is for middle month (October 2015) plotted at 43, i.e. these options will expire 43 days from today.

Interpretation

Look at the 2nd set of dots from left. We can notice a blue dot above the +2SD line (top most line, colored in maroon) for middle month option. Suppose this dot is for option 8200 CE, expiring 29-Oct-2015, then it means that today 8200 CE is experiencing an implied volatility, which is higher (by +2SD) than the volatility experienced in this stock whenever there are "43 days to expiry" over the last 15 months [remember we have considered data for 15 months]. Therefore this option has a high IV, hence the premiums would be high and one can consider designing a trade to short the 'volatility' with an expectation that the volatility will cool off.

Similarly a black dot near -2 SD line on the graph, is for a Put option. It suggests that, this particular put option has very low IV, hence low premium and therefore it could be trading cheap. One can consider designing a trade so as to buy this put option.

A trader can plot volatility cone for stocks and overlap it with the option's current IV. In a sense, the volatility cone helps us develop an insight about the state of current implied volatility with respect to the past realized volatility.

Those options which are close to + 2SD line are trading costly and options near -2 SD line are considered to be trading cheap. Trader can design trades to take advantage of 'mispriced' IV. In general, try to short options which are costlier and go long on options which are trading cheap.

Please note: Use the plot only for options which are liquid.

With this discussion on Volatility Smile and Volatility Cone, hopefully our understanding on Volatility has come to a solid ground.

20.3 – Gamma vs Time

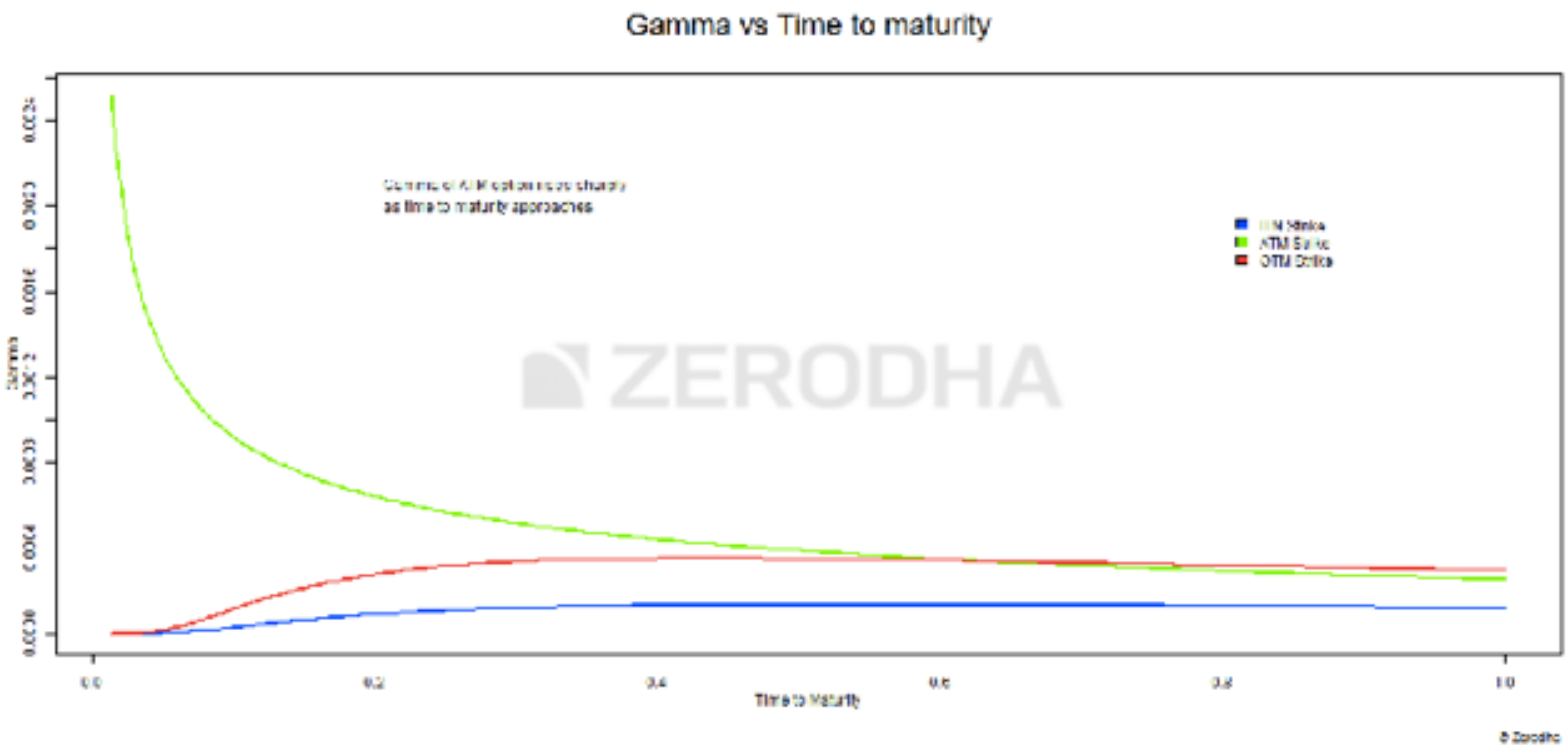
Over the next two sections let us focus our attention to inter greek interactions.

Let us now focus a bit on greek interactions, and to begin with we will look into the behavior of Gamma with respect to time. Here are a few points that will help refresh your memory on Gamma

- ➡ Gamma measures the rate of change of delta
- ➡ Gamma is always a positive number for both Calls and Puts
- ➡ Large Gamma can translate to large gamma risk (directional risk)
- ➡ When you buy options (Calls or Puts) you are long Gamma
- ➡ When you short options (Calls or Puts) you are short Gamma
- ➡ Avoid shorting options which have a large gamma

The last point says – avoid shorting options which have a large gamma. Fair enough, however imagine this – you are at a stage where you plan to short an option which has a small gamma value. The idea being you short the low gamma option and hold the position till expiry so that you get to keep the entire option premium. The question however is, how do we ensure the gamma is likely to remain low throughout the life of the trade?

The answer to this lies in understanding the behavior of Gamma versus time to expiry/maturity. Have a look at the graph below –



The graph above shows how the gamma of ITM, ATM, and OTM options behave as the 'time to expiry' starts to reduce. The Y axis represents gamma and the X axis represents time to expiry. However unlike other graphs, don't look at the X – axis from left to right, instead look at the X axis from right to left. At extreme right, the value reads 1, which suggests that there is ample time to expiry. The value at the left end reads 0, meaning there is no time to expiry. The time lapse between 1 and 0 can be thought of as any time period – 30 days to expiry, 60 days to expiry, or 365 days to expiry. Irrespective of the time to expiry, the behavior of gamma remains the same.

The graph above drives across these points –

➡ When there is ample time to expiry, all three options ITM, ATM, OTM have low Gamma values. ITM option's Gamma tends to be lower compared to ATM or OTM options

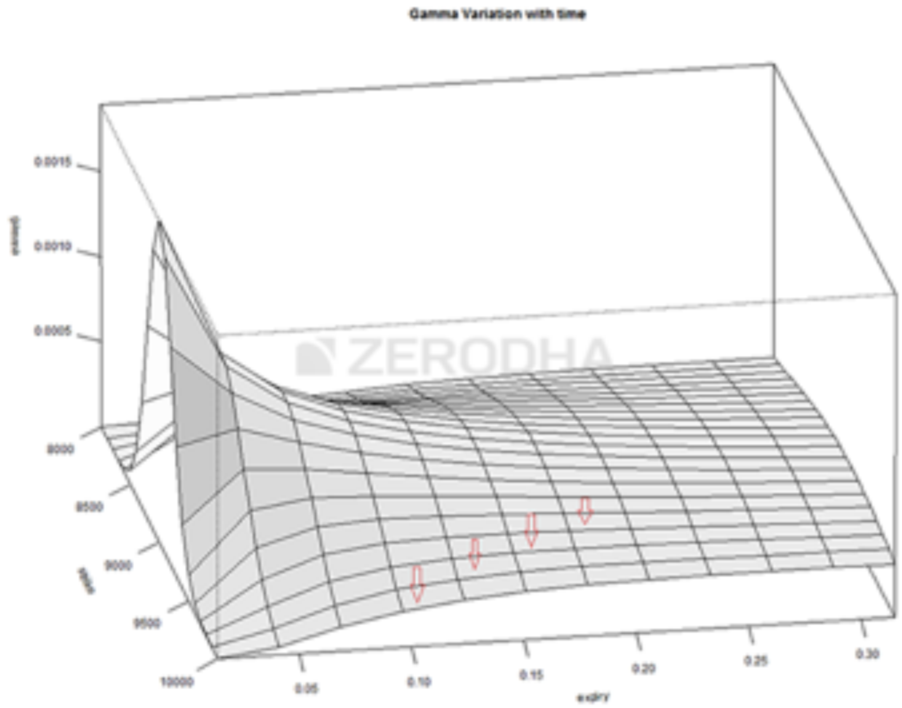
➡ The gamma values for all three strikes (ATM, OTM, ITM) remain fairly constant till they are half way through the expiry

➡ ITM and OTM options race towards zero gamma as we approach expiry

➡ The gamma value of ATM options shoot up drastically as we approach expiry

From these points it is quite clear that, you really do not want to be shorting "ATM" options, especially close to expiry as ATM Gamma tends to be very high.

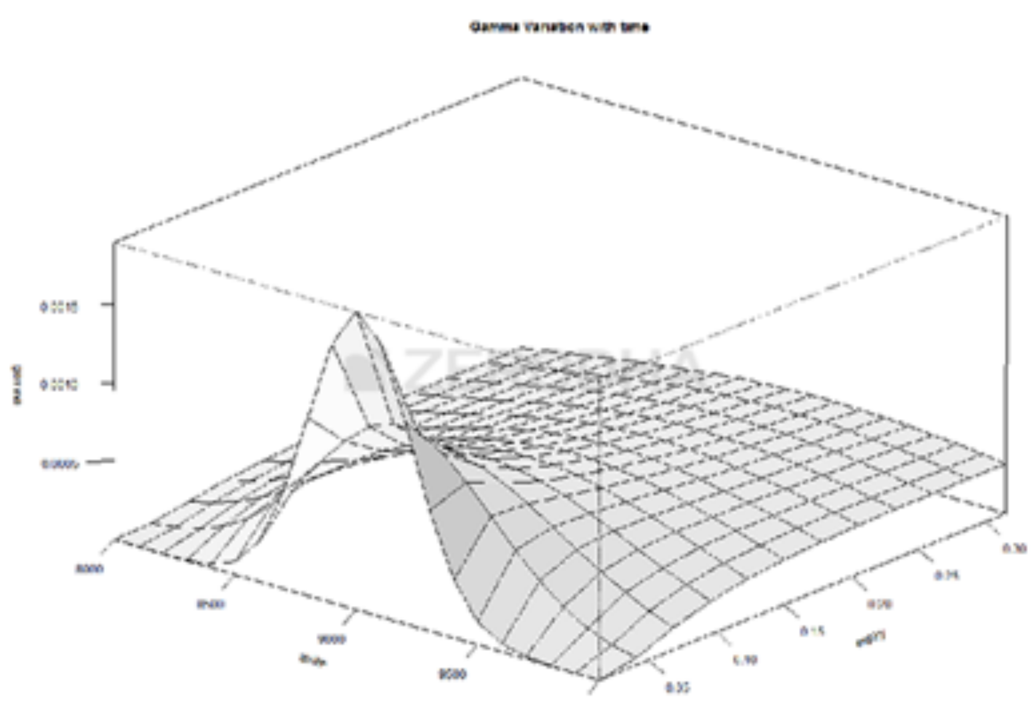
In fact if you realize we are simultaneously talking about 3 variables here – Gamma, Time to expiry, and Option strike. Hence visualizing the change in one variable with respect to change in another makes sense. Have a look at the image below –



The graph above is called a ‘Surface Plot’, this is quite useful to observe the behavior of 3 or more variables. The X-axis contains ‘Time to Expiry’ and the ‘Y axis’ contains the gamma value. There is another axis which contains ‘Strike’.

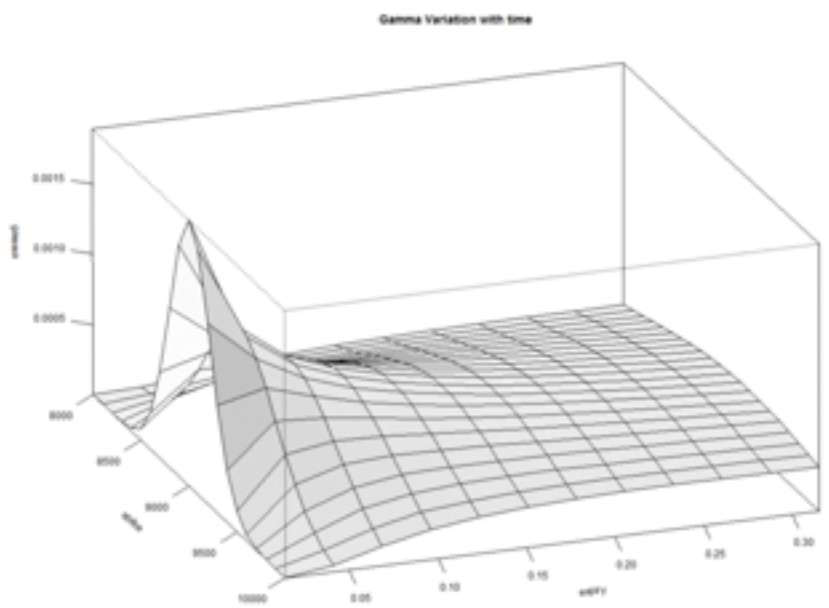
There are a few red arrows plotted on the surface plot. These arrows are placed to indicate that each line that the arrow is pointing to, refers to different strikes. The outermost line (on either side) indicates OTM and ITM strikes, and the line at the center corresponds to ATM option. From these lines it is very clear that as we approach expiry, the gamma values of all strikes except ATM tends to move towards zero. The ATM and few strikes around ATM have non zero gamma values. In fact Gamma is highest for the line at the center – which represents ATM option.

We can look at it from the perspective of the strike price –



This is the same graph but shown from a different angle, keeping the strike in perspective. As we can see, the gamma of ATM options shoot up while the Gamma of other option strikes don't.

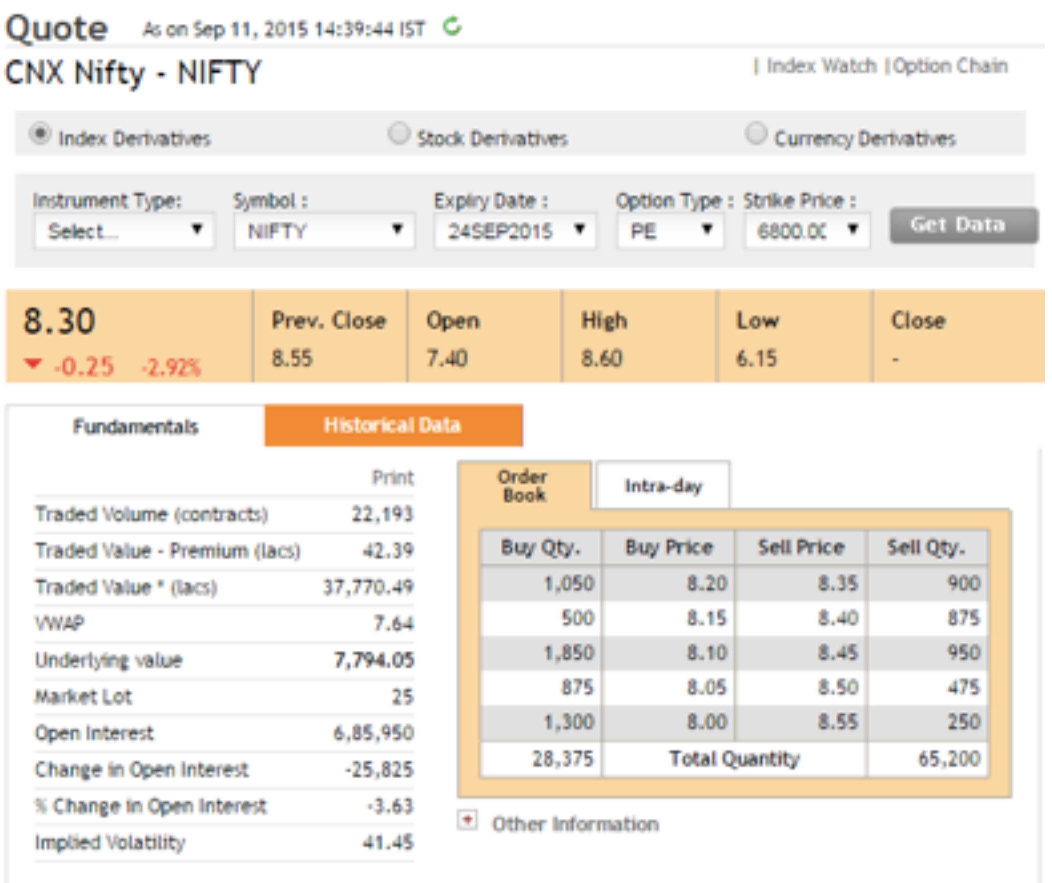
In fact here is a 3D rendering of Gamma versus Strike versus Time to Expiry. The graph below is a GIF, in case it refuses to render properly, please do click on it to see it in action.



Hopefully the animated version of the surface plot gives you a sense of how gamma, strikes, and time to expiry behave in tandem.

20.4 – Delta versus implied volatility

These are interesting times for options traders, have a look at the image below –



Quote As on Sep 11, 2015 14:39:44 IST

CNX Nifty - NIFTY | Index Watch | Option Chain

Index Derivatives | Stock Derivatives | Currency Derivatives

Instrument Type: Select... | Symbol : NIFTY | Expiry Date : 24SEP2015 | Option Type : PE | Strike Price : 6800.0C | Get Data

8.30	Prev. Close	Open	High	Low	Close
-0.25 -2.92%	8.55	7.40	8.60	6.15	-

Fundamentals | Historical Data

Print

Traded Volume (contracts)	22,193
Traded Value - Premium (lacs)	42.39
Traded Value * (lacs)	37,770.49
VWAP	7.64
Underlying value	7,794.05
Market Lot	25
Open Interest	6,85,950
Change in Open Interest	-25,825
% Change in Open Interest	-3.63
Implied Volatility	41.45

Order Book | Intra-day

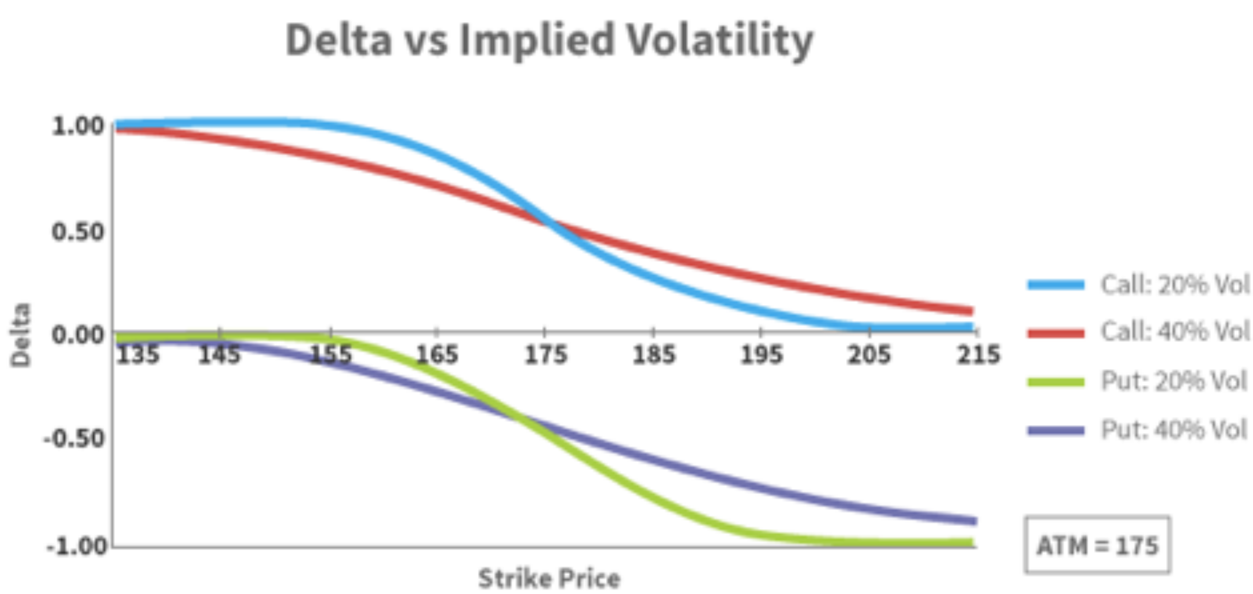
Buy Qty.	Buy Price	Sell Price	Sell Qty.
1,050	8.20	8.35	900
500	8.15	8.40	875
1,850	8.10	8.45	950
875	8.05	8.50	475
1,300	8.00	8.55	250
28,375	Total Quantity		65,200

Other Information

The snapshot was taken on 11th September when Nifty was trading at 7,794. The snapshot is that of 6800 PE which is currently trading at Rs.8.3/-.

Figure this, 6800 is a good 1100 points way from the current Nifty level of 7794. The fact that 6800 PE is trading at 5.5 implies there are a bunch of traders who expect the market to move 1100 points lower within 11 trading sessions (do note there are also 2 trading holidays from now to expiry).

Given the odds of Nifty moving 1100 (14% lower from present level) in 11 trading sessions are low, why is the 6800 PE trading at 8.3? Is there something else driving the options prices higher besides pure expectations? Well, the following graph may just have the answer for you –



The graph represents the movement of Delta with respect to strike price. AHere is what you need to know about the graph above –

- ➡ The blue line represents the delta of a call option, when the implied volatility is 20%
- ➡ The red line represents the delta of a call option, when the implied volatility is 40%
- ➡ The green line represents the delta of a Put option, when the implied volatility is 20%
- ➡ The purple line represents the delta of a Put option, when the implied volatility is 40%
- ➡ The call option Delta varies from 0 to 1
- ➡ The Put option Delta varies from 0 to -1
- ➡ Assume the current stock price is 175, hence 175 becomes ATM option

With the above points in mind, let us now understand how these deltas behave –

➡ Starting from left – observe the blue line (CE delta when IV is 20%), considering 175 is the ATM option, strikes such as 135, 145 etc are all Deep ITM. Clearly Deep ITM options have a delta of 1

➡ When IV is low (20%), the delta gets flattened at the ends (deep OTM and ITM options). This implies that the rate at which Delta moves (further implying the rate at which the option premium moves) is low. In other words deep ITM options tends to behave exactly like a futures contract (when volatility is low) and OTM option prices will be close to zero.

➡ You can observe similar behavior for Put option with low volatility (observe the green line)

➡ Look at the red line (delta of CE when volatility is 40%) – we can notice that the end (ITM/OTM) is not flattened, in fact the line appears to be more reactive to underlying price movement. In other words, the rate at which the option's premium change with respect to change in underlying is high, when volatility is high. In other words, a large range of options around ATM are sensitive to spot price changes, when volatility is high.

➡ Similar observation can be made for the Put options when volatility is high (purple line)

➡ Interestingly when the volatility is low (look at the blue and green line) the delta of OTM options goes to almost zero. However when the volatility is high, the delta of OTM never really goes to zero and it maintains a small non zero value.

Now, going back to the initial thought – why is the 6800 PE, which is 1100 points away trading at Rs.8.3/-?

Well that's because 6800 PE is a deep OTM option, and as the delta graph above suggests, when the volatility is high (see image below), deep OTM options have non zero delta value.

I would suggest you draw your attention to the Delta versus IV graph and in particular look at the Call Option delta when implied volatility is high (maroon line). As we can see the delta does not really collapse to zero (like the blue line – CE delta when IV is low). This should explain why the premium is not really low. Further add to this the fact that there is sufficient time value, the OTM option tends to have a 'respectable' premium.

Key takeaways from this chapter

1. Volatility smile helps you visualize the fact that the OTM options usually have high IVs
2. With the help of a 'Volatility Cone' you can visualize today's implied volatility with respect to past realized volatility
3. Gamma is high for ATM option especially towards the end of expiry
4. Gamma for ITM and OTM options goes to zero when we approach expiry
5. Delta has an effect on lower range of options around ATM when IV is low and its influence increases when volatility is high.
6. When the volatility is high, the far OTM options do tend to have a non zero delta value

Greek Calculator

21.1 – Background

So far in this module we have discussed all the important Option Greeks and their applications. It is now time to understand how to calculate these Greeks using the Black & Scholes (BS) Options pricing calculator. The BS options pricing calculator is based on the Black and Scholes options pricing model, which was first published by Fisher Black and Myron Scholes (hence the name Black & Scholes) in 1973, however Robert C Merton developed the model and brought in a full mathematical understanding to the pricing formula.

This particular pricing model is highly revered in the financial market, so much so that both Robert C Merton and Myron Scholes received the 1997 Noble Prize for Economic Sciences. The B&S options pricing model involves mathematical concepts such as partial differential equations, normal distribution, stochastic processes etc. The objective in this module is not to take you through the math in B&S model; in fact you could look at this video from Khan Academy for the same – https://www.youtube.com/watch?t=7&v=pr-u4LCFYEY

My objective is to take you through the practical application of the Black & Scholes options pricing formula.

21.2 – Overview of the model

Think of the BS calculator as a black box, which takes in a bunch of inputs and gives out a bunch of outputs. The inputs required are mostly market data of the options contract and the outputs are the Option Greeks.

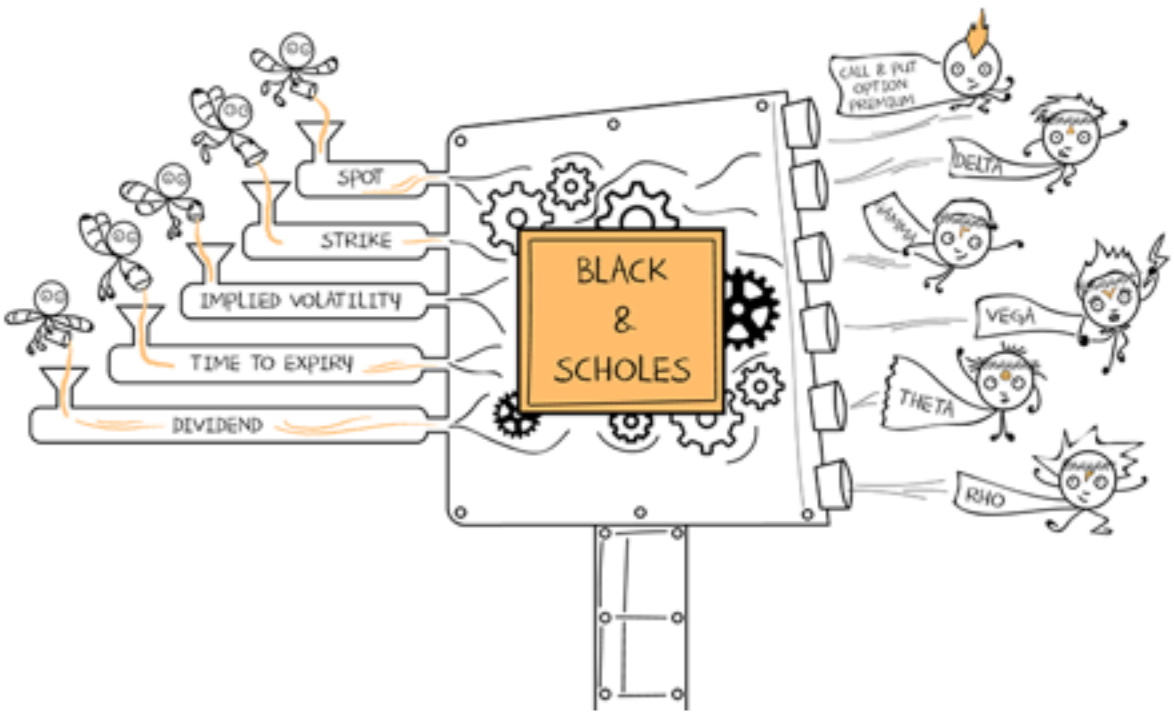
The framework for the pricing model works like this:

1. We input the model with Spot price, Strike price, Interest rate, Implied volatility, Dividend, and Number of days to expiry

2. The pricing model churns out the required mathematical calculation and gives out a bunch of outputs

3.The output includes all the Option Greeks and the theoretical price of the call and put option for the strike selected

The illustration below gives the schema of a typical options calculator:



On the input side:

Spot price – This is the spot price at which the underlying is trading. Note we can even replace the spot price with the futures price. We use the futures price when the option contract is based on futures as its underlying. Usually the commodity and in some cases the currency options are based on futures. For equity option contacts always use the spot price.

Interest Rate – This is risk free rate prevailing in the economy. Use the RBI 91 day Treasury bill rate for this purpose. You can get the rate from the RBI website, RBI has made it available on their landing page, as highlighted below.

As of September 2015 the prevailing rate is 7.4769% per annum.

Dividend – This is the dividend per share expected in the stock, provided the stock goes ex dividend within the expiry period. For example, assume today is 11th September and you wish to calculate the Option Greeks for the ICICI Bank option contract. Assume ICICI Bank is going ex dividend on 18th Sept with a dividend of Rs.4. The expiry for the September series is 24th September 2015, hence the dividend would be Rs.4. in this case.

Number of days to expiry – This the number of calendar days left to expiry

Volatility – This is where you need to enter the option's implied volatility. You can always look at the option chain provided by NSE to extract the implied volatility data. For example, here is the snap shot of ICICI Bank's 280 CE, and as we can see, the IV for this contract is 43.55%.

Option Chain (Equity Derivatives)

Underlying Stock: **ICICIBANK 272.70** As on Sep 23, 2015 15:07:27 IST

View Options Contracts for: Select Index OR Search for an underlying stock: GO Filter by: Expiry Date 24SEP2015 Futures contracts

CALLS												PUTS										
Chart	OI	Chng in OI	Volume	IV	LTP	Net Chng	Bid Qty	Bid Price	Ask Price	Ask Qty	Strike Price	Bid Qty	Bid Price	Ask Price	Ask Qty	Net Chng	LTP	IV	Volume	Chng in OI	OI	Chart
	-	-	-	-	-	-	-	-	-	-	190.00	-	-	-	-	-	-	-	-	-	-	
	-	-	-	-	-	-	1,000	63.05	-	-	200.00	-	-	1.25	8,000	-	-	-	-	-	13,000	
	-	-	-	-	-	-	6,000	61.10	64.05	6,000	210.00	-	-	0.35	4,000	-	-	-	-	-	36,000	
	11,000	-	-	-	-	-	2,000	51.15	52.75	1,000	220.00	-	-	0.05	24,000	-	-	-	-	-	237,000	
	9,000	1,000	1	-	41.15	2.50	6,000	41.25	45.50	2,000	230.00	8,000	0.05	0.10	25,000	-	0.05	136.45	23	-20,000	292,000	
	20,000	-	-	-	-	-	1,000	31.15	36.40	1,000	240.00	-	-	0.05	14,000	-0.05	0.05	105.89	32	-10,000	441,000	
	83,000	-10,000	32	129.79	23.65	2.95	1,000	22.15	22.65	1,000	250.00	33,000	0.10	0.15	1,000	-0.25	0.10	83.88	174	-21,000	764,000	
	264,000	-45,000	166	60.10	12.60	2.50	1,000	12.60	12.90	1,000	260.00	26,000	0.35	0.40	5,000	-0.55	0.40	68.66	1,276	90,000	646,000	
	456,000	-116,000	2,103	40.94	4.35	0.75	1,000	4.00	4.25	2,000	270.00	16,000	1.50	1.60	4,000	-2.15	1.55	51.11	1,486	-8,000	694,000	
	1,359,000	-118,000	1,179	43.55	0.40	-0.40	22,000	0.35	0.40	17,000	280.00	1,000	7.30	7.80	1,000	-2.85	7.45	49.00	200	-37,000	393,000	
	1,320,000	-157,000	321	61.40	0.10	-0.15	75,000	0.05	0.10	1,000	290.00	1,000	16.95	17.50	1,000	-2.55	16.80	-	61	-50,000	239,000	
	2,085,000	-45,000	308	80.39	0.05	-0.05	29,000	0.05	0.10	380,000	300.00	6,000	26.60	27.40	1,000	-1.80	27.50	161.47	19	-15,000	141,000	
	735,000	4,000	103	103.87	0.05	-	-	-	0.05	21,000	310.00	4,000	35.80	37.65	1,000	4.00	38.00	-	44	-32,000	70,000	
	662,000	-5,000	31	125.96	0.05	-	-	-	0.05	23,000	320.00	7,000	45.85	48.45	4,000	7.50	49.00	241.40	21	-11,000	57,000	
	556,000	-13,000	28	146.91	0.05	-0.05	-	-	0.05	18,000	330.00	5,000	55.05	66.95	2,000	-	-	-	-	-	65,000	
	114,000	-1,000	1	166.86	0.05	-	-	-	0.05	11,000	340.00	3,000	65.55	68.60	10,000	7.40	68.90	300.02	3	-3,000	21,000	
	92,000	-	-	-	-	-	-	-	0.05	30,000	350.00	1,000	46.00	112.80	1,000	-	-	-	-	-	7,000	
	8,000	-	1	204.26	0.05	-	-	-	0.05	29,000	360.00	-	-	120.95	2,000	-1.50	86.00	-	1	-1,000	17,000	
	-	-	-	-	-	-	-	-	0.05	30,000	370.00	-	-	-	-	-	-	-	-	-	-	
	1,000	-	-	-	-	-	-	-	0.05	2,000	380.00	-	-	-	-	-	-	-	-	-	1,000	
	-	-	-	-	-	-	-	-	0.05	30,000	390.00	-	-	-	-	-	-	-	-	-	-	
	1,000	-	-	-	-	-	-	-	0.05	30,000	400.00	-	-	-	-	-	-	-	-	-	2,000	
	-	-	-	-	-	-	-	-	0.10	30,000	410.00	-	-	-	-	-	-	-	-	-	-	

Let us use this information to calculate the option Greeks for ICICI 280 CE.

- ➡ Spot Price = 272.7
- ➡ Interest Rate = 4769%
- ➡ Dividend = 0
- ➡ Number of days to expiry = 1 (today is 23rd September, and expiry is on 24th September)
- ➡ Volatility = 43.55%

Once we have this information, we need to feed this into a standard Black & Scholes Options calculator. We do have this calculator on our website – https://zerodha.com/tools/black-scholes , you can use the same to calculate the Greeks.

Once you enter the relevant data in the calculator and click on 'calculate', the calculator displays the Option Greeks –

On the output side, notice the following –

➡ The premium of 280 CE and 280 PE is calculated. This is the theoretical option price as per the B&S options calculator. Ideally this should match with the current option price in the market

➡ Below the premium values, all the Options Greeks are listed.

I'm assuming that by now you are fairly familiar with what each of the Greeks convey, and the application of the same.

One last note on option calculators – the option calculator is mainly used to calculate the Option Greeks and the theoretical option price. Sometimes small difference arises owing to variations in input assumptions. Hence for this reason, it is good to have room for the inevitable modeling errors. However by and large, the option calculator is fairly accurate.

21.3 – Put Call Parity

While we are discussing the topic on Option pricing, it perhaps makes sense to discuss 'Put Call Parity' (PCP). PCP is a simple mathematical equation which states –

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

The equation above holds true assuming –

1. Both the Put and Call are ATM options
2. The options are European
3. They both expire at the same time
4. The options are held till expiry

For people who are not familiar with the concept of Present value, I would suggest you read through this - http://zerodha.com/varsity/chapter/dcf-primer/ (section 14.3).

Assuming you are familiar with the concept of Present value, we can restate the above equation as –

P + S = Ke(-rt) + C

Where, Ke(-rt) represents the present value of strike, with K being the strike itself. In mathematical terms, strike K is getting discounted continuously at rate of 'r' over time't'

Also, do realize if you hold the present value of the strike and hold the same to maturity, you will get the value of strike itself, hence the above can be further restated as –

Put Option + Spot Price = Strike + Call options

So why should the equality hold? To help you understand this better think about two traders, Trader A and Trader B.

- ➡ Trader A holds ATM Put option and 1 share of the underlying stock (left hand side of PCP equation)
- ➡ Trader B holds a Call option and cash amount equivalent to the strike (right hand side of PCP equation)

This being the case, as per the PCP the amount of money both traders make (assuming they hold till expiry) should be the same. Let us put some numbers to evaluate the equation –

Underlying = Infosys
Strike = 1200
Spot = 1200

Trader A holds = 1200 PE + 1 share of Infy at 1200
Trader B holds = 1200 CE + Cash equivalent to strike i.e 1200

Assume upon expiry Infosys expires at 1100, what do you think happens?

Trader A's Put option becomes profitable and he makes Rs.100 however he loses 100 on the stock that he holds, hence his net pay off is 100 + 1100 = 1200.

Trader B's Call option becomes worthless, hence the option's value goes to 0, however he has cash equivalent to 1200, hence his account value is 0 + 1200 = 1200.

Let's take another example, assume Infy hits 1350 upon expiry, lets see what happens to the accounts of both the trader's.

Trader A = Put goes to zero, stock goes to 1350/-
Trader B = Call value goes to 150 + 1200 in cash = 1350/-

So clearly, irrespective of where the stock expires, the equations hold true, meaning both trader A and trader B end up making the same amount of money.

All good, but how would you use the PCP to develop a trading strategy? Well, for that you will have to wait for the next module which is dedicated to "Option Strategies" J. Before we start the next module on Option Strategies, we have 2 more chapters to go in this module.

Key takeaways from this chapter

1. The options calculator is based on the Black & Scholes model
2. The Black & Scholes model is used to estimate the option's theoretical price along with the option's Greek
3. The interest rate in the B&S calculator refers to the risk free rate as available on the RBI site
4. The implied volatility can be fetched from the option chain from the NSE website
5. The put call parity states that the payoff from a put option plus the spot equals the payoff from call option plus the strike.

CHAPTER 22

Re-introducing Call & Put Options

22.1 – Why now?

I suppose this chapter's title may confuse you. After rigorously going through the options concept over the last 21 chapters, why are we now going back to "Call & Put Options" again? In fact we started the module by discussing the Call & Put options, so why all over again?

Well, this is because I personally believe that there are two learning levels in options – before discovering option Greeks and after discovering the option Greeks. Now that we have spent time learning Option Greeks, perhaps it is time to take a fresh look at the basics of the call and put options, keeping the option Greeks in perspective.

Let's have a quick high-level recap –

1. You buy a Call option when you expect the underlying price to increase (you are out rightly bullish)

2. You sell a Call option when you expect the underlying price not to increase (you expect the market to either stay flat or go down but certainly not up)

3. You buy a Put option when you expect the underlying price to decrease (you are out rightly bearish)

4. You sell a Put option when you expect the underlying price not to decrease (you expect the market to stay flat or go up but certainly not down)

Of course the initial few chapters gave us an understanding on the call and put option basics, but the agenda now is to understand the basics of call and put options keeping both volatility and time in perspective. So let's get started.

22.2 – Effect of Volatility

We know that one needs to buy a Call Option when he/she expects the underlying asset to move higher. Fair enough, for a moment let us assume that Nifty is expected to go up by a certain percent, given this would you buy a Call option if –

1. The volatility is expected to go down while Nifty is expected to go up?

2. What would you do if the time to expiry is just 2 days away?

3. What would you do if the time to expiry is more than 15 days away?

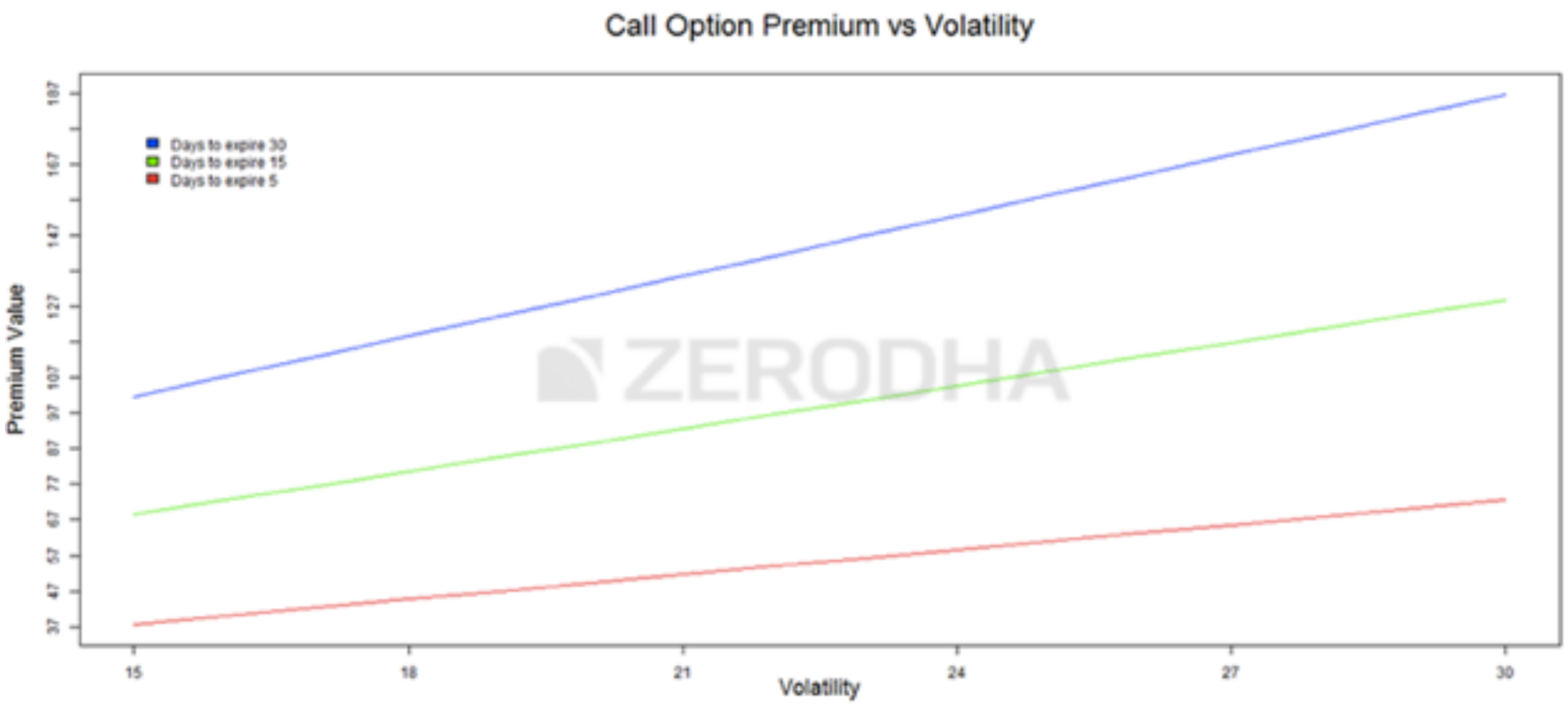
4. Which strike would you choose to trade in the above two cases – OTM, ATM, or ITM and why would you choose the same?

These questions clearly demonstrate the fact that buying a call option (or put option) is not really a straightforward task. There is a certain degree of ground work required before you buy an option. The ground work mainly revolves around assessment of volatility, time to expiry, and of course the directional movement of the market itself.

I will not talk about the assessment of market direction here; this is something you will have to figure out yourself based on theories such as technical analysis, quantitative analysis, or any other technique that you deem suitable.

For instance you could use technical analysis to identify that Nifty is likely to move up by 2-3% over the next few days. Having established this, what would you do? Would you buy an ATM option or ITM option? Given the fact that Nifty will move up by 2-3% over the next 2 days, which strike gives you maximum bang for the buck? This is the angle I would like to discuss in this chapter.

Let's start by looking at the following graph, if you recollect we discussed this in the chapter on Vega –

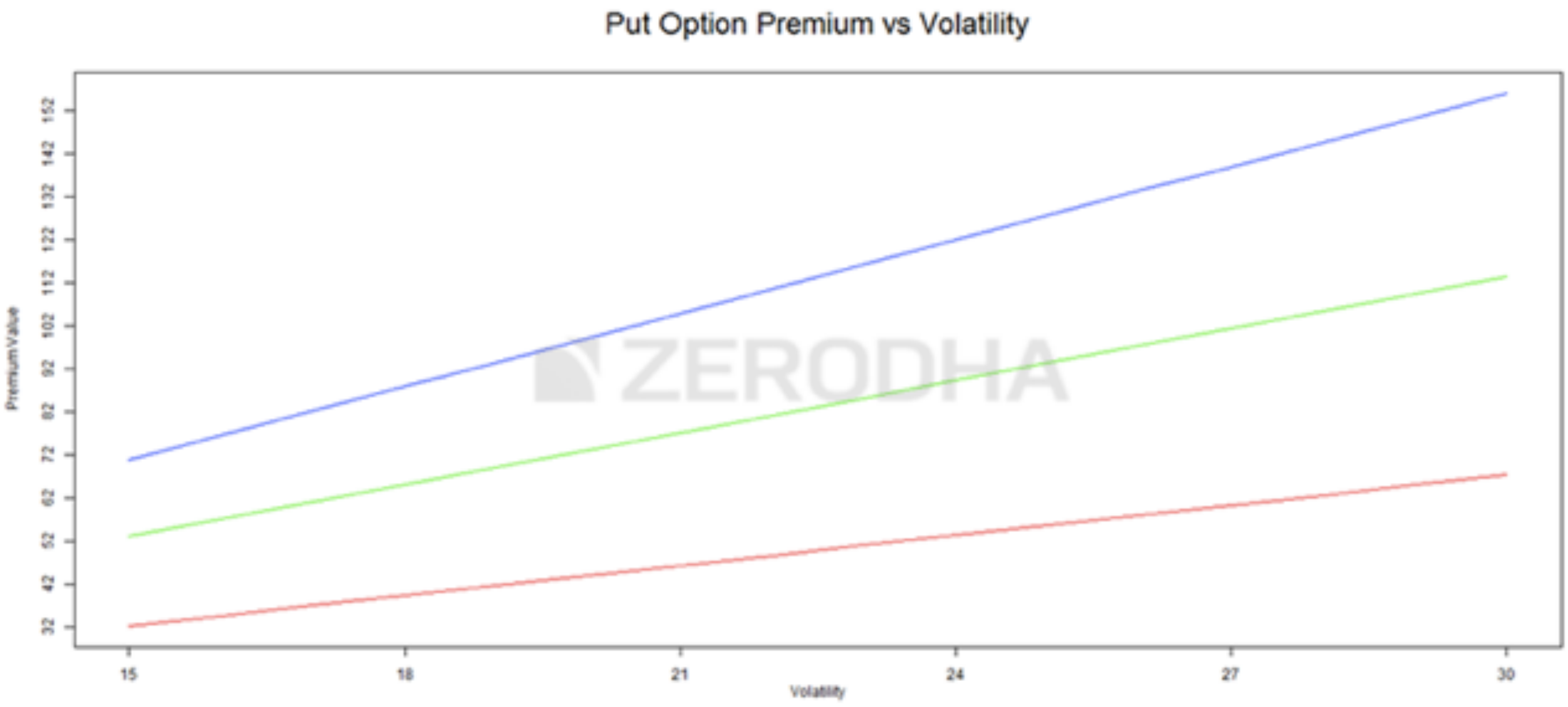


The graph above depicts how a call option premium behaves with respect to increase in volatility across different 'time to expiry' time frames. For example the blue line shows how the call option premium behaves when there are 30 days to expiry, green for 15 days to expiry, and red for 5 days to expiry.

With help of the graph above, we can arrive at a few practical conclusions which we can incorporate while buying/selling call options

1. Regardless of time to expiry, the premium always increases with increase in volatility and the premium decreases with decrease in volatility
2. For volatility to work in favor of a long call option one should time buying a call option when volatility is expected to increase and avoid buying call option when volatility is expected to decrease
3. For volatility to work in favor of a short call option, one should time selling a call option when volatility is expected to fall and avoid selling a call option when the volatility is expected to increase

Here is the graph of the put option premium versus volatility –



This graph is very similar to the graph of call premium versus volatility – therefore the same set of conclusions hold true for put options as well.

These conclusions make one thing clear – buy options when you expect volatility to increase and short options when you expect the volatility to decrease. Now the next obvious question is – which strike to choose when you decide to buy or sell options? This is where the assessment of time to expiry comes into play.

22.3 – Effect of Time

Let us just assume that the volatility is expected to increase along with increase in the underlying prices. Clearly buying a call option makes sense. However the more important aspect is to identify the right strike to buy. Infact when you wish to buy an option it is important to analyze how far away we are with respect to market expiry. Selection of strike depends on the time to expiry.

Do note – understanding the chart below may seem a bit confusing in the beginning, but it is not. So don't get disheartened if you don't get it the first time you read, just give it another shot.

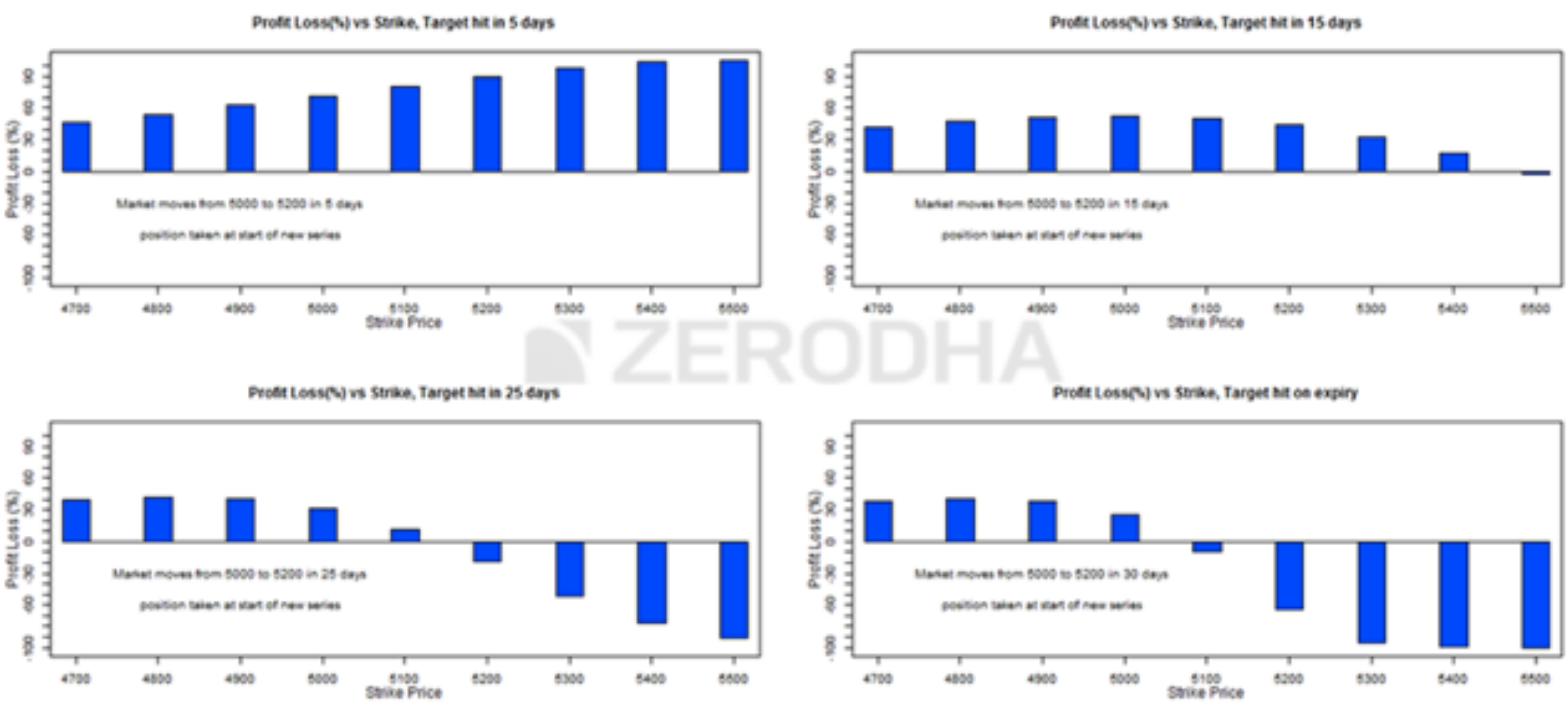
Before we proceed we need to get a grip on the timelines first. A typical F&O series has about 30 days before expiry (barring February series). To help you understand better, I have divided the series into 2 halves – the first half refers to the first 15 days of the series and the 2nd half refers to the last 15 days of the F&O series. Please do keep this in perspective while reading through below.

Have a look at the image below; it contains 4 bar charts representing the profitability of different strikes. The chart assumes –

1. The stock is at 5000 in the spot market, hence strike 5000 is ATM
2. The trade is executed at some point in the 1st half of the series i.e between the start of the F&O series and 15th of the month
3. We expect the stock to move 4% i.e from 5000 to 5200

Given the above, the chart tries to investigate which strike would be the most profitable given the target of 4% is achieved within –

1. 5 days of trade initiation
2. 15 days of trade initiation
3. 25 days of trade initiation
4. On expiry day



So let us start from the **first chart** on the left top. This chart shows the profitability of different call option strikes given that the trade is executed in the first half of the F&O series. The target is expected to be achieved within 5 days of trade execution.

Here is a classic example – today is 7th Oct, Infosys results are on 12th Oct, and you are bullish on the results. You want to buy a call option with an intention of squaring it off 5 days from now, which strike would you choose?

From the chart it is clear – when there is ample time to expiry (remember we are at some point in the 1st half of the series), and the stock moves in the expected direction, then all strikes tend to make money. However, the strikes that make maximum money are (far) OTM options. As we can notice from the chart, maximum money is made by 5400 and 5500 strike.

Conclusion – When we are in the 1st half of the expiry series, and you expect the target to be achieved quickly (say over few days) buy OTM options. In fact I would suggest you buy 2 or 3 strikes away from ATM and not beyond that.

Look at the **2nd chart (top right)** – here the assumption is that the trade is executed in the 1st half the series, the stock is expected to move by 4%, but the target is expected to be achieved in 15 days. Except for the time frame (target to be achieved) everything else remains the same. Notice how the profitability changes, clearly buying far OTM option does not makes sense. In fact you may even lose money when you buy these OTM options (look at the profitability of 5500 strike).

Conclusion – When we in the 1st half of the expiry series, and you expect the target to be achieved over 15 days, it makes sense to buy ATM or slightly OTM options. I would not recommend buying options that are more than 1 strike away from ATM. One should certainly avoid buying far OTM options.

In the **3rd chart (bottom left)** the trade is executed in the 1st half the series and target expectation (4% move) remains the same but the target time frame is different. Here the target is expected to be achieved 25 days from the time of trade execution. Clearly as we can see OTM options are not worth buying. In most of the cases one ends up losing money with OTM options. Instead what makes sense is buying ITM options.

Also, at this stage I have to mention this – people end up buying OTM options simply because the premiums are lower. Do not fall for this, the low premium of OTM options creates an illusion that you won't lose much, but in reality there is a very high probability for you to lose all the money, albeit small amounts. This is especially true in cases where the market moves but not at the right speed. For example the market may move 4% but if this move is spread across 15 days, then it does not make sense holding far OTM options. However, far OTM options make money when the movement in the market is swift – for example a 4% move within 1 or say 2 days. This is when far OTM options moves smartly.

Conclusion – When we are at the start of the expiry series, and you expect the target to be achieved over 25 days, it makes sense to buy ITM options. One should certainly avoid buying ATM or OTM options.

The **last chart (bottom right)** is quite similar to the 3rd chart, except that you expect the target to be achieved on the day of the expiry (over very close to expiry). The **conclusion** is simple – under such a scenario all option strikes, except ITM lose money. Traders should avoid buying ATM or OTM options.

Let us look at another set of charts – the idea here is to figure out which strikes to choose given that the trade is executed in the 2nd half of the series i.e at any point from 15th of the month till the expiry. Do bear in mind the effect of time decay accelerates in this period; hence as we are moving closer to expiry the dynamic of options change.

The 4 charts below help us identify the right strike for different time frames during which the target is achieved. Of course we do this while keeping theta in perspective.

Chart 1 (top left) evaluates the profitability of different strikes wherein the trade is executed in the 2nd half of the series and the target is achieved the same day of trade initiation. News driven option trade such as buying an option owing to a corporate announcement is a classic example. Buying an index option based on the monetary policy decision by RBI is another example. Clearly as we can see from the chart all strikes tend to make money when the target is achieved the same day, however the maximum impact would be on (far) OTM options.

Do recall the discussion we had earlier – when market moves swiftly (like 4% in 1 day), the best strikes to trade are always far OTM.

Conclusion – When you expect the target to be achieved the same day (irrespective of time to expiry) buy far OTM options. I would suggest you buy 2 or 3 strikes away from ATM options and not beyond that. There is no point buying ITM or ATM options.

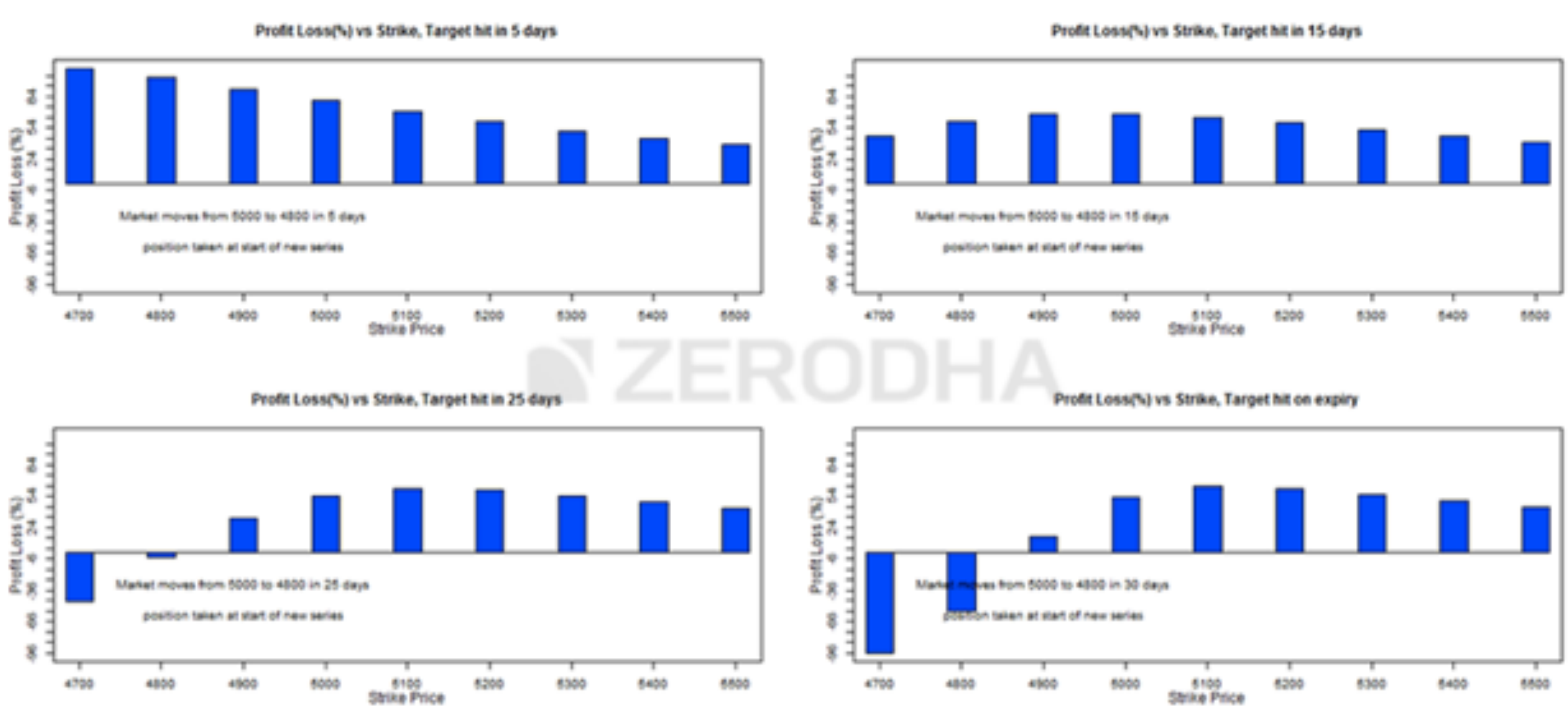
Chart 2 (top right) evaluates the profitability of different strikes wherein the trade is executed in the 2nd half of the series and the target is achieved within 5 days of trade initiation. Notice how the profitability of far OTM options diminishes. In the above case (chart 1) the target is expected to be achieved in 1 day therefore buying (far) OTM options made sense, but here the target is achieved in 5 days, and because the trade is kept open for 5 days especially during the 2nd half of the series, the impact of theta is higher. Hence it just does not make sense risking with far OTM options. The safest bet under such a scenario is strikes which are slightly OTM.

Conclusion – When you are in the 2nd half of the series, and you expect the target to be achieved around 5 days from the time of trade execution buy strikes that are slightly OTM. I would suggest you buy 1 strike away from ATM options and not beyond that.

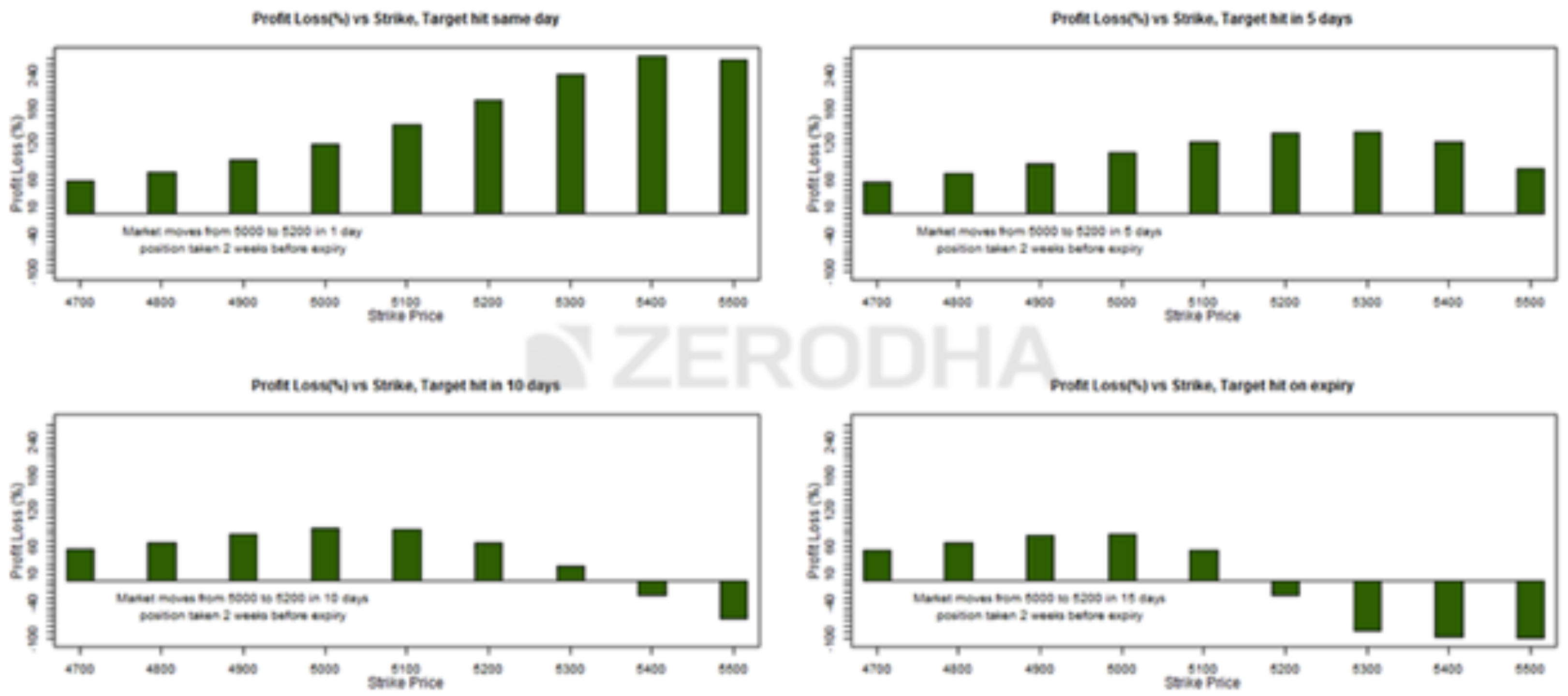
Chart 3 (bottom right) and Chart 4 (bottom left) – both these charts are similar expect in chart 3 the target is achieved 10 days from the trade initiation and in chart 4, the target is expected to be achieved on the day of the expiry. I suppose the difference in terms of number of days won't be much, hence I would treat them to be quite similar. From both these charts we can reach 1 **conclusion** – far OTM options tend to lose money when the target is expected to be achieved close to expiry. In fact when the target is achieved closer to the expiry, the heavier the far OTM options bleed. The only strikes that make money are ATM or slightly ITM option.

While the discussions we have had so far are with respect to buying a call option, similar observations can be made for PUT options as well. Here are two charts that help us understand which strikes to buy under various situations –

These charts help us understand which strikes to trade when the trade is initiated in the first half of the series, and the target is achieved under different time frames.



While these charts help us understand which strikes to trade when is the trade is executed in the 2nd half of the series and the target is achieved under different time frames.



If you go through the charts carefully you will realize that the conclusions for the Call options holds true for the Put options as well. Given this we can generalize the best practices for buying options –

Position Initiation	Target Expectation	Best strike to trade
1st half of the series	5 days from initiation	Far OTM (2 strikes away from ATM)
1st half of the series	15 days from initiation	ATM or slightly OTM (1 strike away from ATM)
1st half of the series	25 days from initiation	Slightly ITM options
1st half of the series	On expiry day	ITM
2nd half of the series	Same day	Far OTM (2 or 3 strikes away from ATM)
2nd half of the series	5 days from initiation	Slightly OTM (1 strike away from ATM)
2nd half of the series	10 days from initiation	Slightly ITM or ATM
2nd half of the series	On expiry day	ITM

So the next time you intend to buy a naked Call or Put option, make sure you map the period (either 1st half or 2nd half of the series) and the time frame during which the target is expected to be achieved. Once you do this, with the help of the table above you will know which strikes to trade and more importantly you will know which strikes to avoid buying.

With this, we are now at the verge of completion of this module. In the next chapter I would like to discuss some of the simple trades that I initiated over the last few days and also share my trade rationale behind each trade. Hopefully the case studies that I will present in the next chapter will give you a perspective on the general thought process behind simple option trades.

Key takeaways from this chapter

1. Volatility plays a crucial role in your decision to buy options
2. In general buy options when you expect the volatility to go higher
3. Sell options when you expect the volatility to decrease
4. Besides volatility the time to expiry and the time frame during which the target is expected to be achieved also matters

CHAPTER 23

Case studies – wrapping it all up!

23.1 – Case studies

We are now at the very end of this module and I hope the module has given you a fair idea on understanding options. I've mentioned this earlier in the module, at this point I feel compelled to reiterate the same – options, unlike futures is not a straight forward instrument to understand. Options are multi dimensional instruments primarily because it has many market forces acting on it **simultaneously**, and this makes options a very difficult instrument to deal with. From my experience I've realized the only way to understand options is by regularly trading them, based on options theory logic.

To help you get started I would like to discuss few **simple** option trades executed successfully. Now here is the best part, these trades are executed by Zerodha Varsity readers over the last 2 months. I believe these are trades inspired by reading through the contents of Zerodha Varsity, or at least this is what I was told. :)

Either ways I'm happy because each of these trades has a logic backed by a mutli disciplinary approach. So in that sense it is very gratifying, and it certainly makes a perfect end to this module on Options Theory.

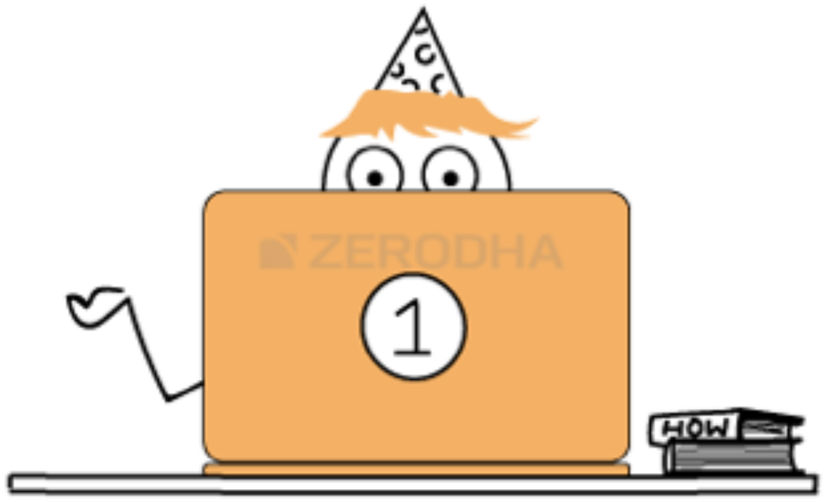
Do note the traders were kind enough to oblige to my request to discuss their trades here, however upon their request I will refrain from identifying them.

Here are the 4 trades that I will discuss –

1. CEAT India – Directional trade, inspired by Technical Analysis logic
2. Nifty – Delta neutral, leveraging the effect of Vega
3. Infosys – Delta neutral, leveraging the effect of Vega
4. Infosys – Directional trade, common sense fundamental approach

For each trade I will discuss what I like about it and what could have been better. Do note, all the snapshots presented here are taken by the traders themselves, I just specified the format in which I need these snapshots.

So, let's get started.



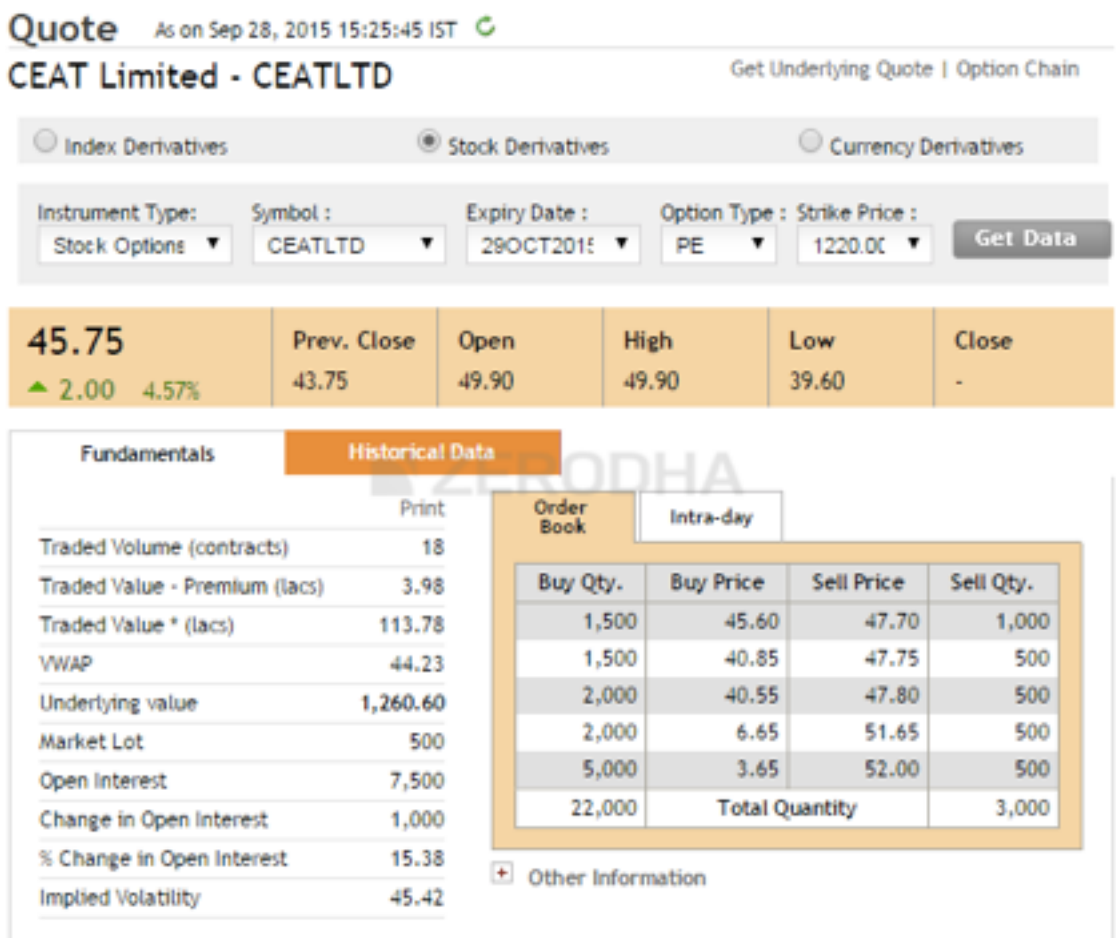
23.2 – CEAT India

The trade was executed by a 27 year old 'Options newbie'. Apparently this was his first options trade ever.

Here is his logic for the trade: CEAT Ltd was trading around Rs.1260/- per share. Clearly the stock has been in a good up trend. However he believed the rally would not continue as there was some sort of exhaustion in the rally.

My thinking is that he was encouraged to believe so by looking at the last few candles, clearly the last three day's trading range was diminishing.

To put thoughts into action, he bought the 1220 (OTM) Put options by paying a premium of Rs.45.75/- per lot. The trade was executed on 28th September and expiry for the contract was on October 29th. Here is the snapshot of the same –


Quote As on Sep 28, 2015 15:25:45 IST

CEAT Limited - CEATLTD

Get Underlying Quote | Option Chain

Index Derivatives | Stock Derivatives | Currency Derivatives

Instrument Type: Stock Options | Symbol : CEATLTD | Expiry Date : 29OCT2015 | Option Type : PE | Strike Price : 1220.00 | Get Data

45.75	Prev. Close	Open	High	Low	Close
2.00 4.57%	43.75	49.90	49.90	39.60	-

Fundamentals | Historical Data

	Print
Traded Volume (contracts)	18
Traded Value - Premium (lacs)	3.98
Traded Value * (lacs)	113.78
VWAP	44.23
Underlying value	1,260.60
Market Lot	500
Open Interest	7,500
Change in Open Interest	1,000
% Change in Open Interest	15.38
Implied Volatility	45.42

Order Book | Intra-day

Buy Qty.	Buy Price	Sell Price	Sell Qty.
1,500	45.60	47.70	1,000
1,500	40.85	47.75	500
2,000	40.55	47.80	500
2,000	6.65	51.65	500
5,000	3.65	52.00	500
22,000	Total Quantity		3,000

Other Information

I asked the trader few questions to understand this better –

1. Why did you choose to trade options and not short futures?

a. Shorting futures would be risky, especially in this case as reversals could be sharp and MTM in case of sharp reversals would be painful

2. When there is so much time to expiry, why did I choose to trade a slightly OTM option and not really far OTM option?

a. This is because of liquidity. Stock options are not really liquid, hence sticking to strikes around ATM is a good idea

3. What about stoploss?

a. The plan is to square off the trade if CEAT makes a new high. In other words a new high on CEAT indicates that the uptrend is still intact, and therefore my contrarian short call was flawed

4. What about target?

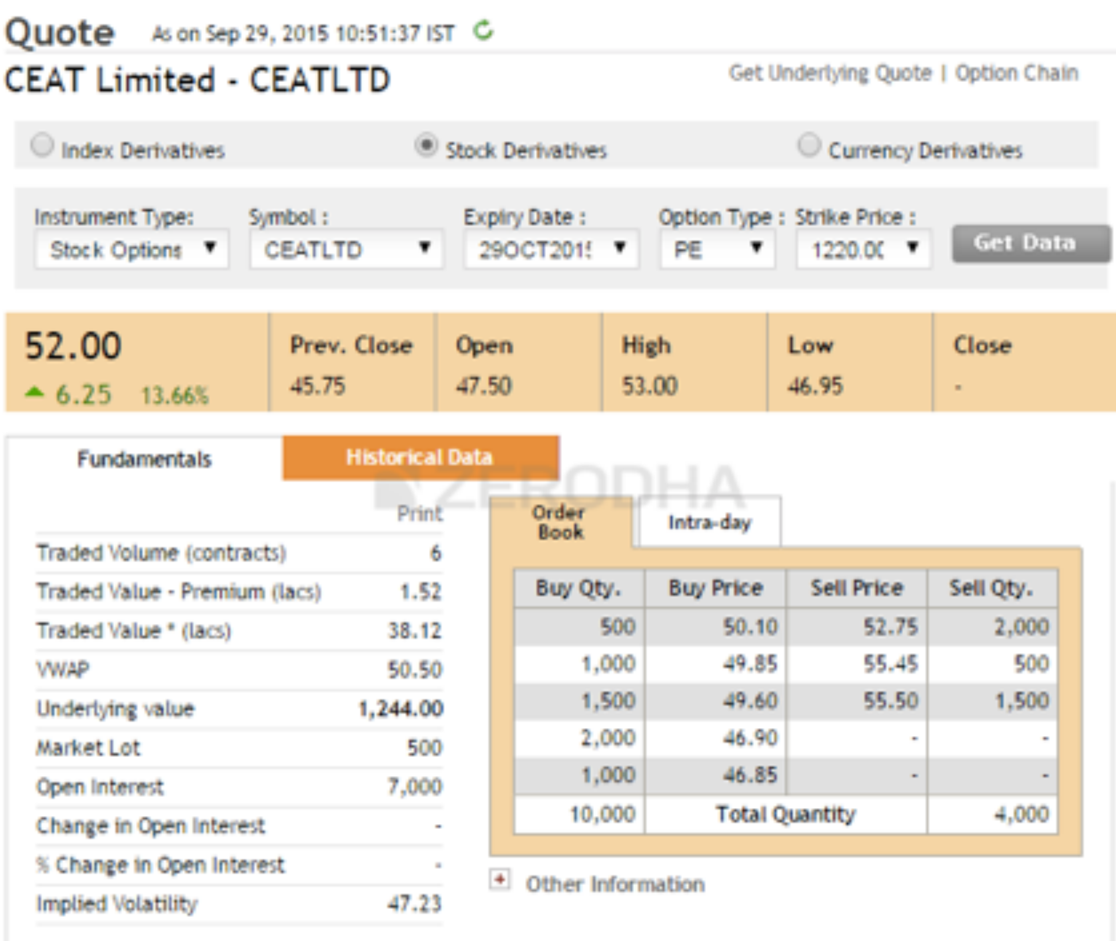
a. Since the stock is in a good up trend, the idea is to book profits as soon as it's deemed suitable. Reversals can be sharp, so no point holding on to short trades. In fact it would not be a bad idea to reverse the trade and buy a call option.

5. What about holding period?

a. The trade is a play on appreciation in premium value. So I will certainly not look at holding this to expiry. Given that there is ample time to expiry, a small dip in stock price will lead to a decent appreciation in premium.

Note – the QnA is reproduced in my own words, the idea here is to produce the gist and not the exact word to word conversation.

So after he bought CEAT PE, this is what happened the very next day –



Stock price declined to 1244, and the premium appreciated to 52/-. He was right when he said "since there is ample time to expiry, a small dip in the stock price will lead to a good increase in option premium". He was happy with 7/- in profits (per lot) and hence he decided to close the trade.

Looking back I guess this was probably a good move.

Anyway, I guess this is not bad for a first time, overnight options trade.

My thoughts on this trade – Firstly I need to appreciate this trader's clarity of thought, more so considering this was his first options trade. If I were to set up a trade on this, I would have done this slightly differently.

1. From the chart perspective the thought process was clear – exhaustion in the rally. Given this belief I would prefer selling call options instead of buying them. Why would I do this? – Well, exhaustion does not necessarily translate to correction in stock prices. More often than not, the stock would enter a side way movement making it attractive to option sellers

2. I would select strikes based on the normal distribution calculation as explained earlier in this module (needless to say, one had to keep liquidity in perspective as well)

3. I would have executed the trade (selling calls) in the 2nd half of the series to benefit from time decay

Personally I do not prefer naked directional trades as they do not give me a visibility on risk and reward. However the only time when I initiate a naked long call option (based on technical analysis) trade is when I observe a flag formation –

1. Stock should have rallied (prior trend) at least 5-10%

2. Should have started correcting (3% or so) on low volumes – indicates profit booking by week hands

I find this a good setup to buy call options.

23.3 – RBI News play (Nifty Options)

This is a trade in Nifty Index options based on RBI's monetary policy announcement. The trade was executed by a Varsity reader from Delhi. I considered this trade structured and well designed.

Here is the background for this trade.

Reserve Bank of India (RBI) was expected to announce their monetary policy on 29th September. While it is hard for anyone to guess what kind of decision RBI would take, the general expectation in the market was that RBI would slash the repo rates by 25 basis points. For people not familiar with monetary policy and repo rates, I would suggest you read this –

http://zerodha.com/varsity/chapter/key-events-and-their-impact-on-markets/

RBI's monetary policy is one of the most eagerly awaited events by the market participants as it tends to have a major impact on market's direction.

Here are few empirical market observations this trader has noted in the backdrop market events

1. The market does not really move in any particular direction, especially 2 – 3 days prior to the announcement. He find this applicable to stocks as well – ex : quarterly results
2. Before the event/announcement market's volatility invariably shoots up
3. Because the volatility shoots up, the option premiums (for both CE and PE) also shoot up

While, I cannot vouch for his first observations, the 2nd and 3rd observation does make sense.

So in the backdrop of RBI's policy announcement, ample time value, and increased volatility (see image below) he decided to write options on 28th of September.

Nifty was somewhere around 7780, hence the strike 7800 was the ATM option. The 7800 CE was trading at 203 and the 7800 PE was trading at 176, both of which he wrote and collected a combined premium of Rs.379/-.

Here is the option chain showing the option prices.

CALLS												PUTS										
Chart	OI	Chng in OI	Volume	IV	LTP	Net Chng	Bid Qty	Bid Price	Ask Price	Ask Qty	Strike Price	Bid Qty	Bid Price	Ask Price	Ask Qty	Net Chng	LTP	IV	Volume	Chng in OI	OI	Chart
	-	-	-	-	-	-	25	601.05	758.95	25	7150.00	25	19.00	29.95	100	-91.15	29.85	26.39	4	100	200	
	74,875	5,350	542	-	653.00	-60.00	125	650.85	655.45	25	7200.00	200	34.15	34.45	5,550	2.90	34.45	26.03	55,784	198,025	1,205,375	
	-	-	-	-	-	-	25	501.05	678.95	25	7250.00	25	38.55	41.00	100	6.45	40.95	25.93	212	1,475	3,175	
	70,300	17,600	915	12.73	559.80	-63.00	400	563.35	565.35	25	7300.00	75	46.15	46.70	25	4.70	46.65	25.50	73,928	146,575	1,257,775	
	-	-	-	-	-	-	25	421.05	588.95	25	7350.00	25	52.60	55.95	300	9.35	53.35	25.12	65	525	550	
	103,525	14,500	1,118	17.18	479.10	-56.95	50	480.30	482.00	150	7400.00	2,325	61.55	61.95	25	6.65	61.95	24.89	87,722	230,125	3,237,450	
	200	-	-	-	458.00	-	25	351.15	498.85	25	7450.00	25	69.75	74.35	200	6.40	71.00	24.57	177	675	2,800	
	699,800	25,950	4,189	19.11	406.00	-51.00	25	402.45	405.90	25	7500.00	25	81.50	82.05	25	9.40	82.05	24.37	191,577	485,200	3,703,075	
	200	-	-	-	418.00	-	25	301.15	418.95	25	7550.00	150	89.80	95.90	200	9.85	93.45	24.04	621	3,850	8,500	
	542,325	14,325	5,862	18.89	329.25	-49.15	25	327.65	332.60	25	7600.00	25	106.10	107.00	1,800	13.40	106.85	23.79	212,984	90,575	2,483,550	
	200	-	2	18.96	295.10	27.10	25	279.35	497.80	25	7650.00	25	118.20	122.30	25	17.70	121.70	23.53	2,276	15,700	20,900	
	865,250	33,825	14,975	18.99	262.65	-41.70	50	261.00	262.70	50	7700.00	25	136.75	138.35	25	18.95	138.00	23.26	210,343	19,625	1,987,950	
	4,025	1,100	286	18.71	229.80	-35.05	25	231.30	260.45	125	7750.00	50	152.10	159.00	25	22.20	155.00	22.88	2,872	16,000	27,950	
	1,506,325	215,550	94,528	18.88	203.00	-35.40	125	202.00	203.00	4,650	7800.00	50	175.05	175.60	175	25.95	175.60	22.71	200,052	346,575	3,603,000	
	30,200	11,375	3,337	18.86	176.90	-28.85	25	174.00	176.95	100	7850.00	125	189.95	196.00	25	28.75	195.00	22.20	5,810	5,200	19,425	
	1,706,200	403,625	207,609	18.41	149.20	-28.95	125	148.55	149.20	7,850	7900.00	1,375	219.20	220.00	1,500	32.75	219.20	22.01	145,245	95,675	1,353,125	
	22,550	12,900	2,865	18.09	125.00	-28.20	50	124.85	125.00	25	7950.00	400	237.85	252.95	25	35.30	241.95	21.44	541	3,375	7,575	
	2,874,425	515,175	304,831	17.75	103.00	-24.15	375	102.90	103.00	200	8000.00	25	270.60	271.35	100	39.65	271.00	21.34	58,185	5,075	1,317,000	
	47,125	27,350	4,321	17.65	85.50	-21.75	200	82.10	86.80	100	8050.00	25	282.65	313.95	50	41.10	300.00	21.02	8	75	350	
	2,303,125	416,575	337,764	17.28	68.10	-18.00	1,600	68.10	68.85	50	8100.00	25	333.15	336.00	250	44.95	333.00	20.94	10,964	-4,900	771,775	
	31,000	20,200	2,564	17.09	54.40	-14.55	25	54.40	56.25	25	8150.00	25	347.35	626.35	25	-	310.00	12.49	3	25	950	
	3,244,925	596,550	245,193	16.99	43.40	-11.40	1,025	43.00	43.40	1,100	8200.00	25	404.30	408.75	25	53.05	405.00	20.86	6,201	10,550	882,775	
	24,050	21,150	2,754	16.95	34.50	-7.55	25	32.00	34.50	300	8250.00	25	425.35	489.95	25	20.00	450.00	21.78	5	125	400	
	3,393,175	651,600	189,161	16.73	26.20	-8.60	3,850	26.20	26.90	200	8300.00	50	483.80	487.70	25	55.10	485.30	21.10	2,752	12,275	649,050	
	4,725	1,350	345	17.07	21.95	-4.20	75	19.00	25.00	75	8350.00	25	478.65	580.25	50	75.00	496.00	14.65	1	25	125	
	2,038,500	353,150	171,103	16.68	15.65	-5.40	125	15.65	16.00	500	8400.00	125	570.15	574.80	25	56.85	570.40	21.38	1,262	17,850	372,700	

I had a discussion with him to understand his plan of action; I'm reproducing the same (in my own words) for your understanding –

1. Why are you shorting 7800 CE and 7800 PE?

a. Since there was ample time to expiry and increased volatility, I believe that the options are expensive, and premiums are higher than usual. I expect the volatility to decrease eventually and therefore the premiums to decrease as well. This would give me an opportunity to buyback both the options at a lower price

2. Why did you choose to short ATM option?

a. There is a high probability that I would place market orders at the time of exit, given this I want to ensure that the loss due to impact cost is minimized. ATM options have lesser impact cost, therefore it was a natural choice.

3. For how long do you plan to hold the trade?

a. Volatility usually drops as we approach the announcement time. From empirical observation I believe that the best time to square of these kinds of trade would be minutes before the announcement. RBI is expected to make the announcement around 11:00 AM on September29th; hence I plan to square off the trade by 10:50 AM.

4. What kind of profits do you expect for this trade?

a. I expect around 10 – 15 points profits per lot for this trade.

5. What is you stop loss for this trade?

a. Since the trade is a play on volatility, its best to place SL based on Volatility and not really on the option premiums. Besides this trade comes with a predefined 'time based stoploss' – remember no matter what happens, the idea is to get out minutes before RBI makes the announcement.

So with these thoughts, he initiated the trade. To be honest, I was more confident about the success of this trade compared to the previous trade on CEAT. To a large extent I attribute the success of CEAT trade to luck, but this one seemed like a more rational set up.

Anyway, as per plan the next day he did manage to close the trade minutes before RBI could make the policy announcement.

Here is the screenshot of the options chain –

	CALLS											PUTS										
Chart	OI	Chng in OI	Volume	IV	LTP	Net Chng	Bid Qty	Bid Price	Ask Price	Ask Qty	Strike Price	Bid Qty	Bid Price	Ask Price	Ask Qty	Net Chng	LTP	IV	Volume	Chng in OI	OI	Chart
	-	-	-	-	-	-	25	509.25	787.75	25	7150.00	300	25.05	42.85	150	18.50	48.35	-	75	1,750	1,950	
	77,575	2,700	205	-	637.75	-10.50	25	635.75	642.45	25	7200.00	100	34.85	35.10	725	-0.05	35.00	26.30	101,009	387,075	1,592,450	
	-	-	-	-	-	-	25	430.20	851.75	25	7250.00	50	40.35	51.55	25	2.75	43.10	27.05	1,069	21,300	24,475	
	70,875	575	860	-	550.70	-6.10	25	552.50	557.05	25	7300.00	525	47.45	47.70	175	0.45	47.50	25.77	93,643	220,150	1,477,925	
	-	-	-	-	-	-	1,000	327.25	634.60	1,000	7350.00	200	41.65	71.85	200	16.60	70.55	28.73	152	1,950	2,500	
	98,825	-4,700	2,406	-	472.20	-3.45	25	469.85	475.10	50	7400.00	50	63.55	63.75	75	1.10	63.70	-	137,519	336,700	3,574,150	
	200	-	4	-	372.60	-85.40	1,000	262.90	573.70	1,000	7450.00	250	62.40	81.65	150	-	72.35	25.42	216	600	3,400	
	845,975	146,175	17,940	-	393.25	-5.20	75	391.25	393.75	50	7500.00	125	84.20	84.50	100	1.65	84.65	24.67	205,869	367,350	4,070,425	
	725	525	72	17.79	364.05	-53.95	200	341.20	365.85	150	7550.00	50	95.55	96.60	225	1.65	95.60	24.52	1,627	11,700	20,200	
	587,475	45,150	16,796	17.81	319.60	-5.65	425	319.80	320.70	125	7600.00	25	109.50	109.90	200	1.75	109.75	-	123,213	298,350	2,781,900	
	3,875	3,675	227	-	281.30	-13.80	400	278.85	288.05	25	7650.00	675	121.65	124.25	25	-0.10	122.85	24.00	2,353	14,175	35,075	
	1,130,450	265,200	75,302	17.88	251.95	-6.80	125	251.90	252.75	100	7700.00	3,100	141.40	141.60	100	2.25	141.40	-	142,371	272,575	2,260,525	
	28,200	24,175	2,910	18.28	219.00	-9.45	25	218.85	224.45	400	7750.00	25	155.85	158.05	675	1.25	159.20	-	2,742	15,150	43,100	
	1,810,500	304,175	136,377	-	191.20	-7.25	300	191.20	191.70	25	7800.00	75	178.70	179.15	175	1.60	178.75	23.04	83,098	-121,350	3,481,650	
	49,250	19,050	2,427	17.77	164.45	-6.95	275	164.35	166.20	200	7850.00	25	196.05	202.25	25	6.75	205.00	-	1,273	11,525	30,950	
	2,379,375	673,175	198,353	17.46	137.95	-7.60	200	138.05	138.40	325	7900.00	50	222.50	224.00	50	2.15	223.85	-	36,234	-31,700	1,321,425	
	41,950	19,400	2,471	17.16	115.90	-7.05	425	114.60	115.90	25	7950.00	100	245.25	254.80	25	-10.75	236.65	21.74	153	2,250	9,825	
	3,571,575	697,150	297,373	17.04	95.00	-5.90	150	94.70	95.00	350	8000.00	50	277.05	278.50	50	4.85	279.85	22.10	17,688	-53,550	1,263,450	
	55,550	8,425	2,845	16.77	76.45	-6.55	600	77.05	77.70	25	8050.00	100	280.70	319.65	50	-2.20	297.80	-	5	-	350	
	2,731,125	428,000	174,489	-	62.00	-4.65	425	61.80	62.00	650	8100.00	50	341.05	343.25	50	3.45	343.10	-	4,599	-10,800	760,975	
	40,300	9,300	1,061	17.04	50.45	-3.45	400	49.80	51.10	25	8150.00	100	296.60	559.85	125	-	-	-	-	-	950	
	3,687,550	442,625	177,176	16.51	39.10	-3.25	225	39.10	39.30	350	8200.00	150	412.75	416.70	50	2.90	415.15	22.43	2,296	-9,375	873,400	
	26,400	2,350	1,359	-	30.00	-3.45	1,000	27.15	33.25	1,000	8250.00	1,000	361.15	579.60	50	-	-	-	-	-	400	
	3,735,700	342,525	152,047	-	24.20	-2.00	350	24.15	24.35	50	8300.00	25	497.40	501.75	25	10.15	502.60	-	1,119	7,925	656,975	
	5,675	950	61	-	12.60	-8.70	25	14.15	21.50	25	8350.00	25	450.15	698.95	50	75.00	571.00	-	1	-	125	
	2,037,900	-600	82,947	-	14.45	-1.30	575	14.30	14.45	1,075	8400.00	150	584.35	587.65	25	8.65	586.25	24.28	786	-950	371,750	

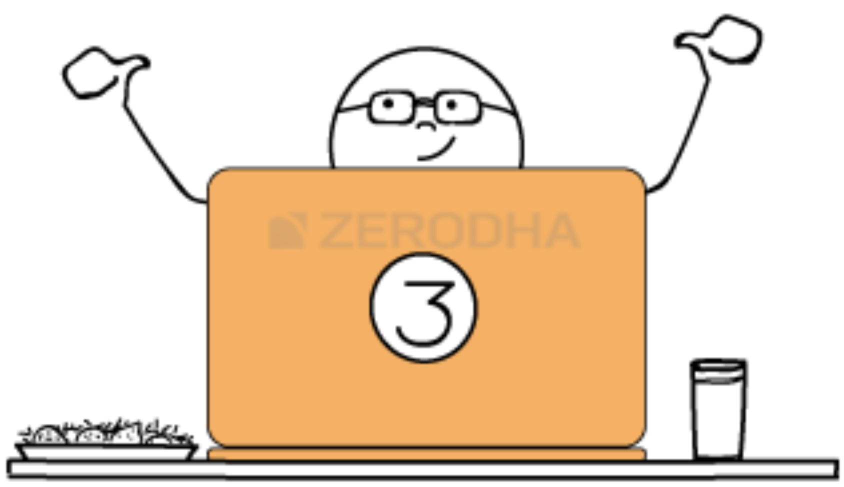
As expected the volatility dropped and both the options lost some value. The 7800 CE was trading at 191 and the 7800 PE was trading at 178. The combined premium value was at 369, and he did manage to make a quick 10 point profit per lot on this trade. Not too bad for an overnight trade I suppose.

Just to give you a perspective – this is what happened immediately after the news hit the market.

My thoughts on this trade – In general I do subscribe to the theory of volatility movement and shorting options before major market events. However such trades are to be executed couple of days before the event and not 1 day before.

Let me take this opportunity to clear one misconception with respect to the news/announcement based option trades. Many traders I know usually set up the opposite trade i.e buy both Call and Put option before major events. This strategy is also called the "Long Straddle". The thought process with a long straddle is straight forward – after the announcement the market is bound to move, based on the direction of the market movement either Call or Put options will make money. Given this the idea is simple – hold the option which is making money and square off the option that is making a loss. While this may seem like a perfectly logical and intuitive trade, what people usually miss out is the impact of volatility.

When the news hits the market, the market would certainly move. For example if the news is good, the Call options will definitely move. **However more often than not the speed at which the Put option premium will lose value is faster than the speed at which the call option premium would gain value**. Hence you will end up losing more money on the Put option and make less money on Call option. For this reasons I believe selling options before an event to be more meaningful.



23.4 – Infosys Q2 Results

This trade is very similar to the previous RBI trade but better executed. The trade was executed by another Delhiite.

Infosys was expected to announce their Q2 results on 12th October. The idea was simple – news drives volatility up, so short options with an expectation that you can buy it back when the volatility cools off. The trade was well planned and the position was initiated on 8th Oct – 4 days prior to the event.

Infosys was trading close to Rs.1142/- per share, so he decided to go ahead with the 1140 strike (ATM).

Here is the snapshot at the time of initiating the trade –

Option Chain (Equity Derivatives) Underlying Stock: INFY 1142.60 As on Oct 08, 2015 10:36:06 IST

View Options Contracts for: Select Index OR Search for an underlying stock: GO Filter by: Expiry Date 29OCT2015 Futures contracts

CALLS												PUTS										
Chart	OI	Chng in OI	Volume	IV	LTP	Net Chng	Bid Qty	Bid Price	Ask Price	Ask Qty	Strike Price	Bid Qty	Bid Price	Ask Price	Ask Qty	Net Chng	LTP	IV	Volume	Chng in OI	OI	Chart
	-	-	-	-	-	-	1,250	273.00	-	-	760.00	-	-	-	-	-	-	-	-	-	-	
	-	-	-	-	-	-	1,250	252.50	-	-	780.00	-	-	-	-	-	-	-	-	-	-	
	3,500	-	-	-	-	-	1,500	233.00	-	-	800.00	3,250	0.05	1.95	250	-	-	-	-	-	250	
	-	-	-	-	-	-	1,500	213.00	-	-	820.00	-	-	-	-	-	-	-	-	-	-	
	-	-	-	-	-	-	1,500	193.00	-	-	840.00	-	-	-	-	-	-	-	-	-	-	
	-	-	-	-	-	-	1,500	173.00	-	-	860.00	-	-	3.00	250	-	-	-	-	-	-	
	-	-	-	-	-	-	1,500	153.50	-	-	880.00	-	-	-	-	-	-	-	-	-	-	
	-	-	-	-	-	-	1,500	233.80	243.25	1,500	900.00	1,000	2.00	3.00	2,250	-	-	-	-	-	15,250	
	-	-	-	-	-	-	1,500	214.55	223.90	1,500	920.00	3,500	1.15	4.85	3,000	-	-	-	-	-	750	
	-	-	-	-	-	-	1,500	195.80	206.30	1,500	940.00	500	2.50	4.45	3,000	-	-	-	-	-	10,000	
	5,250	-	-	-	-	-	1,500	175.55	-	-	960.00	250	3.50	3.85	1,750	-0.40	3.70	50.35	8	250	46,250	
	750	-	-	-	-	-	2,250	59.00	-	-	980.00	500	4.90	5.10	1,250	-1.30	5.10	49.11	43	2,000	28,000	
	13,500	-	-	-	-	-	2,250	142.25	-	-	1000.00	20,750	6.90	7.15	3,250	-0.95	7.15	48.75	366	6,000	228,250	
	12,500	-	-	-	-	-	2,250	124.50	-	-	1020.00	250	9.35	9.70	3,000	-1.70	9.60	48.51	93	2,000	56,000	
	2,750	-	-	-	-	-	4,500	105.50	114.45	500	1040.00	250	12.70	12.90	500	-2.30	12.95	47.66	348	28,250	233,500	
	8,500	-	-	-	-	-	5,250	91.00	99.15	3,000	1060.00	750	17.05	17.35	500	-3.35	17.00	47.59	139	-	209,500	
	7,250	250	2	41.28	87.50	11.50	4,250	80.05	85.10	5,500	1080.00	750	22.75	23.10	500	-3.75	22.85	47.59	110	6,250	90,250	
	113,750	-10,250	91	38.38	70.10	3.55	3,000	69.15	71.70	4,750	1100.00	500	29.75	30.00	2,500	-4.25	29.75	47.91	586	3,000	292,250	
	192,250	-	165	39.94	59.05	3.05	250	58.45	59.05	750	1120.00	250	37.85	38.15	750	-5.35	37.95	47.96	325	1,750	379,250	
	602,500	52,750	1,103	40.26	48.00	3.55	750	47.70	48.20	250	1140.00	2,250	46.95	47.45	250	-5.40	47.00	48.00	823	67,250	497,500	
	255,000	35,500	609	41.18	39.95	3.15	1,500	39.60	40.00	750	1160.00	2,750	58.40	59.80	250	-6.00	58.40	49.13	36	-250	121,250	
	173,750	20,250	263	41.85	33.00	2.60	250	32.50	32.80	750	1180.00	4,000	70.85	74.45	5,000	-6.35	70.50	49.29	5	-	47,000	
	1,021,250	57,500	1,170	42.88	26.90	1.65	250	26.70	26.95	750	1200.00	500	84.50	86.40	4,000	-6.00	85.00	51.66	6	-500	40,000	
	382,500	3,250	150	43.46	21.35	1.25	1,500	21.25	21.70	3,000	1220.00	4,500	94.85	105.55	1,750	-	-	-	-	-	750	
	195,750	19,750	308	43.65	16.50	0.15	750	16.60	16.80	250	1240.00	4,250	108.75	127.55	2,000	-	-	-	-	-	500	
	222,500	7,000	203	43.99	13.10	0.30	750	12.90	13.10	1,000	1260.00	-	-	-	-	-	-	-	-	-	500	
	130,750	16,000	152	44.37	10.00	-0.10	1,750	10.00	10.25	250	1280.00	2,500	144.00	-	-	-	-	-	-	-	250	
	500,250	26,250	539	44.67	7.85	-0.30	2,000	7.80	8.15	6,000	1300.00	500	68.00	167.35	500	-	-	-	-	-	11,250	
	75,000	9,000	70	45.06	6.10	-0.15	1,750	5.95	6.20	500	1320.00	1,500	178.25	190.00	1,500	-	-	-	-	-	-	
	49,750	2,000	23	45.56	5.00	0.15	750	4.60	4.85	750	1340.00	2,250	194.65	-	-	-	-	-	-	-	250	
	33,250	4,250	46	45.93	3.50	-0.50	1,500	3.55	3.70	250	1360.00	1,500	215.80	225.35	1,500	-	-	-	-	-	250	
	64,000	4,000	21	46.44	3.00	-0.30	1,500	2.65	2.85	2,250	1380.00	750	233.80	243.95	750	-	-	-	-	-	-	
Total	4,066,250																				2,309,000	Total

On 8th October around 10:35 AM the 1140 CE was trading at 48/- and the implied volatility was at 40.26%. The 1140 PE was trading at 47/- and the implied volatility was at 48%. The combined premium received was 95 per lot.

I repeated the same set of question (asked during the earlier RBI trade) and the answers received were very similar. For this reason I will skip posting the question and answer extract here.

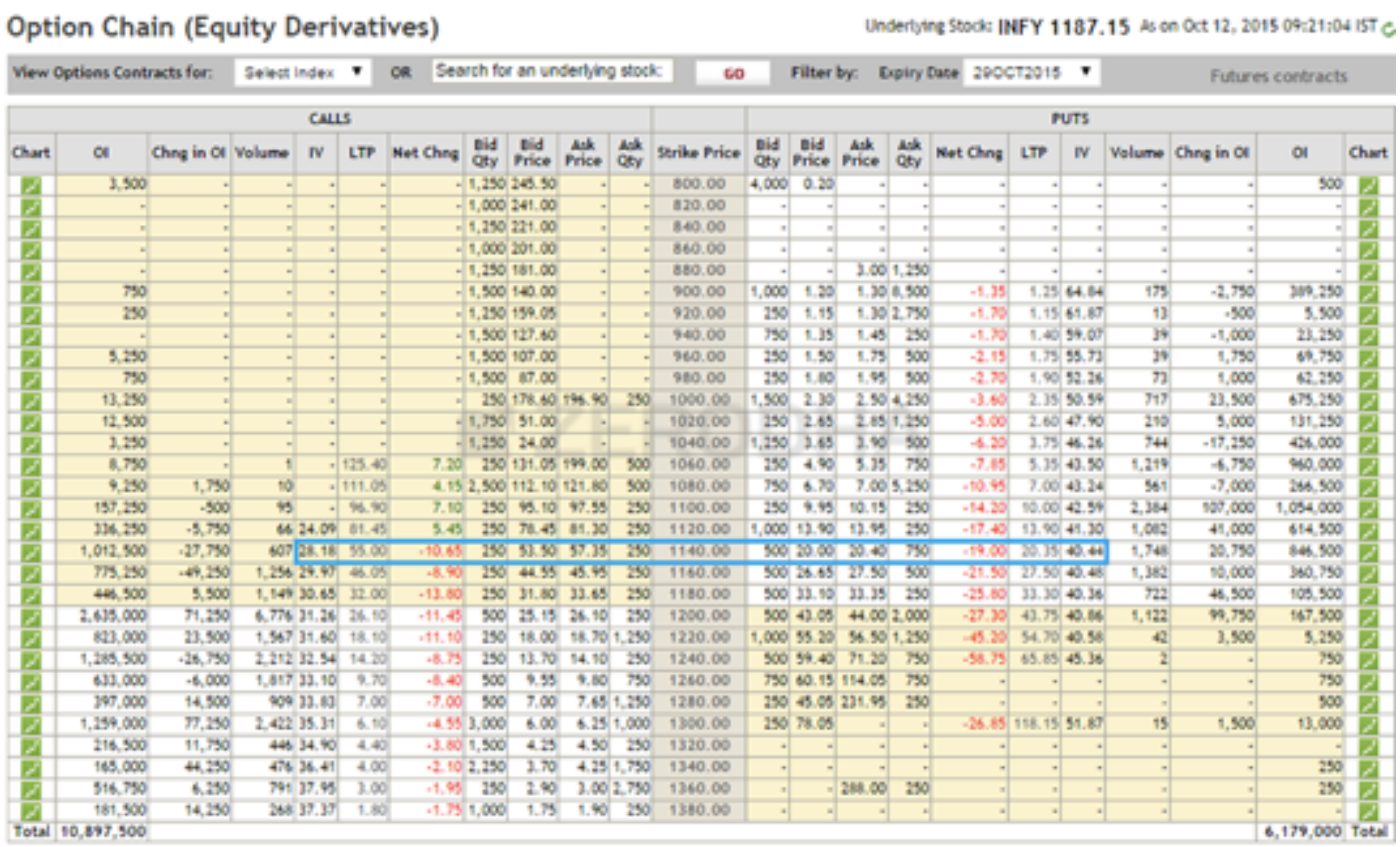
Going back to Infosys's Q2 results, the market's expectation was that Infosys would announce fairly decent set of number. In fact the numbers were better than expected, here are the details –

"For the July-September quarter, Infosys posted a net profit of $519 million, compared with $511 million in the year-ago period. Revenue jumped 8.7 % to $2.39 billion. On a sequential basis, revenue grew 6%, comfortably eclipsing market expectations of 4-4.5% growth.

In rupee terms, net profit rose 9.8% to Rs.3398 crore on revenue of Rs. 15,635 crore, which was up 17.2% from last year”. *Source: Economic Times*.

The announcement came in around 9:18 AM, 3 minutes after the market opened, and this trader did manage to close the trade around the same time.

Here is the snapshot –



Option Chain (Equity Derivatives)

Underlying Stock: INFY 1187.15 As on Oct 12, 2015 09:21:04 IST

View Options Contracts for: Select Index OR Search for an underlying stock: GO Filter by: Expiry Date 29OCT2015 Futures contracts

CALLS												PUTS										
Chart	OI	Chng in OI	Volume	IV	LTP	Net Chng	Bid Qty	Bid Price	Ask Price	Ask Qty	Strike Price	Bid Qty	Bid Price	Ask Price	Ask Qty	Net Chng	LTP	IV	Volume	Chng in OI	OI	Chart
	3,500	-	-	-	-	-	1,250	245.50	-	-	800.00	4,000	0.20	-	-	-	-	-	-	-	500	
	-	-	-	-	-	-	1,000	241.00	-	-	820.00	-	-	-	-	-	-	-	-	-	-	
	-	-	-	-	-	-	1,250	221.00	-	-	840.00	-	-	-	-	-	-	-	-	-	-	
	-	-	-	-	-	-	1,000	201.00	-	-	860.00	-	-	-	-	-	-	-	-	-	-	
	-	-	-	-	-	-	1,250	181.00	-	-	880.00	-	-	3.00	1,250	-	-	-	-	-	-	
	750	-	-	-	-	-	1,500	140.00	-	-	900.00	1,000	1.20	1.30	8,500	-1.35	1.25	64.84	175	-2,750	389,250	
	250	-	-	-	-	-	1,250	159.05	-	-	920.00	250	1.15	1.30	2,750	-1.70	1.15	61.87	13	-500	5,500	
	-	-	-	-	-	-	1,500	127.60	-	-	940.00	750	1.35	1.45	250	-1.70	1.40	59.07	39	-1,000	23,250	
	5,250	-	-	-	-	-	1,500	107.00	-	-	960.00	250	1.50	1.75	500	-2.15	1.75	55.73	39	1,750	69,750	
	750	-	-	-	-	-	1,500	87.00	-	-	980.00	250	1.80	1.95	500	-2.70	1.90	52.26	73	1,000	62,250	
	13,250	-	-	-	-	-	250	178.60	196.90	250	1000.00	1,500	2.30	2.50	4,250	-3.60	2.35	50.59	717	23,500	675,250	
	12,500	-	-	-	-	-	1,750	51.00	-	-	1020.00	250	2.65	2.85	1,250	-5.00	2.60	47.90	210	5,000	131,250	
	3,250	-	-	-	-	-	1,250	24.00	-	-	1040.00	1,250	3.65	3.90	500	-6.20	3.75	46.26	744	-17,250	426,000	
	8,750	-	1	-	125.40	7.20	250	131.05	199.00	500	1060.00	250	4.90	5.35	750	-7.85	5.35	43.50	1,219	-6,750	960,000	
	9,250	1,750	10	-	111.05	4.15	2,500	112.10	121.80	500	1080.00	750	6.70	7.00	5,250	-10.95	7.00	43.24	561	-7,000	266,500	
	157,250	-500	95	-	96.90	7.10	250	95.10	97.55	250	1100.00	250	9.95	10.15	250	-14.20	10.00	42.59	2,384	107,000	1,054,000	
	336,250	-5,750	66	24.09	81.45	5.45	250	78.45	81.30	250	1120.00	1,000	13.90	13.95	250	-17.40	13.90	41.30	1,082	41,000	614,500	
	1,012,500	-27,750	607	28.18	55.00	-10.65	250	53.50	57.35	250	1140.00	500	20.00	20.40	750	-19.00	20.35	40.44	1,748	20,750	846,500	
	775,250	-49,250	1,256	29.97	46.05	-8.90	250	44.55	45.95	250	1160.00	500	26.65	27.50	500	-21.50	27.50	40.48	1,382	10,000	360,750	
	446,500	5,500	1,149	30.65	32.00	-13.80	250	31.80	33.65	250	1180.00	500	33.10	33.35	250	-25.80	33.30	40.36	722	46,500	105,500	
	2,635,000	71,250	6,776	31.26	26.10	-11.45	500	25.15	26.10	250	1200.00	500	43.05	44.00	2,000	-27.30	43.75	40.86	1,122	99,750	167,500	
	823,000	23,500	1,567	31.60	18.10	-11.10	250	18.00	18.70	1,250	1220.00	1,000	55.20	56.50	1,250	-45.20	54.70	40.58	42	3,500	5,250	
	1,285,500	-26,750	2,212	32.54	14.20	-8.75	250	13.70	14.10	250	1240.00	500	59.40	71.20	750	-58.75	65.85	45.36	2	-	750	
	633,000	-6,000	1,817	33.10	9.70	-8.40	500	9.55	9.80	750	1260.00	750	60.15	114.05	750	-	-	-	-	-	750	
	397,000	14,500	909	33.83	7.00	-7.00	500	7.00	7.65	1,250	1280.00	250	45.05	231.95	250	-	-	-	-	-	500	
	1,259,000	77,250	2,422	35.31	6.10	-4.55	3,000	6.00	6.25	1,000	1300.00	250	78.05	-	-	-26.85	118.15	51.87	15	1,500	13,000	
	216,500	11,750	446	34.90	4.40	-3.80	1,500	4.25	4.50	250	1320.00	-	-	-	-	-	-	-	-	-	-	
	165,000	44,250	476	36.41	4.00	-2.10	2,250	3.70	4.25	1,750	1340.00	-	-	-	-	-	-	-	-	-	250	
	516,750	6,250	791	37.95	3.00	-1.95	250	2.90	3.00	2,750	1360.00	-	-	288.00	250	-	-	-	-	-	250	
	181,500	14,250	268	37.37	1.80	-1.75	1,000	1.75	1.90	250	1380.00	-	-	-	-	-	-	-	-	-	-	
Total	10,897,500																				6,179,000	Total

The 1140 CE was trading at 55/- and the implied volatility had dropped to 28%. The 1140 PE was trading at 20/- and the implied volatility had dropped to 40%.

Do pay attention to this – the speed at which the call option shot up was lesser than the speed at which the Put option dropped its value. The combined premium was 75 per lot, and he made a 20 point profit per lot.

My thoughts on this trade – I do believe this trader comes with some experience; it is quite evident with the trade’s structure. If I were to execute this trade I would probably do something very similar.

23.5 – Infosys Q2 aftermath (fundamentals based)

This trade was executed by a fellow Bangalorean. I know him personally. He comes with impressive fundamental analysis skills. He has now started experimenting with options with the intention of identifying option trading opportunities backed by his fundamental analysis skills. It would certainly be interesting to track his story going forward.

Here is the background to the trade –

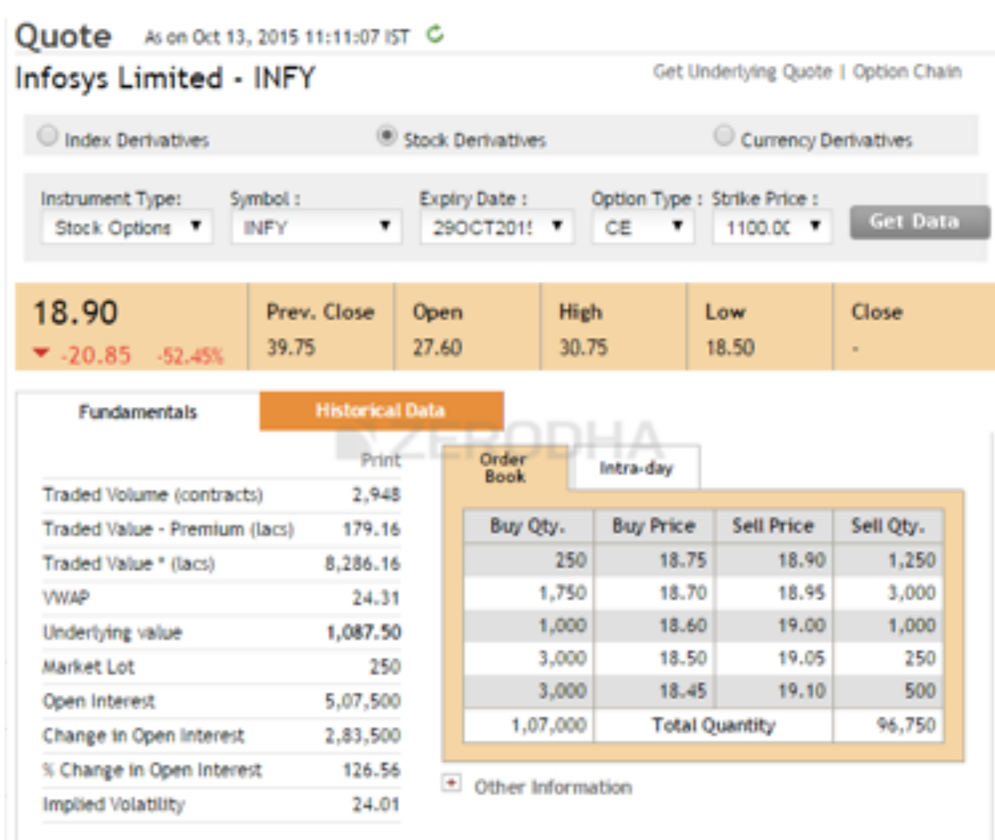
Infosys had just announced an extremely good set of numbers but the stock was down 5% or so on 12th Oct and about 1% on 13th Oct.

Upon further research, he realize that the stock was down because Infosys cut down their revenue guidance. Slashing down the revenue guidance is a very realistic assessment of business, and he believed that the market had already factored this. However the stock going down by 6% was not really the kind of reaction you would expect even after markets factoring in the news.

He believed that the market participants had clearly over reacted to guidance value, so much so that the market failed to see through the positive side of the results.

His belief – if you simultaneously present the markets good news and bad news, market always reacts to bad news first. This was exactly what was going on in Infosys.

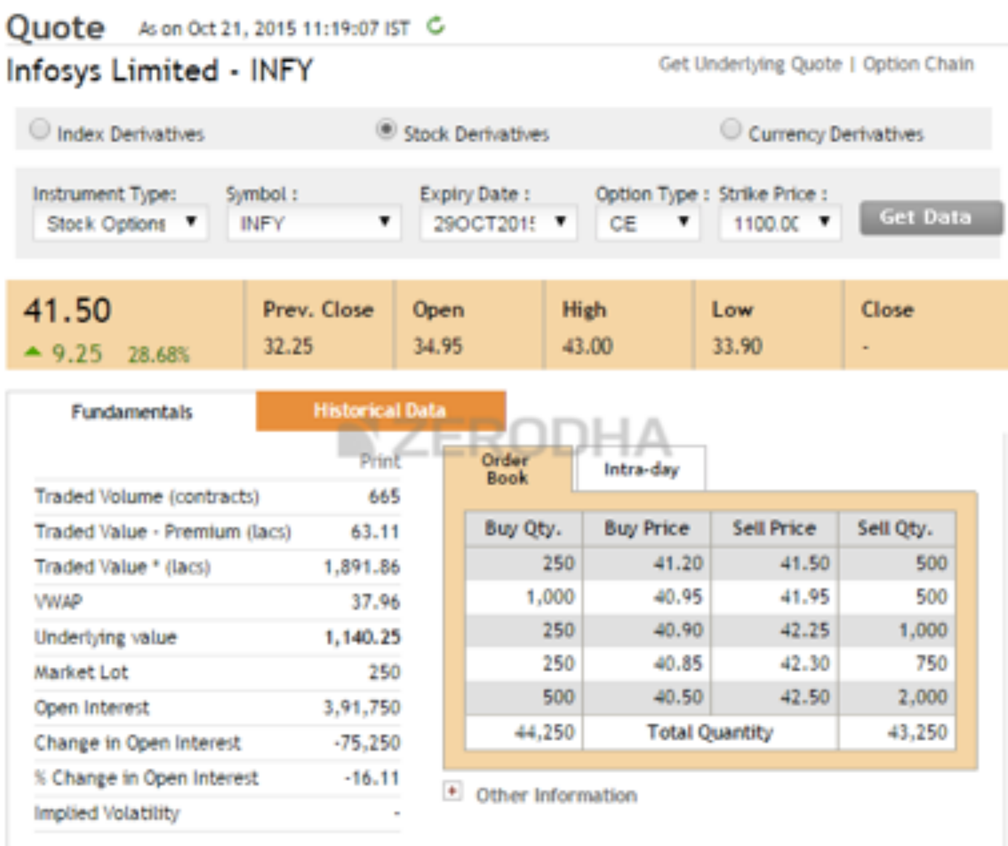
He decided to go long on a call option with an expectation that the market will eventually wake up and react to the Q2 results.



He decided to buy Infosys's 1100 CE at 18.9/- which was slightly OTM. He planned to hold the trade till the 1100 strike transforms to ITM. He was prepared to risk Rs.8.9/- on this trade, which meant that if the premium dropped to Rs.10, he would be getting out of the trade taking a loss.

After executing the trade, the stock did bounce back and he got an opportunity to close the trade on 21st Oct.

Here is the snapshot –



He more than doubled his money on this trade. Must have been a sweet trade for him

Do realize the entire logic for the trade was developed using simple understanding of financial statements, business fundamentals, and options theory.

My thoughts on this trade – Personally I would not be very uncomfortable initiating naked trades. Besides in this particular while the entry was backed by logic, the exit, and stoploss weren't. Also, since there was ample time to expiry the trader could have risked with slightly more OTM options.

And with this my friends, we are at the end of this module on Options Theory!

I hope you found this material useful and I really hope this makes a positive impact on your options trading techniques.

Good luck.