## Derivatives Trading Module



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## What are Derivatives

- Derivative is a product whose value is derived from the value of one or more basic variables, called bases (underlying asset, index, or reference rate), in a contractual manner. The underlying asset can be equity, forex, commodity or any other asset.
- For Example: Curd price is depend on Milk, Sugar price depend on Sugar cane.
- In the Indian context the Securities Contracts (Regulation) Act, 1956
- (SC(R)A) defines "derivative" to include-
- 1. A security derived from a debt instrument, share, loan whether secured or
- unsecured, risk instrument or contract for differences or any other form
- of security.
- 2. A contract which derives its value from the prices, or index of prices, of
- underlying securities.
- Derivatives are securities under the SC(R)A and hence the trading of
- derivatives is governed by the regulatory framework under the SC(R)A.


## TYPES OF DERIVATIVES



## Products in Derivatives Market

- Forwards
- It is a contractual agreement between two parties to buy/sell an underlying asset at a certain future date for a particular price that is pre-decided on the date of contract. Both the contracting parties are committed and are obliged to honour the transaction irrespective of price of the underlying asset at the time of delivery. Since forwards are negotiated between two parties, the terms and conditions of contracts are customized. These are Over-the-counter (OTC) contracts.
- Futures
- A futures contract is similar to a forward, except that the deal is made through an organized and regulated exchange rather than being negotiated directly between two parties. Indeed, we may say futures are exchange traded forward contracts.
- Options
- An Option is a contract that gives the right, but not an obligation, to buy or sell the underlying on or before a stated date and at a stated price. While buyer of option pays
- the premium and buys the right, writer/seller of option receives the premium with obligation to sell/ buy the underlying asset, if the buyer exercises his right.
- Swaps
- A swap is an agreement made between two parties to exchange cash flows in the future according to a prearranged formula. Swaps are, broadly speaking, series of forward contré Swaps help market participants manage risk associated with volatile interest rates, currency exchange rates and commodity prices.


## Difference between Equity \& Derivatives

## Equity

- You need just $10 \%$ money to trade.
- You are hiring the stock.
- You have to settle within time limit given.
- Brokerage would be same.
- You are not liable to get dividend.
- You have to buy lot not a single share.
- You can buy a single share also if want to buy.


## Difference between Future \& Forward

Future

- Buyer \& Seller don't know each others.
- Contract are standardised.
- MTM settled on daily basis.
- No third party risk due to exchange availability.
- Expiry date is decided in advance and will not change
- Only cash settled in mostly cash.
- Legal existence is there.
- Buyer \& Seller know each others.
- Contract are customised.
- No need for MTM.
- Third risk is high because no one is intermediate.
- Expiry date is decided by mutual consent.
- Physical settlement in mostly cases.
- No legal existence.


## WHAT ARE FORWARDS \& FUTURES?

- Forward Contract

- Future Contract



## Market Participants

## - Hedgers

- They face risk associated with the prices of underlying assets and use derivatives to reduce their risk. Corporations, investing institutions and banks all use derivative products to hedge or reduce their exposures to market variables such as interest rates, share values, bond prices, currency exchange rates and commodity prices.
- Speculators/Traders
- They try to predict the future movements in prices of underlying assets and based on the view, take positions in derivative contracts. Derivatives are preferred over underlying asset for trading purpose, as they offer leverage, are less expensive (cost of transaction is generally lower than that of the underlying) and are faster to execute in size (high volumes market).
- Arbitrageurs
- Arbitrage is a deal that produces profit by exploiting a price difference in a product in two different markets. Arbitrage originates when a trader purchases an asset cheaply in one location and simultaneously arranges to sell it at a higher. price in another location. Such opportunities are unlikely to persist for very lon§; since arbitrageurs would rush in to these transactions, thus closing the price gav at different locations.


## Understanding of Index

## - What is Index :

Index is the barometer of the market. It reflect the change in the market. A good index must be well diversified so that it can represent the market. In India the most popularindices have been the BSE Sensex and S\&P CNX Nifty. The BSE Sensex has 30 stocks comprising the index which are selected based on market capitalization, industry representation, trading frequency etc. It represents 30 large well-established and financially sound companies.

- The Nifty index consists of shares of 50 companies with each having a market capitalization of more than Rs 500 crore.
- Major Indices in India:

1. SENSEX
2. NIFTY
3. BANK NIFTY
4. VIX
5. CNXIT

## Equity market



## Current level : 8934

No. of listed co : 1850
Timing : 9:00 am to 3.30 pm
Duration : Mondayto Friday
PE Ratio
: 21.53
(10/03/2017)
Market cap : 60 T
52 week H / L : 8992: 7405
Website : www.nseindia.com

## Nifty / Fifty

## Nifty 50 Companies - Sectorwise Weightage (\%)



## List of Nifty / Fifty

| Company Name | Industry |
| :--- | :--- |
| ABB India Ltd. | INDUSTRIAL |
| MANUFACTURING |  |
| Apollo Hospitals Enterprises Ltd. | HEALTHCARE SERVICES |
| Ashok Leyland Ltd. | AUTOMOBILE |
| Bajaj Finance Ltd. | FINANCIAL SERVICES |
| Bajaj Finserv Ltd. | FINANCIAL SERVICES |
| Bharat Electronics Ltd. | MANUFACTURING |
| Bharat Forge Ltd. | INDUSTRIAL |
| MANUFACTURING |  |
| Britannia Industries Ltd. | CONSUMER GOODS |
| Cadila Healthcare Ltd. | PHARMA |
| Castrol India Ltd. | ENERGY |
| Colgate Palmolive (India) Ltd. | CONSUMER GOODS |
| Container Corporation of India Ltd. | SERVICES |
| Cummins India Ltd. | INDUSTRIAL |
| DLF Ltd. | MANUFACTURING |
| Dabur India Ltd. | CONSTRUCTION |
| Divi's Laboratories Ltd. | PHARMA |
| Emami Ltd. | CONSUMER GOODS |
| GlaxoSmithkline Consumer Healthcare Ltd. | CONSUMER GOODS |
| Glaxosmithkline Pharmaceuticals Ltd. | PHARMA |
| Glenmark Pharmaceuticals Ltd. | PHARMA |
| Godrej Consumer Products Ltd. | CONSUMER GOODS |
| Havells India Ltd. | CONSUMER GOODS |
| Hindustan Petroleum Corporation Ltd. | ENERGY |
| Hindustan Zinc Ltd. | METALS |


|  | Way to Financial Abundance |
| :---: | :---: |
| Indiabulls Housing Finance Ltd. | FINANCIAL SERVICES |
| Indian Oil Corporation Ltd. | ENERGY |
| InterGlobe Aviation Ltd. | SERVICES |
| JSW Steel Ltd. | METALS |
| LIC Housing Finance Ltd. | FINANCIAL SERVICES |
| Marico Ltd. | CONSUMER GOODS |
| Motherson Sumi Systems Ltd. | AUTOMOBILE |
| NHPC Ltd. | ENERGY |
| NMDC Ltd. | METALS |
| Oil India Ltd. | ENERGY |
| Oracle Financial Services Software Ltd. | $1 T$ |
| Pidilite Industries Ltd. | CHEMICALS |
| Piramal Enterprises Ltd. | PHARMA |
| Power Finance Corporation Ltd. | FINANCIAL SERVICES |
| Procter \& Gamble Hygiene \& Health Care Ltd. | CONSUMER GOODS |
| Punjab National Bank | FINANCIAL SERVICES |
| Shree Cement Ltd. | CEMENT \& CEMENT PRODUCTS |
| Shriram Transport Finance Co. Ltd. | FINANCIAL SERVICES |
| Siemens Ltd. | INDUSTRIAL MANUFACTURING |
| Steel Authority of India Ltd. | METALS |
| Titan Company Ltd. | CONSUMER GOODS |
| Torrent Pharmaceuticals Ltd. | PHARMA |
| UPL Ltd. | FERTILISERS \& PESTICIDE ${ }^{\text {c }}$ ? |
| United Breweries Ltd. | CONSUMER GOODS - is |
| United Spirits Ltd. | CONSUMER GOOds ${ }^{\text {c }}$ |
| Vedanta Ltd. | METALS <br> BEST STOCK MARKET SCHOOL |

List of Nifty / Fifty

| Sr.no. | Company Name | Industry | Symbol |
| :---: | :---: | :---: | :---: |
| 1 | ACC Ltd. | CEMENT \& CEMENT PRODUCTS | ACC |
| 2 | Adani Ports and Special Economic Zone Ltd. | SERVICES | ADANIPORTS |
| 3 | Ambuja Cements Ltd. | CEMENT \& CEMENT PRODUCTS | AMBUJACEM |
| 4 | Asian Paints Ltd. | CONSUMER GOODS | ASIANPAINT |
| 5 | Aurobindo Pharma Ltd. | PHARMA | AUROPHARMA |
| 6 | Axis Bank Ltd. | FINANCIAL SERVICES | AXISBANK |
| 7 | Bajaj Auto Ltd. | AUTOMOBILE | BAJAJ-AUTO |
| 8 | Bank of Baroda | FINANCIAL SERVICES | BANKBARODA |
| 9 | Bharat Heavy Electricals Ltd. | INDUSTRIAL MANUFACTURING | BHEL |
| 10 | Bharat Petroleum Corporation Ltd. | ENERGY | BPCL |
| 11 | Bharti Airtel Ltd. | TELECOM | BHARTIARTL |
| 12 | Bharti Infratel Ltd. | TELECOM | INFRATEL |
| 13 | Bosch Ltd. | AUTOMOBILE | BOSCHLTD |
| 14 | Cipla Ltd. | PHARMA | CIPLA |
| 15 | Coal India Ltd. | METALS | COALINDIA |
| 16 | Dr. Reddy's Laboratories Ltd. | PHARMA | DRREDDY |
| 17 | Eicher Motors Ltd. | AUTOMOBILE | EICHERMOT |
| 18 | GAIL (India) Ltd. | ENERGY | GAIL |
| 19 | Grasim Industries Ltd. | CEMENT \& CEMENT PRODUCTS | GRASIM |
| 20 | HCL Technologies Ltd. | IT | HCLTECH |
| 21 | HDFC Bank Ltd. | FINANCIAL SERVICES | HDFCBANK |
| 22 | Hero MotoCorp Ltd. | AUTOMOBILE | HEROMOTOCO |
| 23 | Hindalco Industries Ltd. | METALS | HINDALCO |
| 24 | Hindustan Unilever Ltd. | CONSUMER GOODS | HINDUNILVR |
|  | Housing Development Finance |  |  |

## List of Nifty / Fifty

| 261 T C Ltd. | CONSUMER GOODS | ITC |
| :---: | :---: | :---: |
| 27 ICICI Bank Ltd. | FINANCIAL SERVICES | ICICIBANK |
| 28 Idea Cellular Ltd. | TELECOM | IDEA |
| 29 IndusInd Bank Ltd. | FINANCIAL SERVICES | INDUSINDBK |
| 30 Infosys Ltd. | IT | INFY |
| 31 Kotak Mahindra Bank Ltd. | FINANCIAL SERVICES | KOTAKBANK |
| 32 Larsen \& Toubro Ltd. | CONSTRUCTION | LT |
| 33 Lupin Ltd. | PHARMA | LUPIN |
| 34 Mahindra \& Mahindra Ltd. | AUTOMOBILE | M\&M |
| 35 Maruti Suzuki India Ltd. | AUTOMOBILE | MARUTI |
| 36 NTPC Ltd. | ENERGY | NTPC |
| 37 Oil \& Natural Gas Corporation Ltd. | ENERGY | ONGC |
| Power Grid Corporation of India 38 Ltd. | ENERGY | POWERGRID |
| 39 Reliance Industries Ltd. | ENERGY | RELIANCE |
| 40 State Bank of India | FINANCIAL SERVICES | SBIN |
| 41 Sun Pharmaceutical Industries Ltd. | PHARMA | SUNPHARMA |
| 42 Tata Consultancy Services Ltd. | IT | TCS |
| 43 Tata Motors Ltd DVR | AUTOMOBILE | TATAMTRDVR |
| 44 Tata Motors Ltd. | AUTOMOBILE | TATAMOTORS |
| 45 Tata Power Co. Ltd. | ENERGY | TATAPOWER |
| 46 Tata Steel Ltd. | METALS | TATASTEEL |
| 47 Tech Mahindra Ltd. | IT | TECHM |
| 48 UltraTech Cement Ltd. | CEMENT \& CEMENT PRODUCTS | ULTRACEMCO |
| 49 Wipro Ltd. | IT | WIPRO |
| 50 Yes Bank Ltd. | FINANCIAL SERVICES | YESBANK |

## Weightage (\%)



## Equity market

## Bombay Stock Exchange Limited <br>  <br> The edge is efficiency

Current level : 28946
No. of listed co : 5400
Timing : 9:00 am to 3.30 pm
Duration
PE Ratio
: Mondayto Friday
: $20.52 \quad(10 / 03 / 2017)$
Market cap : 48 T
52 Week H/L : 24354/29145
Website : www.bseindia.com

## How Index Calculated

- Index can be calculated by :

Current Market Capitalization

## Base Value

 Base Market Capitalization
## Classification of Derivatives

1. Future Contract :
(i) Index Future : Nifty \& Bank Nifty
(ii) Stock Future : Any Individual Stock Future : Tata Steel
2. Option Contract :
(i) Index Options: Nifty \& Bank Nifty (Most Popular )
(ii) (i) Call Option : Right to buy ( For Bullish Market)
(iii) (ii) Put Option : Right to Sell ( For Bearish Market )
(iv) Stock Options: Any particular stock call \& Put options

## Future contract

Futures markets were innovated to overcome the limitations of forwards. A futures contract is an agreement made through an organized exchange to buy or sell a fixed amount of a commodity or a financial asset on a future date at an agreed price. Simply, futures are standardised forward contracts that are traded on an exchange. The clearing house associated with the exchange guarantees settlement of these trades. A trader, who buys futures contract, takes a long position and the one, who sells futures, takes a short position. The words buy and sell are figurative only because no money or underlying asset changes hand, between buyer and seller, when the deal is signed.

Future contract are traded worldwide due to its characteristic and popular among investors, Traders.
Before trading in to the future contract we have to understand terminology of the future contract with suitable examples.

## Terminology of the Future contract

| Sr | Name | Explanation / Description |
| :--- | :--- | :--- |
| $\mathbf{1}$ | Spot <br> price | The price at which an asset trades in the spot market. |
| $\mathbf{2}$ | Futures <br> price | The price at which the futures contract trades in the <br> futures market. |
| $\mathbf{3}$ | Contrac <br> t cycle | It is a period over which a contract trades. The maximum number of <br> index futures contracts is of 3 months contract cycle- the near month <br> (September 2016), the next month (October 2016) and the far month <br> (November 2016). Every futures contract expires on last Thursday. |
| $\mathbf{4}$ | Expiry <br> date | The day on which a derivative contract ceases to exist. It is last <br> trading <br> day of the contract. The expiry date in the quadane <br> 24, 2015. It is the last Thursday of the expiry month. If the last <br> Thursday is a trading holiday, the contracts expire on the previous <br> trading day. On expiry date, all the contracts are compulsorily settled. |


| 5. | Tick Size | It is minimum move allowed in the price quotations. Exchange decide the tick sizes on traded contracts as part of contract specification. Tick size for Nifty futures is 5 paisa. Bid price is the price buyer is willing to pay and ask price is the price seller is willing to sell. |
| :---: | :---: | :---: |
| 6. | Basis | The difference between the spot price and the futures price is called basis. |
| 7. | Cost of Carry | Cost of Carry is the relationship between futures prices and spot prices. It measures the storage cost (in commodity markets) plus the interest that is paid to finance or 'carry' the asset till delivery less the income earned on the asset during the holding period. |
| 8. | Contract Size and contract value | Futures contracts are traded in lots and to arrive at the contract value we have to multiply the price with contract multiplier or lot size or contract size. |
| 9. | Margin <br> Account | As exchange guarantees the settlement of all the trades, to protect itself against default by either counterparty, it charges various margins from brokers. Brokers in turn charge margins from their customers. |

## Terminology...............

| 10. | Initial Margin | The amount one needs to deposit in the margin account <br> at the time of entering a <br> futures contract is known as the initial margin. |
| :--- | :--- | :--- |
| 11. | Marking to Market <br> (MTM) | In futures market, while contracts have maturity of <br> several months, profits and losses <br> are settled on day-to-day basis - called mark to market <br> (MTM) settlement. |
| 12. | Open Interest and <br> Volumes Traded | An open interest is the total number of contracts <br> outstanding (yet to be settled) for an underlying asset, <br> Volumes traded give us an idea about the market activity <br> with regards to specific contract over a given period - <br> volume over a day, over a week or month or over entire <br> life of the contract. |
| 13. | Price Band | No price band applicable for derivatives securities, just <br> circuit breakers apply as per exchange norms. |

## Index Future Example

| 1 | Instrument type | Future Index | wayvo finacald bimmance |
| :---: | :---: | :---: | :---: |
| 2 | Underlying asset | Nifty |  |
| 3 | Expiry date | 30th March 2017 |  |
| 4 | CMP | 9088 ( as on 14/03/2017) |  |
| 5 | Lot Size | 75 |  |
| 6 | Total Turnover | 9088*75 = 681600 rupees |  |
| 7 | Margin require | 68000 (10\% Approx.) |  |
| 8 | Tick Size | 5 paisa |  |
| 9 | Contract Cycle | Near - March, Next - April, Far - May |  |
| 10 | Open | 9145 |  |
| 11 | High | 9158 |  |
| 12 | Low | 9077 |  |
| 13 | Closing | 9103 |  |
| 14 | Open Interest | 13.24\% |  |

## Stock Future Example

| 1 | Instrument type | Future Stock | wayo finamald bumanare |
| :---: | :---: | :---: | :---: |
| 2 | Underlying asset | ZEEL |  |
| 3 | Expiry date | 30th March 2017 |  |
| 4 | CMP | 525 |  |
| 5 | Lot Size | 1300 |  |
| 6 | Total Turnover | 1300*525 = 682500 |  |
| 7 | Margin require | 51000 -/ Approx (10\% ) |  |
| 8 | Tick Size | 5 paisa |  |
| 9 | Contract Cycle | Near - March, Next - April, Far - May |  |
| 10 | Open | 520 |  |
| 11 | High | 527 |  |
| 12 | Low | 520 |  |
| 13 | Closing | 523.3 |  |
| 14 | Open Interest | 0.57 \% |  |

## FUTURES PRICING

## Example - Tata Cosuntancy

- Future Price 2350 = 2338 (Cash market Price) $\mathbf{+ 1 2 \text { (Premium) }}$
- Future Price $2350=2365$ (Cash market Price) $\mathbf{+ 1 5}$ (Discount)




## Settlement / Pay off

- Pay off charts for futures
- In case of futures contracts, long as well as short position has unlimited profit or loss potential. This results into linear pay offs for futures contracts. Futures pay offs are explained in detail below:
- Pay off for buyer of futures: Long futures

Let us say a person goes long in a futures contract at Rs.100. This means that he has agreed to buy the underlying at Rs. 100 on expiry. Now, if on expiry, the price of the underlying is Rs. 150, then this person will buy at Rs. 100, as per the futures contract and will immediately be able to sell the underlying in the cash market at Rs.150, thereby making a profit of Rs. 50. Similarly, if the price of the underlying falls to Rs. 70 at expiry, he would have to buy at Rs. 100, as per the futures contract, and if he sells the same in the cash market, he would receive only Rs. 70, translating into a loss of Rs. 30.

- Short Futures pay off

As one person goes long, some other person has to go short, otherwise a deal will not take place. The profits and losses for the short futures position will be exactly opposite of the long futures position. This is shown in the below table and chart:

## Long Future @ 100

Short Future @ 100

| Market price at expiry | Long Futures Pay off | Market price at expiry | Long Futures Pay off |
| :---: | :---: | :---: | :---: |
| 50 | -50 | 50 | 50 |
| 60 | -40 | 60 | 40 |
| 70 | -30 | 70 | 30 |
| 80 | -20 | 80 | 20 |
| 90 | -10 | 90 | 10 |
| 100 | 0 | 100 | 0 |
| 110 | 10 | 110 | -10 |
| 120 | 20 | 120 | -20 |
| 130 | 30 | 130 | -30 |
| 140 | 40 | 140 | -40 |
| 150 | 50 | 150 | -50 |
| 160 | 60 | 160 | -60 |




## Options

- An Option is a contract that gives the right, but not an obligation, to buy or sell the underlying asset on or before a stated date/day, at a stated price, for a price. The party taking a long position i.e. buying the option is called buyer/ holder of the option and the party taking a short position i.e. selling the option is called the seller/ writer of the option. The option buyer has the right but no obligation with regards to buying or selling the underlying asset, while the option writer has the obligation in the contract. Therefore, option buyer/holder will exercise his option only when the situation is favourable to him, but, when he decides to exercise, option writer would be legally bound to honour the contract.
- Options may be categorized into two main types:-
- 回Call Options
- @ Put Options
- Option, which gives buyer a right to buy the underlying asset, is called Call option
- the option which gives buyer a right to sell the underlying asset, is called Put option.


## Options

Options are the contracts that give the buyers the right, but not the obligation, to buy or sell a specified underlying at a set price on or before a specified date.


## Why Options ??

- Investment - Options can be used to protect existing positions.
- Attractive return - Make large profits on the back of a small capital outlay.
- Limited risk - Buying option is like buying protection against downside.
- Less price and high volatility - Volatility in option market is quite high making handsome returns possible .
- Operational in all market scenarios - Options can be traded in both trending as well as ranging market.
- Higher Leverage in Options

While trading in Intraday Cash, we need 25\% margin of the turnover.
For Equity Future segment we need 10\% margin of the turnover.
For Option segment we need 2\% (approx. for buying) margin of the turnover.
Thus Option gives you opportunity to trade higher with little money.
Margin required in Commodity \& Currency segment is around 6 to $8 \%$.

## Moneyness of an Option

| Call Option | Moneyness | Put Option |
| :--- | :--- | :--- |
| Strike Price $<$ Spot Price | In The Money | Strike Price $>$ Spot Price |
| Strike Price $=$ Spot Price | At The Money | Strike Price $=$ Spot Price |
| Strike Price $>$ Spot Price | Out of the Money | Strike Price < Spot Price |

## Duration of an Option

In India, options can be traded for 3 months:

1. Near Month

January (current on-going month)
2. Next Month

February (next month)
3. Far Month

March (next to next month)

## (

## Option Terminology

| 1 | Index options | These options have the index as the underlying. Like : <br> Nifty, Bank Nifty |
| :--- | :--- | :--- |
| $\mathbf{2}$ | Stock options | Stock options are options on individual stocks. |
| $\mathbf{3}$ | Buyer of an option | The buyer of an option is the one who by paying the <br> option premium buys the right but not the obligation <br> to exercise his option on the seller/writer. |
| $\mathbf{4}$ | Writer of an option | The writer of a call/put option is the one who <br> receives <br> the option premium and is thereby obliged to <br> sell/buy the asset if the buyer exercises on him. |
| $\mathbf{5}$ | Call option | A call option gives the holder the right but not the <br> obligation to buy an asset by a certain date for a <br> certain price. |
| $\mathbf{6}$ | Put option | A put option gives the holder the right but not the <br> obligation to sell an asset by a certain date for a <br> certain price |
| 7 | Option price/premium | Option price is the price which the option buyer <br> pays to the option seller. It is also referred to as the <br> option premium |

## Option Terminology

| 8 | Expiration date | The date specified in the options contract is known as the expiration date, the exercise date, the strike date or the maturity |
| :---: | :---: | :---: |
| 9 | Strike price | The price specified in the options contract is known as the strike price or the exercise price. |
| 10 | American options: | American options are options that can be exercised at any time up to the expiration date. Most exchange-traded options are American. |
| 11 | European options | European options are options that can be exercised only on the expiration date itself. |
| 12 | In-the-money option | A call option on the index is said to be in-the-money when the current index stands at a level higher than the strike price (i.e. spot price > strike price). |
| 13 | At-the-money option | An at-the-money (ATM) option is an option that would lead to zero cash flow if it were exercised immediately. An option on the index is at-the-money when the current index equals the strike price (i.e. spot price = strike price). |
| 14 | Out-of-themoney option: | An out-of-the-money (OTM) option is an option that wourk lead to a negative cash flow. A call option on the index is out-of-the-money when the current index stands at a level |

## Option Terminology

| 15 | Intrinsic value of an option | The option premium can be broken down into two components - intrinsic value and time value. The intrinsic value of a call is the amount the option is ITM, if it is ITM. If the call is OTM, its intrinsic value is zero. Putting it another way, the intrinsic value of a call is Max[0, $(S t-K)]$ which means the intrinsic value of a call is the greater of 0 or ( $S t-K$ ). Similarly, the intrinsic value of a put is $\operatorname{Max}[0, K-S t]$, i.e. the greater of 0 or ( $K-S t$ ). $K$ is the strike price and $S t$ is the spot price. |
| :---: | :---: | :---: |
| 16 | Time value of an option | The time value of an option is the difference between its premium and its intrinsic value |
| 17 | Exercise | When we exchange settle the ITM options on expiry of the contract rather than you |
| 18 | Square off | When you oneself clear the position before the expiry |
| 19 | Lot Size | It would be same as in the Future contract Like for Nifty it is : 75 |
| 20 | Strike Price | Target price of the buyer or seller of the option |
| 21 | Interval | Difference between Strike price called interval, it will depens on the price of the underlying securities |
| 22 | Open Interest | Open interest is the total number of option contracts outstanding for an underlying asset. |

## Index Options

| 1 | Instrument type | Index Option |
| :--- | :--- | :--- |
| 2 | Underlying asset | Nifty |
| 3 | Expiry date | $30^{\text {th }}$ March 2017 |
| 4 | CMP (Supot) | 9088 ( as on 14/03/2017) |
| 5 | Strike Prich andanane |  |
| 6 | Option Type | 9400 |
| 7 | Premium / CMP | Call Options |
| 8 | Options Category | Out of the Mon have to pay 75*80 = 6000-/ (OTM) |
| 9 | Contract Cycle | Near - March, Next - April, Far - May |
| 10 | Open | 111.90 |
| 11 | High | 119.70 |
| 12 | Low | 73 |
| 13 | Closing | 84 |
| 14 | Open Interest | $-8.42 \%$ |

Stock Options

| 1 | Instrument type | Stock Option | wyy vfinamad bowneance |
| :---: | :---: | :---: | :---: |
| 2 | Underlying asset | Asian Paint |  |
| 3 | Expiry date | 30th March 2017 |  |
| 4 | CMP (Supot) | 1070 ( as on 14/03/2017) |  |
| 5 | Strike Price | 1100 |  |
| 6 | Option Type | Call Options |  |
| 7 | Premium / CMP | 8 -/ Rs. pay : Lot size* Premium ( $600 * 8=4800-/$ |  |
| 8 | Options Category | Out of the Money Call (OTM) |  |
| 9 | Contract Cycle | Near - March, Next - April, Far - May |  |
| 10 | Open | 111.90 |  |
| 11 | High | 119.70 |  |
| 12 | Low | 73 |  |
| 13 | Closing | 84 |  |
| 14 | Open Interest | -8.42\% |  |

## Difference between Future \& Option

## Future

Option

| $\mathbf{1}$ | Unlimited profit and Loss |
| :--- | :--- |
| $\mathbf{2}$ | Token money called Span Margin |
| $\mathbf{3}$ | You Have to maintain MTM daily |
| $\mathbf{4}$ | The max loss can not be counted |
| $\mathbf{5}$ | Can be bet only two side either <br> buying / selling |
| $\mathbf{6}$ | Time value does not effect the price |
| $\mathbf{7}$ |  <br> seller |
| $\mathbf{8}$ | Brokerage is depend on the <br> turnover basis (Lot size) |
| $\mathbf{9}$ | Seller no need to arrange more <br> fund |
| $\mathbf{1 0}$ | Price depend on underlying assets <br> only |
| $\mathbf{1 1}$ |  |


| 1 | Unlimited profit and Itd loss |
| :--- | :--- |
| 2 | Token money called Premium |
| 3 | No need to maintain any MTM |
| 4 | The max loss can be counted first |
| 5 | Can be bet on multiple strike price <br> available for the contract |
| 6 | Time value effect the price |
| 7 | Settlement is different for buyer <br> and seller |
| 8 | Brokerage is depend on the number <br> of the lot you buy / sell |
| 9 | Writer / seller required to pay extra |
| 10 |  <br> underlying assets both |
| 11 | Tax implication is different for <br> buyer \& Seller |

## Option Pay off

－Long on option
－Buyer of an option is said to be＂long on option＂．As described above，he／she would
－have a right and no obligation with regard to buying／selling the underlying asset in the
－contract．When you are long on equity option contract：

- 回 You have the right to exercise that option．
- 回 Your potential loss is limited to the premium amount you paid for buying theoption．
- 回 Profit would depend on the level of underlying asset price at the time of exercise／expiry of the contract．
－Short on option
－Seller of an option is said to be＂short on option＂．As described above，he／she would
－have obligation but no right with regard to selling／buying the underlying asset in the
－contract．When you are short（i．e．，the writer of）an equity option contract：
- 回 Your maximum profit is the premium received．
- 回 You can be assigned an exercised option any time during the life of option
－contract（for American Options only）．All option writers should be aware that
－assignment is a distinct possibility．
－回 Your potential loss is theoretically unlimited as defined below．


## Profit and Loss for the Long Call (Buyer of a Call) Option



## Profit and Loss for the Short Call (Writer of a Call) Option

## Profit and Loss for the Long Put (Buyer of a Put) Option



## Profit and Loss for the Short Put (Writer of a Put) Option



## Long Call

|  | Current Nifty index |  |
| :--- | :--- | :--- |
|  | Strike Price (Rs.) | 9200 |
| Call Option | Premium (Rs.) | 40 |
| Mr. XYZ Pays francala dumbandare |  |  |
|  | Break Even Point (Rs.) (Strike Price <br> + Premium give | 9240 |

The payoff schedule

| On expiry 30th March Nifty closes at | Net Payoff from Call Option (Rs.) |
| :--- | :--- |
| 9000 | -40 |
| 9100 | -40 |
| 9200 | -40 |
| 9240 | 0 |
| 9300 | 60 |
| 9400 | 160 |
| 9500 | 260 |
|  |  |

## Short Call

|  | Current Nifty index |  |
| :--- | :--- | :--- |
|  | Strike Price (Rs.) | 9200 |
| Put Option | Premium (Rs.) | 40 |
| Mr. XYZ Pacad Abumanamee |  |  |

The payoff schedule

| On expiry 30th March Nifty closes at | Net Payoff from Call Option (Rs.) |
| :--- | :--- |
| 9000 | 40 |
| 9100 | 40 |
| 9200 | 40 |
| 9240 | 0 |
| 9300 | -60 |
| 9400 | -160 |
| 9500 | -260 |
|  |  |

## Long Put

|  | Current Nifty index |  |
| :--- | :--- | :--- |
|  | Strike Price (Rs.) | 9000 |
| Call Option | Premium (Rs.) | 20 |
| Mr. XYZ Pamanala dbumaname |  |  |

The payoff schedule

| On expiry 30th March Nifty closes at | Net Payoff from Call Option (Rs.) |
| :--- | :--- |
| 9200 | -20 |
| 9100 | -20 |
| 9000 | -20 |
| 8980 | 0 |
| 8900 | 80 |
| 8800 | 180 |
| 8700 | 280 |
|  |  |

## Short Put

|  | Current Nifty index |  |
| :--- | :--- | :--- |
|  | Strike Price (Rs.) | 9000 |
| Call Option | Premium (Rs.) | 20 |
| Mr. XYZ Pays francala dumbandere |  |  |
|  | Break Even Point (Rs.) (Strike Price <br> - Premium Received | 8980 |

The payoff schedule

| On expiry 30th March Nifty closes at | Net Payoff from Call Option (Rs.) |
| :--- | :--- |
| 9200 | 20 |
| 9100 | 20 |
| 9000 | 20 |
| 8980 | 0 |
| 8900 | -80 |
| 8800 | -180 |
| 8700 | -280 |
|  |  |

## When to trade What..?

## An Option trader can take 4 views on the market

## Bullish

- When one is expecting the market to move up, he can buy Calls or sell Puts.
- Eg: If Nifty is at 8700 , buy 8700 Call or Sell 8700 Put.

Bearish

- When one is expecting the market to move down, he can buy Puts or sell Calls.
- Eg: If market is at 8700 , buy 8700 Put or Sell 8700 Call.


## Expecting a movement in any direction

- Before an event which is likely to create huge volatility in the markets, eg: Elections, Results , etc. , one can use strategies like Buy Call \& Buy Put
- Eg: If market is at 8700, buy 8700 Call and buy 8700 Put.
- After an event, when the market is likely to consolidate in a narrow range, one can use strategies like sell Call and sell Put of different strikes.
- Eg: If market is at 8700 , sell 8000 Call and Sell 8400 Put


## Precautions while using options

Always maintain strict stop loss.
Never do averaging of losing position.
As the option nears the expiry, the value of the option reduces due to time decay.
While executing a strategy, understand the combination of options and the risks involved.
Initiation of a strategy is very important. Eg: A long call and long put strategy should be initiated when both premiums are almost equal.
Keeping a stop loss order on a strategy can be difficult, hence keep a watch on the profit/loss of the strategy.
Selling of options would require initial and exposure margin.
Losses are limited in buying of options in comparison to selling of options.
Always prefer to take view in option's closer to market price (At the money option is better than out of the money).

## ANALYZING FUTURES \& OPTIONS

Futures can be analyzed using following -

- Price movement
- Open Interest
- Cost of Carry
- Technical tools and study

Open Interest

- Open Interest is the total number of outstanding contracts that are held by market participants at the end of the day.
-Options can be analyzed using following -
- Price (Spot \& Strike)
- Open Interest
- Implied Volatility
- Time Value
- Greeks
- Technical Tools


## Others IMP term

- Option Greeks:

Option premiums change with changes in the factors that determine option pricing i.e. factors such as strike price, volatility, term to maturity etc. The sensitivities most commonly tracked in the market are known collectively as "Greeks" represented by Delta, Gamma, Theta, Vega and Rho.

- Delta ( $\delta$ or $\Delta$ )

The most important of the 'Greeks' is the option's "Delta". This measures the sensitivity of the option value to a given small change in the price of the underlying asset. It may also be seen as the speed with which an option moves with respect to price of the underlying asset. Delta = Change in option premium/ Unit change in price of the underlying asset. Delta for call option buyer is positive. This means that the value of the contract increases as the share price rises. To that extent it is rather like a long or 'bull' position in the underlying asset. Delta for call option seller will be same in magnitude but with the opposite sign (negative). Delta for put option buyer is negative. The value of the contract increases as the share price falls. This is similar to a short or 'bear' position in the underlying asset. Delta for put option seller will be same in magnitude but with the opposite sign (positive). Therefore, delta is the degree to which an option price will move given a change in the underlying stock or index price, all else being equal.

## Others IMP term Option

- Gamma (Y):
- It measures change in delta with respect to change in price of the underlying asset. This is called a second derivative option with regard to price of the underlying asset. It is calculated as the ratio of change in delta for a unit change in market price of the underlying asset. Gamma = Change in an option delta/ Unit change in price of underlying asset Gamma works as an acceleration of the delta, i.e. it signifies the speed with which an option will go either in-the-money or out-of-the-money due to a change in price of the underlying asset.
- Theta ( $\theta$ ) :
- It is a measure of an option's sensitivity to time decay. Theta is the change in option price given a one-day decrease in time to expiration. It is a measure of time decay. Theta is generally used to gain an idea of how time decay is affecting your option positions. Theta = Change in an option premium/Change in time to expiry Usually theta is negative for a long option, whether it is a call or a put. Other things being equal, options tend to lose time value each day throughout their life. This is due to the fact that the uncertainty element in the price decreases.


## Others IMP term Option

- Vega (v)
- This is a measure of the sensitivity of an option price to changes in market volatility. It is the change of an option premium for a given change (typically 1\%) in the underlying volatility. Vega = Change in an option premium/ Change in volatility Vega is positive for a long call and a long put. An increase in the assumed volatility of the underlying increases the expected pay-out from a buy option, whether it is a call or a put.
- Rho ( $\rho$ )
- Rho is the change in option price given a one percentage point change in the risk-free interest rate. Rho measures the change in an option's price per unit increase in the cost of funding the underlying. Rho = Change in an option premium/ Change in cost of funding the underlying
- Summary
- From a trader's perspective, we may say that he has the choice of futures of various expiries and also options of various expiries and various strikes. Depending upon his analysis of the then existing market conditions and his risk appetite, he can devise


## Delta

- 'Delta of an Option' comes handy. The Delta measures how an options value changes with respect to the change in the underlying. In simpler terms, the Delta of an option helps us answer questions of this sort - "By how many points will the option premium change for every 1 point change in the underlying?"
- Therefore the Option Greek's 'Delta' captures the effect of the directional movement of the market on the Option's premium.
- The delta is a number which varies -
- Between 0 and 1 for a call option, some traders prefer to use the 0 to 100 scale. So the delta value of 0.55 on 0 to 1 scale is equivalent to 55 on the 0 to 100 scale.
- Between -1 and $0(-100$ to 0$)$ for a put option. So the delta value of 0.4 on the -1 to 0 scale is equivalent to -40 on the -100 to 0 scale


## How to apply

- We know the delta is a number that ranges between 0 and 1. Assume a call optio delta of 0.3 or 30 - what does this mean?
- Well, as we know the delta measures the rate of change of premium for every unit change in the underlying. So a delta of 0.3 indicates that for every 1 point change in the underlying, the premium is likely change by 0.3 units, or for every 100 point change in the underlying the premium is likely to change by 30 points. The following example should help you understand this better -
- Nifty @ 10:55 AM is at 8288 , Option Strike = 8250 Call Option
- Premium $=133$, Delta of the option $=+0.55$
- Nifty @ 3:15 PM is expected to reach 8310
- What is the likely option premium value at 3:15 PM?
- Well, this is fairly easy to calculate. We know the Delta of the option is 0.55 , which means for every 1 point change in the underlying the premium is expected to change by 0.55 points.
- We are expecting the underlying to change by 22 points ( $8310-8288$ ), hence the premium is supposed to increase by
- $=22 * 0.55==12.1$
- Therefore the new option premium is expected to trade around 145.1 (133+12.1)
- Which is the sum of old premium + expected change in premium


## Example

- what if one anticipates a drop in Nifty? What will happen to the premium?
- Nifty @ 10:55 AM is at 8288
- Option Strike $=8250$ Call Option
- Premium = 133
- Delta of the option $=0.55$
- Nifty @ 3:15 PM is expected to reach 8200
- What is the likely premium value at 3:15 PM?
- We are expecting Nifty to decline by $\mathbf{- 8 8}$ points ( $8200-8288$ ), hence the change in premium will be -
- $=-88 * 0.55$
- $=-48.4$
- Therefore the premium is expected to trade around
- = 133-48.4
- $=84.6$ (new premium value)


## Delta Helps in Evaluation of the options

- For example assume you expect a massive 100 point up move on Nifty, and based on this expectation you decide to buy an option. There are two Call options and you need to decide which one to buy.
- Call Option 1 has a delta of 0.05
- Call Option 2 has a delta of 0.2
- Now the question is, which option will you buy?
- Let us do some math to answer this -
- Change in underlying = 100 points
- Call option 1 Delta $=0.05$
- Change in premium for call option $1=100 * 0.05=5$
- Call option 2 Delta $=0.2$
- Change in premium for call option $2=100 * 0.2=20$
- As you can see the same 100 point move in the underlying has different effects on different options. In this case clearly the trader would be better off buying Call Option 2. This should give you a hint - the delta helps you select the right option strike to trade. But of course there are more dimensions to this, which we will explore soon.


## Who decides the value of the Delta?

- The value of the delta is one of the many outputs from the Black \& Scholes option pricing formula. As I have mentioned earlier in this module, the B\&S formula takes in a bunch of inputs and gives out a few key outputs. The output includes the option's delta value and other Greeks. After discussing all the Greeks, we will also go through the B\&S formula to strengthen our understanding on options. However for now, you need to be aware that the delta and other Greeks are market driven values and are computed by the B\&S formula.
- However here is a table which will help you identify the approximate delta value for a given option.

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

## Delta for a Put Option

- Do recollect the Delta of a Put Option ranges from -1 to 0. The negative sign is just to illustrate the fact that when the underlying gains in value, the value of premium goes down. Keeping this in mind, consider the following details -

| Parameters |  |  |
| :--- | :--- | :--- |
|  | Nifty | Values |
| Underlying | 8300 |  |
| Strike | 8268 |  |
| Spot value | 128 |  |
| Premium | -0.55 |  |
| Delta | 8310 |  |
| Expected Nifty Value (Case 1) | 8230 |  |
| Expected Nifty Value (Case 2) |  |  |

- Note -8268 is a slightly ITM option, hence the delta is around - 0.55 (as indicated from the table above).
- The objective is to evaluate the new premium value considering the delta value to be 0.55 . Do pay attention to the calculations made below.
- Case 1: Nifty is expected to move to 8310
- Expected change $=8310-8268=42$
- Delta $=-0.55=-0.55^{*} 42=-23.1$
- Current Premium = 128,
- New Premium = 128-23.1 = 104.9


## Case 2: Nifty is expected to move to 8230

- Expected change $=8268-8230=38$
- Delta $=-0.55=-0.55 * 38=-20.9$
- Current Premium = 128
- New Premium = $128+20.9=148.9$
- Here we adding the value of delta since I know that the value of a Put option gains when the underlying value decreases.
- Key takeaways from this chapter
- Option Greeks are forces that influence the premium of an option
- Delta is an Option Greek that captures the effect of the direction of the market
- Call option delta varies between 0 and 1 , some traders prefer to use 0 to 100.
- Put option delta varies between -1 and 0 (-100 to 0 )
- The negative delta value for a Put Option indicates that the option premium and underlying value moves in the opposite direction
- ATM options have a delta of 0.5
- ITM option have a delta of close to 1
- OTM options have a delta of close to 0 .


## Delta versus spot price

- here is a quick recap from the previous chapter -
- Call options has a +ve delta. A Call option with a delta of 0.4 indicates that for every 1 point gain/loss in the underlying the call option premium gains/losses 0.4 points
- Put options has a -ve delta. A Put option with a delta of -0.4 Indicates that for every 1 point loss/gain in the underlying the put option premium gains/losses 0.4 points
- OTM options have a delta value between 0 and 0.5 , ATM option has a delta of 0.5 , and ITM option has a delta between 0.5 and 1.
- Let me take cues from the $3^{\text {rd }}$ point here and make some deductions. Assume Nifty Spot is at 8312, strike under consideration is 8400, and option type is CE (Call option, European).
- What is the approximate Delta value for the 8400 CE when the spot is 8312 ?
- Delta should be between 0 and 0.5 as 8400 CE is OTM. Let us assume Delta is 0.4
- Assume Nifty spot moves from 8312 to $\mathbf{8 4 0 0}$, what do you think is the Delta value?
- Delta should be around 0.5 as the 8400 CE is now an ATM option
- Further assume Nifty spot moves from 8400 to 8500 , what do you think is the Delta value?
- Delta should be closer to 1 as the 8400 CE is now an ITM option. Let us say 0.8.
- Finally assume Nifty Spot cracks heavily and drops back to 8300 from 8500 , what happens to delta?
- With the fall in spot, the option has again become an OTM from ITM, hence the value of delta also falls from 0.8 to let us say 0.35 .
- What can you deduce from the above 4 points?
- Clearly as and when the spot value changes, the moneyness of an option changes, and therefore the delta also changes.


## Delta versus spot price



Have a look at the chart below - it captures the movement of delta versus the spot price. The chart is a generic one and not specific to any particular option or strike as such. As you can see there are two lines -
The blue line captures the behaviour of the Call option's delta (varies from 0 to 1) The red line captures the behaviour of the Put option's delta (varies from -1 to 0 )

## Delta Acceleration

- This graph talks about the 'Delta Acceleration' - there are 4 delta stages mentioned in the graph, let us look into each one of them.

- This is the stage when the option is OTM or deep OTM. The delta here is close to U. The delta will remain close to 0 even when the option moves from deep OTM to OTM. For example when spot is 8400,8700 Call Option is Deep OTM, which is likely to have a delta of 0.05 . Now even if the spot moves from 8400 to let us say 8500 , the delta of 8700 Call option will not move much as 8700 CE is still an OTM option. The delta will still be a small non - zero number.
- So if the premium for 8700 CE when spot is at 8400 is Rs.12, then when Nifty moves to 8500 (100 point move) the premium is likely to move by 100 * $0.05=5$ points.
- Hence the new premium will be Rs. $12+5$ = Rs.17/-. However the 8700 CE is now considered slightly OTM and not really deep OTM.
- Most important to note - the change in premium value in absolute terms maybe small (Rs.5/-) but in percentage terms the Rs.12/- option has changed by $41.6 \%$ to Rs.17/-
- Conclusion - Deep OTM options tends to put on an impressive percentage however for this to happen the spot has to move by a large value.
- Recommendation - avoid buying deep OTM options because the deltas are really small and the underlying has to move massively for the option to work in your favor. There is more bang for the buck elsewhere. However for the very same reason selling deep OTM makes sense, but we will evaluate when to sell these options when we take up the Greek 'Theta'.


## Take off \& Acceleration

- This is the stage when the option transitions from OTM to ATM. This is where the maximum bang for the buck lies, and therefore the risk.
- Consider this - Nifty spot @ 8400, Strike is 8500 CE, option is slightly OTM, delta is 0.25 , Premium is Rs.20/-.
- Spot moves from 8400 to 8500 ( 100 point), to figure out what happens on the premium side, let us do some math -
- Change in underlying $=100$
- Delta for 8500 CE $=0.25$
- Premium change $=100 * 0.25=25$
- New premium = Rs. $20+25=$ Rs. $45 /-$
- Percentage change $=125 \%$
- Do you see that? For the same 100 point move slightly OTM options behaves very differently.
- Conclusion - The slightly OTM option which usually has a delta value of say 0.2 or 0.3 is more sensitive to changes in the underlying. For any meaningful change in the underlying the percentage change in the slightly OTM options is very impressive. In fact this is exactly how option traders double or triple their money i.e. by buying slightly OTM options when they expect big moves in the underlying. But I would like to remind you that this is just one face of the cube, there are other faces we still need to explore.
- Recommendation - Buying slightly OTM option is more expensive than buying deep OTM options, but if you get your act right you stand to make a killing. Whenever you buy options, consider buying slightly OTM options (of course assuming there is plent, \& time to expiry, we will talk about this later).
- Let us take this forward and see how the ATM option would react for the same 100 point move.
- Spot $=8400$
- Strike $=8400$ (ATM)
- Premium = Rs.60/-
- Change in underlying = 100
- Delta for 8400 CE $=0.5$
- Premium change $=100 * 0.5=50$
- New premium $=$ Rs. $60+50=$ Rs. $110 /-$
- Percentage change $=83 \%$
- Conclusion - ATM options are more sensitive to changes in the spot when compared to OTM options. Now because the ATM's delta is high the underlying need not really move by a large value. Even if the underlying moves by a small value the option premium changes. However buying ATM options are more expensive when compared to OTM options.
- Recommendation - Buy ATM options when you want to play safe. The ATM option will move even if the underlying does not move by a large value. Also as a corollary, do not attempt to sell an ATM option unless you are very sure about what you are doing.


## Stabilization

- When the option transitions from ATM to ITM and Deep ITM the delta starts to stabilize at 1. As we can see from the graph, the delta starts to flatten out when hits the value of 1. This means the option can be ITM or deep ITM but the delta gets fixed to 1 and would not change in value.
- Let us see how this works -
- Nifty Spot = 8400
- Option 1 = 8300 CE Strike, ITM option, Delta of 0.8, and Premium is Rs. 105
- Option 2 = 8200 CE Strike, Deep ITM Option, Delta of 1.0, and Premium is Rs. 210
- Change in underlying = 100 points, hence Nifty moves to 8500.
- Given this let us see how the two options behave -
- Change in premium for Option $1=100$ * $0.8=80$
- New Premium for Option $1=$ Rs. $105+80=$ Rs.185/-
- Percentage Change $=80 / 105=76.19 \%$
- Change in premium for Option $2=100 * 1=100$
- New Premium for Option $2=$ Rs. $210+100=$ Rs.310/-
- Percentage Change $=100 / 210=47.6 \%$


## Stabilization

- Conclusion - In terms of the absolute change in the number of points, the deep ITM option scores over the slightly ITM option. However in terms of percentage change it is the other way round. Clearly ITM options are more sensitive to the changes in the underlying but certainly most expensive.
- Most importantly notice the change in the deep ITM option (delta 1) for a change of 100 points in the underlying there is a change of 100 points in the option premium. This means to say when you buy a deep ITM option it is as good as buying the underlying itself. This is because whatever is the change in the underlying, the deep ITM option will experience the same change.
- Recommendation - Buy the ITM options when you want to play very safe. When I say safe, I'm contrasting the deep ITM option with deep OTM option. The ITM options have a high delta, which means they are most sensitive to changes in the underlying.
- Deep ITM option moves in line with the underlying, this means you can substitute a deep ITM option to a futures contract!
- Deep ITM option moves in line with the underlying, this means you can substitute a deep ITM option to a futures contract!
- Think about this -
- Nifty Spot @ 8400
- Nifty Futures = 8409
- Strike = 8000 (deep ITM)
- Premium $=450$
- Delta = 1.0
- Change in spot = 30 points
- New Spot value = 8430
- Change in Futures $=8409+30=8439$ à Reflects the entire 30 point change
- Change Option Premium $=1 * 30=30$
- New Option Premium $=30+450=480$ à Reflects the entire 30 point change
- So the point is, both futures and Deep ITM options react very similar to the changes in the underlying. Hence you are better off buying a Deep ITM option and therefore lessen your margin burden. However if you opt to do this, you need to constantly make sure that the Deep ITM option continues to remain Deep ITM (in other words make sure the delta is always 1), plus do keep an eye on the liquidition of the contract.


## Key Takeover

- Model Thinking helps in developing a scientifically streamlined approach to trading
- The Delta changes as and when the spot value changes
- As the option transitions from OTM to ATM to ITM, so does the delta
- Delta hits a value of 0.5 for ATM options
- Delta predevelopment is when the option transitions from Deep OTM to OTM
- Delta Take off and acceleration is when the option transitions from OTM to ATM
- Delta stabilization is when the option transitions from ATM to ITM to Deep ITM
- Buying options in the take off stage tends to give high \% return
- Buying Deep ITM option is as good as buying the underlying.


## Options behave differently

- This table will help us understand how different options behave differently given a certain change in the underlying.
- I've considered Bajaj Auto as the underlying. The price is 2210 and the expectation is a 30 point change in the underlying (which means we are expecting Bajaj Auto to hit 2240). We will also assume there is plenty of time to expiry; hence time is not really a concern.

| Moneyness | Strike | Delta | Old Premium | Change in Premium | New Premium | \% Change |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Deep OTM | 2400 | 0.05 | Rs.3/- | $30 * 0.05=1.5$ | $3+1.5=4.5$ | 50\% |
| Slightly OTM | 2275 | 0.3 | Rs.7/- | $30 * 0.3=9$ | $7+9=16$ | 129\% |
| ATM | 2210 | 0.5 | Rs.12/- | $30 * 0.5=15$ | $12+15=27$ | 125\% |
| Slightly ITM | 2200 | 0.7 | Rs.22/- | $30 * 0.7=21$ | $22+21=43$ | 95.45\% |
| Deep ITM | 2150 | 1 | Rs.75/- | $30 * 1=30$ | $75+30=105$ | 40\% |

## Add up the Deltas

- 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.


## Add up the Deltas

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

| $\begin{aligned} & \text { SI } \\ & \text { No } \end{aligned}$ | Contract | Classifica tion | Lots | Delta | Position Delta |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 1 | 8000 CE | ITM | 1 -Buy | 0.7 | + 1 * $0.7=+0.7$ |
| 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 |  |  |  | $\sqrt{5}$ | $=0.7+0.5+0.05=+1.25$ |

- Observations -
- The positive sign next to 1 (in the Position Delta column) indicates 'Long' position
- 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
- For every 1 point change in Nifty, the combined position changes by 1.25 points
- If Nifty moves by 50 points, the combined position is expected to move by 50 * $1.25=62.5$ points


## Add up the Deltas

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

| $\begin{gathered} \text { SI } \\ \text { No } \end{gathered}$ | 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 -
- 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
- 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
- For every 1 point change in Nifty, the combined position changes by 0.25 points
- If Nifty moves by 50 points, the combined position is expected to move by 50 * $0.25=$ 12.5 points
- Important point to note here - Deltas of the call and puts can be added as long as it belongs to the same underlying.


## Add up the Deltas

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

| $\begin{aligned} & \text { SI } \\ & \text { No } \end{aligned}$ | 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 | - | $+2 *(-1.0)=-2.0$ |
| 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 |  |  | $y$ |  | $0.7-2+0.5+0.05=-0.75$ |

- Observations -
- The combined positions have a negative delta. This means the underlying and the combined option position move in the opposite direction
- 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
- For every 1 point change in Nifty, the combined position changes by -0.75 points
- If Nifty moves by 50 points, the position is expected to move by $50 *(-0.75)=-37.5$ points


## Add up the Deltas

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

| SI <br> 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 | $+1 *(-0.5)=-0.5$ |

- Observations -
- The 8100 CE (ATM) has a positive delta of +0.5
- The 8100 PE (ATM) has a negative delta of -0.5
- The combined position has a delta of 0 , which implies that the combined position does not get impacted by any change in the underlying
- For example - If Nifty moves by 100 points, the change in the options positions will be 100 * $0=0$
- Positions such as this - which have a combined delta of 0 are also called 'Delta Neutral' positions
- Delta Neutral positions do not get impacted by any directional change. They behave as they are insulated to the market movements
- However Delta neutral positions react to other variables like Volatility and Time. We will discuss this at a later stage.


## Add up the Deltas

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

| SI <br> No | Contrac <br> t | Classificatio <br> n | 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 | $+1 *(-0.5)=-0.5$ |  |

- Observations -
- The negative sign next to 1 (in the Position Delta column) indicates 'short' position
- 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
- Likewise if you short a PUT option the delta turns positive
--1 * $(-0.5)=+0.5$


## Gamma

- 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?"
- $1^{\text {st }}$ order Derivative:
- Change in premium with respect to change in underlying is captured by delta, and hence delta is called the $1^{\text {st }}$ order derivative of the premium
- $\mathbf{2}^{\text {nd }}$ order Derivative:
- Change in delta is with respect to change in the underlying value is captured by Gamma, hence Gamma is called the $2^{\text {nd }}$ order derivative of the premium
- 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'.


## Key takeaways from this chapter

- Financial derivatives are called Financial derivatives because of its dependence on calculus and differential equations (generally called Derivatives)
- Delta of an option is a variable and changes for every change in the underlying and premium
- 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"
- Delta is the $1^{\text {st }}$ order derivative of premium
- Gamma is the $2^{\text {nd }}$ order derivative of premium


## 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 -


## The Curvature

- 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 alreadyknow i.e the delta is a variable and it changes all the time. Given this, the question that one needs to answer is -
- I know the delta changes, but why should I care about it?
- If the change in delta really matters, how do I estimate the likely change in delta?
- We will talk about the $2^{\text {nd }}$ 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' (2 $2^{\text {nd }}$ 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.


## Estimating Risk using Gamma

- 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 point every 1 point movement in the underlying.
- Now, assume Nifty moves 70 points against him and the trader continues to hovir 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 $=0.85 * 10=8.5$
- 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.


## 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 $3^{\text {rd }}$ order derivative called 'Speed'. I won't get into discussing 'Speed' for reasons stated earlier. However we need to know the behaviour of Gamma movement so that we can avoid initiating trades with high Gamma. Of course there are other advantages of knowing the behaviour 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

## Gamma vs Spot Price



- 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 CE 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 CE 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 -
- Since the strike under consideration is 80 CE, the option attains ATM status when the spot price equals 80
- Strike values below 80 ( $65,70,75$ etc) are ITM and values above $80(85,90,95$ etx) are OTM options.
- 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 $25 \%$.
- 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
- Also, since ATM options have highest Gamma - avoid shorting ATM options
- 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).
- You can observe similar Gamma behavior for other strikes i.e 100, and 120. In fact the reason tc show different strikes is to showcase the fact that the gamma behaves in the same way for all options strikes


## Key takeaways from this chapter

- 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 up to expiry wherein you expect the option to expire worthless.
- 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 large gamma
- Delta changes rapidly for ATM option
- Delta changes slowly for OTM and ITM options


## 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 $\mathrm{T}+3$ day by buying it back at Rs.51.75/- and profiting Rs.2.25 ...and this is attributable to theta.

| Number of days for preparation | Likelihood of passing |  |  |
| :---: | :---: | :---: | :---: |
| 30 days $\times$ | Very high | * |  |
| 20 days | High |  |  |
| 15 days | Moderate |  |  |
| 10 days | Low |  | - - ${ }^{\text {\% }}$ |
| 5 days | Very low |  |  |
| 1 day | Ultra low |  | Way taismundardund |

Option Premium vs Time to Expiry


- 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 -
- 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
- 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 .


## 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.
- Whenever you pay a premium for options, you are indeed paying towards -
- Time Risk
- 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 -
- 8350 CE
- 8450 CE
- 8400 PE
- 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 -
- 8350 CE $=8423-8350=+73$
- $8450 \mathrm{CE}=8423-8450=-$ ve value hence 0
- 8400 PE $=8400-8423=-$ ve value hence 0
- 8450 PE $=8450-8423=+27$
- Details to note are as follows -
- $\quad$ Spot Value $=8531$, Strike $=8600$ CE
- Status = OTM, Premium = 99.4
- Today's date $=6^{\text {th }}$ July 2015, Expiry $=30^{\text {th }}$ 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.
- 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.
- Spot Value $=8514.5$, Strike $=8450$ CE
- Status = ITM, Premium = 160
- ITM Call Example :
- 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 towardes 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.


## 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 paya much lesser value towards time. In fact here is a snap shot that I took from the earlier months -
- Date $=29^{\text {th }}$ April
- Expiry Date $=30^{\text {th }}$ 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 $3^{\text {rd }}$ Option Greek helps us answer this question.


## Key takeaways from this chapter

- Option sellers are always compensated for the time risk
- Premium = Intrinsic Value + Time Value
- All else equal, options lose money on a daily basis owing to Theta
- Time moves in a single direction hence Theta is a positive number
- Theta is a friendly Greek to option sellers
- 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
- When you short option close to expiry the premium is low (thanks to time value) but the fall in premium is rapid


## Volatility Basics

- 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 $\Theta$.
- So here is the agenda, I suppose this topic will spill over a few chapters -
- We will understand what volatility really means
- Understand how to measure volatility
- Practical Application of volatility
- Understand different types of volatility
- Understand Vega


## Key takeaways from this chapter

- This leads us to a very interesting platform -
- 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?
- 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.
- 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?
- 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!
- We calculated Nifty's range estimating its volatility as $16.5 \%$, what if the volatility changes?
- Vega measures the rate of change of premium with respect to change in volatility
- Volatility is not just the up down movement of markets
- Volatility is a measure of risk
- We can estimate the range of the stock price given its volatility
- Larger the range of a stock, higher is its volatility aka risk.


## Case Study

- Today's Date = 15 th 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 $15^{\text {th }}$ July 2016 the probability of Nifty to be around 7500 could be $25 \%$, while 8600 could around 40\%.


## 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
- 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 ISFM 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 $3^{\text {rd }}$ derivative of underlying called "Speed" or "Gamma of Gamma" or "DgammaDspot". 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 $-0.5+0.04=\mathbf{- 0 . 4 6}$
- 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 :).


## Options Trading Strategies

Bullish Strategies

Bearish Spreads

- 1. Bear Call Spread
- 2. Bear Put Spread
- 3. Bull Put Ladder
- 4. Put Ratio Back spread
- 5. Strip
- 6. Synthetic Put
- 7. Straps
- 
- 1. Bull Call Spread
- 2. Bull Put Spread
- 3. Call Ratio Back Spread
- 4. Bear Call Ladder
- 5. Call Butterfly
- 6. Synthetic Call




## What is Hedging

- Definition : Hedging is the process to minimize the loss of trading / investment by creating a new position that can way off the effect of existing position.
- We can not totally eliminate our loss but we can reduce it up to certain limit.
- It is very popular among trader as well as investor during a big movement in the market or near by upcoming event.
- WHY IT MATTERS:
- Hedging is like buying insurance. It is protection against unforeseen events, but investors usually hope they never have to use it. Portfolio hedging is an important technique to learn. Although the calculations can be complex, most investors find that even a reasonable approximation will deliver a satisfactory hedge. Hedging is especially helpful when an investor has experienced an extended period of gains and feels this increase might not be sustainable in the future. Like all investment strategies, hedging requires a little planning before executing a trade. However, the security that this strategy provides could make it well worth the time and effort.


## How it works

- Hedging involves protecting an existing asset position from future adverse price
- movements. In order to hedge a position, a market player needs to take an equal and opposite position in the futures market to the one held in the cash market. Every portfolio has a hidden exposure to the index, which is denoted by the beta. Assuming you have a portfolio of Rs 1 million, which has a beta of 1.2, you can factor a complete hedge by selling Rs 1.2 mn of S\&P CNX Nifty futures.

Steps:

- 1. Determine the beta of the portfolio. If the beta of any stock is not known, it is safe to assume that it is 1.
- 2. Short sell the indexin such a quantum that the gain on a unit decrease in the index would offset the losses on the rest of his portfolio. This is achieved by multiplying the relative volatility of the portfolio by the market value of his holdings. Therefore in the above scenario we have to short sell 1.2 * 1 million = 1.2 million worth of Nifty


## Types of Hedge

- 1. Long Hedge
- 2. Short Hedge
- 3. Cross Hedge
- 4. Complete Hedge
- 5. Partial Hedge


## Long Hedge \& Short Hedge

- Long hedge: Long hedge is the transaction when we hedge our position in cash market by going long in futures market. For example, we expect to receive some funds in future and want to invest the same amount in the securities market. We have not yet decided the specific company/companies, where investment is to be made. We expect the market to go up in near future and bear a risk of acquiring the securities at a higher price. We can hedge by going long index futures today. On receipt of money, we may invest in the cash market and simultaneously unwind corresponding index futures positions. Any loss due to acquisition of securities at higher price, resulting from the upward movement in the market over intermediate period, would be partially or fully compensated by the profit made on our position in index futures.
- Short hedge: Short Hedge is a transaction when the hedge is accomplished by going
- short in futures market. For instance, assume, we have a portfolio and want to liquidate
- in near future but we expect the prices to go down in near future. This may go against
- our plan and may result in reduction in the portfolio value. To protect our portfolio's
- value, today, we can short index futures of equivalent amount. The amount of loss
- made in cash market will be partly or fully compensated by the profits on our futures
- positions.


## Cross Hedge

- Cross hedge: When futures contract on an asset is not available, market participants look forward to an asset that is closely associated with their underlying and trades in the futures market of that closely associated asset, for hedging purpose. They may trade in futures in this asset to protect the value of their asset in cash market. This is called cross hedge.
- For instance, if futures contracts on jet fuel are not available in the international
- markets then hedgers may use contracts available on other energy products like crude oil, heating oil or gasoline due to their close association with jet fuel for hedging purpose. This is an example of cross hedge.
- Indeed, in a crude sense, we may say that when we are using index futures to hedge against the market risk on a portfolio, we are essentially establishing a cross hedge because we are not using the exact underlying to hedge the risk against.


## Open Interest

- What is Open Interest ?
- How is it different from Volumes?
- How can we benefit from the Volumes and Open interest data?
- How its predict market trend?
- How we can identify operators game in stock


## What is open Interest

- Definition: Open interest is the total number of outstanding contracts that are held by market participants at the end of each day. Open interest measures the total level of activity into the futures market.
- Description: If both parties to the trade are initiating a new position (one new buyer and one new seller), open interest will increase by one contract. If both traders are closing an existing or old position (one old buyer and one old seller), open interest will decline by one contract. If one old trader passes off his position to a new trader (one old buyer sells to one new buyer), open interest will not change.

Increasing open interest means that new money is flowing into the marketplace. The result will be that the present trend (up, down or sideways) will continue. Declining open interest means that the market is liquidating and implies that the prevailing price trend is coming to an end. Therefore, open interest provides a lead indication of an impending change of trend.

To determine the total open interest for any given market, we only need to know the totals from one side or the other, buyers or sellers, and not the sum of both.

## Example

|  | Monday |  |  | Tuesday |  |  | Wednestay |  |  | Thursday |  |  | Friday |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Trader | Buy |  | Contracts <br> Held | Buy |  | Contrates <br> Held | Buy |  | Contracts <br> Held | Buy |  | Contract <br> Held |  |  | Contracts <br> Held |
| Ariun $\rightarrow$ | 61 |  | 61 |  |  | 61 | 36 |  | 91 | 10. |  | 191 |  | 105 | 91 |
| Varn $\rightarrow$ | 4. |  | 4. |  |  | 4. | 21 |  | 61 | 51 | $\bigcirc$ | 111 |  | 105 | 1. |
| Neha $\rightarrow$ |  | 105 | 105 | 8. |  | 25 | 2. |  | 0 |  |  | 0 |  |  |  |
| John $\rightarrow$ |  |  |  |  | 85 | 85 |  | 75 | 155 | 10. |  | 55 |  |  | 55 |
| Vikram $\rightarrow$ |  |  |  |  |  | O |  |  | $\checkmark$ |  | 255 | 255 | 201 |  | 55 |
| Contracts <br> Outstanding |  |  | 10 |  |  | 10 |  |  | 15 |  | $\checkmark$ | 30 |  |  | 10. |

## OI and Volume interpretation

- Open interest information tells us how many contracts are open and live in the market. Volume on the other hand tells us how many trades were executed on the given day. For every 1 buy and 1 sell, volume adds up to 1. For instance, on a given day, 400 contracts were bought and 400 were sold, then the volume for the day is 400 and not 800 . Clearly volumes and open interest are two different; buy seemingly similar set of information. The volume counter starts from zero at the start of the day and increments as and when new trades occur. Hence the volume data always increases on an intra-day basis. However, Ol is not discrete like volumes, Ol stacks up or reduces based on the entry and exit of traders. In fact for the example we have just discussed, let us summarize the OI and volume information.
- Notice how Ol and volume change on a daily basis. Today's volume has no implication on tomorrow's volume. However, it is not true for Ol. From a stand-alone perspective both OI and volume numbers are pretty useless. However traders generally associate these numbers with prices to draw an inference about the market.

Summarizes the trader's perspective with respect to change in volume and prices

| Price | Volume | Trader's Perceptions |
| :--- | :--- | :--- |
| Increase | Increase | Bullish |
| Decrease | Decrease | Bearish trend could probably end, expect reversal |
| Decrease | Increase | Bearish |
| Increase | Decrease | Bullish trend could probably end, expect reversal |

Unlike volumes, the change in Open interest does not really convey any directional view on markets. However it does give a sense of strength between bullish and bearish positions. The following tables summarizes the trader's perspective with respect to changes in the OI and prices -


## Summarizes the trader's perspective with respect to changes

 in volume and prices| Price | Ol | Trader's Perceptions |
| :--- | :--- | :--- |
| Increase | Increase | More trades on the long side |
| Decrease | Decrease | Longs are covering their position, also called <br> long unwinding |
| Decrease | Increase | More trades on the short side |
| Increase | Flat | Shorts are covering their position, also called <br> short covering |

Do note, if there is an abnormally high OI backed by a rapid increase or decrease in prices then be cautious. This situation simply means that there is a lot of euphoria and leverage being built up in the market. In situations like this, even a small trigger could lead to a lot of panic in the market.


- Key takeaways from this chapter
- Open Interest (OI) is a number that tells you how many contracts are currently outstanding (open) in the market
- Ol increases when new contracts are added. Ol decreases when contracts are squared off
- OI does not change when there is transfer of contracts from one party to another
- Unlike volumes, Ol is continuous data
- On a stand along basis OI and Volume information does not convey information, hence it makes sense to always pair it with the price to understand the impact of their respective variation
- Abnormally high Ol indicates high leverage, beware of such situations.


## What is PCR Ratio

- Definition of 'Put-call Ratio :-

Put-call ratio (PCR) is an indicator commonly used to determine the mood of the options market. Being a contrarian indicator, the ratio looks at options build up, helps traders understand whether a recent fall or rise in the market is excessive and if the time has come to take a contrarian call. The ratio is calculated either on the basis of options trading volumes or on the basis of options contracts on a given day or period.

- How it can be calculated :-

PCR $(\mathrm{OI})=$ Put open interest on a given day/Call open interest on the same day
It can also be calculated by dividing put trading volume by call trading volume on a given day.

PCR (Volume) = Put trading volume/call trading volume
PCR for market wide positions can also be calculated by taking total number of OI for all open Call options and for all open Put options in a given series.

## Interpretation of PCR

- If it is below 1 : A PCR ratio below 1 suggests that traders are buying more Call options than Put options. It signals that most market participants are betting on a likely bullish trend going forward. For contrarians, it is a signal to go against the wind.
- If it is higher than 1 : it suggests traders are buying more Puts than Calls. Unlike Call options, Put options are not initiated just for directional call. They are bought also to hedge against any decline in the market.
- The market sentiment is deemed excessively bearish when the PCR is at a relatively high level. But for contrarian investors, it suggests that the market may soon bottom out. On the other hand, when the ratio falls to a relatively low level, it is deemed excessively bullish. For contrarians, it would suggest a market top is in the making.
- The PCR can be calculated for indices, individual stocks and for the derivative segment as a whole.


## What Is the Put/Call Ratio Used For?

- The Put/Call Ratio is used as a contrarian indicator. An extremely high number of puts indicates that traders may be too bearish, and if all the "bears" have already taken positions then there is no one left to push prices lower. A very high Put/Call Ratio is therefore potentially short-term bullish for stocks/stock indexes.
- An extremely low number of puts (high number of calls) indicates that traders may be too bullish, and if all the "bulls" have already taken positions then there is no one left to push prices higher. A very low Put/Call Ratio is therefore potentially short-term bearish for stocks/stock indexes.
- Traders watch for extreme levels in the Put/Call Ratio to signal periods where stock and index prices could reverse. These levels will vary based on which ratio is used (discussed above), as well as market conditions. A longterm up or downtrend in the stock market may alter the exact levels used to indicate extreme bullishness or bearishness. Viewing the long-term Total Put/Call Ratio will show which levels are acting as extremes.


## Example of PCR

- suppose Nifty50 Put option at strike price 9,000 for March expiry saw a volume of 5,609 contracts on a day. Suppose further that Call volume on that day at the same strike price and same expiry stood at 88,220.

In this case, the PCR would be
$5,609 / 88,220=0.06$

- Now suppose the Put open interest for the same expiry and strike price stands at 4,310,600 and Call open interest stands at 6,816,250.

The PCR in this case would be
$4310600 / 6816250=0.63$
If the ratio is high in a falling market, it reflects how bearish the sentiment is. But a rise in the ratio in a rising market is considered a bullish signal.

## What is VIX

- Introduction:-
"VIX" is a trademark of Chicago Board Options Exchange (CBOE). CBOE was the first exchange in the world to compute a volatility index back in 1993. The derivative (F\&O) trading on VIX started in 2004 on CBOE and its popularity has grown immensely over the years. With the increasing popularity of option trading in India, and since India VIX is designed similar to the CBOE VIX, we should be seeing a similar trend in trading activity on the India VIX contracts in the coming years.
- What is India VIX:-

India VIX is a volatility index based on the index option prices of Nifty. It is computed by using the best bid and ask quotes of the out of the money, present and near month Nifty option contracts. VIX is designed to indicate investors' perception of the annual market volatility over the next 30 calendar days, higher the India VIX, higher the expected volatility and viceversa.

## How it works

- The values of India VIX are computed by the National Stock Exchange (NSE) using the order book of Nifty options. Based on the best bid-ask prices (the lower the spread, the better it is) of all Nifty options contracts, the annualised implied volatility is calculated.
- The figure generated is in percentage and indicates the market volatility over the next 30 calendar days. For instance, if India VIX is 37.19, which was the level of index on $5^{\text {th }}$ March 2017, it indicates an expected change of $37.19 \%$ annually over the coming 30 days. In other words, it means that the market is expected to move up or down by $10.74 \%$ (32.3/ 12) over the next 30-day period.
- For calculation purposes, the near and next month call and put options are taken into account. The near month options must have at least one week to expiration. "This norm is followed in order to ensure that pricing variation, which might occur close to expiration, is minimised

When the near month options have less than a week to expiration, the VIX rolls to the second and third months of Nifty options. "Ideally, all the contracts should be included in the computation. However, there is no liquidity in the contracts which have longer expiry terms

## Reading the VIX

- "Investors can use the VIX for investment decisions as well. High levels of the VIX indicate fear, anxiety and stress in the markets. In such scenarios, one can get good price entry points in stocks,"
- Experts explain that the low, high and normal readings of the VIX vary in different kinds of markets. In the bull market, we have seen that the range is $18-24 \%$. In a range-bound and bear market, the range is $16-21 \%$ and $25-40 \%$, respectively.
- Timing the market is a fairly risky strategy. However, if investors want to try it, they should follow the golden rule-be fearful when others are greedy, and greedy when others are fearful. Taking cues from the above strategy, its explains that in a given market scenario, investors should buy when the VIX is at the higher end and sell when it is at the lower end. "Even if you get it right seven times out of 10, it is an achievement. A lot of small investors use ..

The VIX primarily helps in evaluating potential turning points in the markets," b. Technically, a low VIX means that the current trend (bullish or bearish) may continue and a high VIX indicates that a change in trend is likely. "Combined with other fundamental factors, the VIX value can help investors decide whether to continue with their investments or hedge them, and also, how to hedge them,"

## Trading India VIX

- India VIX is an index, and very similar to Nifty, you cannot really trade an index unless you have derivative (F\&O) contracts on them. With the introduction of India VIX futures, we can use the India VIX to hedge the volatility risk to our portfolio and/or use it to speculate.
- The future contract on India VIX
- Lot size: 750 (Reducing to 550 effective 2nd July 2014)
- Symbol: INDIAVIX
- Tick size: India VIX will be calculated up to 4 decimals with a tick size of Rs 0.0025 (for example, India VIX today is 17.0025)
- Quotation price: India VIX * 100 (multiples of 100). If a trader wants to buy or sell contracts of India VIX futures at 14.1475, then the price that shall be be quoted would be Rs.1414.75.
- Trading hours: 9.15 AM to 3.30 PM
- Expiry Day: Tuesday (Every Week)
- Contract Cycle: 3 weekly contracts
- Final Settlement price: Closing Price of the underlying India VIX index
- Final Settlement procedure: Cash
- Margin: Initial Margin of $9 \%+$ Exposure Margin of $5 \%=14 \%$ of the contract value
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Clamet




India VIX Index Quarterly Chart


Spot and three weekly Futures co-movement contract chart

## Arbitrage

- Arbitrageurs:
- An arbitrage is a deal that produces risk free profits by exploiting a mispricing in the market. A simple arbitrage occurs when a trader purchases an asset cheaply in one location/ exchange and simultaneously arranges to sell it at another location/exchange at a higher price. Such opportunities are unlikely to persist for very long, since arbitrageurs would rush in to buy the asset in the cheap location and simultaneously sell at the expensive location, thus reducing the pricing gap.
- An arbitrageur is basically risk averse. He enters into those contracts were he can earn riskless profits. When markets are imperfect, buying in one market and simultaneously selling in other market gives riskless profit. Arbitrageurs are always in the look out for such imperfections.
- In the futures market one can take advantages of arbitrage opportunities by buying from lower priced market and selling at the higher priced market. In index futures arbitrage is possible between the spot market and the futures market (NSE has provided a special software for buying all 50 Nifty stocks in the spot market.


## - Cash and carry arbitrage

- The following data is available on stock A as on Jan 15, 2017.
- Cash market price Rs. 1500
- December Futures Rs. 1520
- Contract multiplier for stock 100 shares
- Assume an implied cost of carry of $8 \%$ p.a.i.e. $0.75 \%$ per month.
- Theoretically/fair price of December futures is 1504.69 (= 1500 * e0.0075*5/12). Going by
- the theoretical price, we may say that December futures on stock A are overvalued. To
- take advantage of the mispricing, an arbitrageur may buy 100 shares of stock A and sell
- 1 futures contract on that at given prices. This would result in the arbitrage profit of Rs.
- 1531 (= $100 \times 15.31$ ), which is the difference between actual and fair prices for 100
- shares. Position of the arbitrager in various scenarios of stock price would be as follows:
- Case I: Stock rises to Rs. 1550 on expiry day
- Profit on underlying = (1550-1500) x $100=$ Rs. 5000
- Loss on futures $=(1550-1520) \times 100=$ Rs. 3000
- Gain on Arbitrage = Rs. 2,000
- Cost of Arbitrage in terms of financing(Rs. 4.69 for 100 shares) = Rs. 469
- $\quad$ Net gain out of arbitrage $=(2000-469)=$ Rs 1531
- Case II: Stock falls to Rs. 1480 on expiry day
- Loss on underlying = (1500-1480) $\times 100=$ Rs. 2000
- Profit on futures $=(1520-1480) \times 100=$ Rs. 4000
- Gain on Arbitrage = Rs. 2000
- Cost of Arbitrage in terms of financing (Rs. 4.69 for 100 shares) = Rs. 469
- Net gain out of arbitrage $=(2000-469)=$ Rs. 1531

