10

# Options – I

## Introduction to Options

The evolution and growth of options trading has already been touched upon in the first chapter. This chapter explains the various features of different kinds of options. The next chapter deals with pricing of options. Chapter 12 looks more closely at options with specific reference to equity markets and outlines some hedging and trading strategies. Chapter 13 deals with some more advanced options strategies. (The term 'strategy' is used in the loose sense of a planned set of transactions carried out with a pre-determined objective in mind. While the strategies in chapters 12 and 13 are explained through equity options, they are also applicable to options on other underlyings.) Real options and employee stock options are covered in chapter 14.

The bulk of options trading happens through exchanges and the major options exchanges in the world are listed in Table 10.1.

**Table 10.1:** Major options exchanges

| Location | Name of exchange | Main underlyings traded |
|---|---|---|
| London | London International Financial Futures and Options Exchange (LIFFE) | Short term interest rates (sterling, dollar, Euro, Swiss franc), German gilts, stock index, equities |
| London | London Commodity Exchange (LCE) | coffee, sugar, wheat, baltic freight index |
| Chicago | Chicago Board Options Exchange (CBOE) | stocks indices, t-bonds, t-notes and currencies |
| Chicago | CME | commodities |
| New York | American Stock Exchange (AMEX) | stocks and stock indices |
| Hong Kong | Hong Kong Futures Exchange | stock indices |



https://doi.org/10.1017/9781108236041.013 Published online by Cambridge University Press

| Location | Name of exchange | Main underlyings traded |
|---|---|---|
| Singapore | Singapore Exchange (SGX) and Singapore Mercantile Exchange (SME) | Various securities; Singapore is also a big market for OTC currency transactions |
| Mumbai | NSE | equity and currency options |
| Korea | Korea Exchange (KRX) | equity |
| Dubai | Dubai Mercantile Exchange and NASDAQ Dubai | equity, commodities |

## Terminology

An option is a contract between two parties whereby one party acquires the right, but not the obligation, to buy or sell a particular commodity or instrument or asset, at a specified price, on or before a specified date. The person who acquires the right is known as the option buyer or holder while the counter-party (who confers the right) is known as the seller or writer. In return for giving such an option to the buyer, the seller charges an amount, which is known as the option premium. The specified price is called the exercise price or strike price. The commodity or instrument or asset covered by the contract is called the 'underlying' commodity or instrument or asset or simply 'the underlying'. The specified date is called the 'expiration date' or 'expiry date' or 'maturity date'. In this chapter, wherever the term 'commodity' is used, it should be construed as covering financial instruments also.

A feature of the jargon of derivatives in general, but particularly visible in the case of options, is the tendency to use colloquial abbreviations for certain terms. The newcomer to these markets may find them confusing. A common tendency is to shorten the terms. For instance, exercise price or strike price may be shortened to 'exercise' or 'strike', put or call options may be simply called 'puts' or 'calls', and so on. The term 'price' is sometimes used to refer to the market price of the option itself rather than the price of the underlying. One has to observe the context in which the word is used and deduce the correct meaning from it.

## Option types: Call and put

Options may be of two types, i.e., call options and put options. In a call option, the option buyer has the right (but not the obligation) to buy the underlying commodity at the pre-determined price (in a sense, 'call' for the item from the market, hence the term). In put options, the option buyer has the right to sell the asset (in a sense, 'put' the item in the market). Before commodity options were banned in India in 1952, the same two types of options were traded as *teji* (call) and *mandi* (put). India now has options trading in equities and currencies, but commodity options were still banned as of early 2017. The following examples illustrate simple call and put options.

*Example 10.1*

*A enters into a contract with B whereby A has the right to purchase 100 ounces of gold from B for $1400 per ounce at any time prior to 1 August. For granting this option A pays B an option premium of $15 per ounce. This is a call option.*

*Example 10.2*

*A enters into a contract with B whereby A has the option to sell 100 ounces of gold to B at a price of $1400 any time before August 1. For granting him this option, A pays B $16 per ounce as premium. This is a put option.*

In both the above examples, A is the buyer (holder) of the option while B is the writer, or grantor. The term 'writer' (or 'grantor') is used for the original seller, while the term seller could refer to a reseller also (e.g., a person selling to square up an earlier purchase).

Simple or plain put and call options are often called 'plain vanilla' options using the analogy of ice cream.

A third type is the double option, which is a call-cum-put (or *teji-mandi)* option, whereby the option buyer acquires the right (but not obligation) to buy or sell the underlying commodity. (In the examples above, gold is the underlying commodity.)

*Example 10.3*

*A enters into a contract with B, whereby he has the option to buy or sell 100 ounces of gold at $1400 per ounce any time before 1 August. For granting this option, B charges a premium of $31.*



https://doi.org/10.1017/9781108236041.013 Published online by Cambridge University Press

It may be noted that the premium for a double option is the sum of the premia for a call and put option at the same strike price for the same duration.

There are many other types of options, called exotic options, which will be described later. One type which looks similar to (but is different from) a double option, is the chooser option in which the buyer has the right to decide by a certain date what 'type' of option he will possess – call or put, but not both. The different types of option may have different exercise prices. While the double option is a call-cum-put, the chooser option is a call-or-put, with the choice of type being deferred.

*Example 10.4*

*A hedge fund buys a chooser option on the S&P 500 which enables it to choose one month from now whether to convert this option into a call option or a put option (both of which expire three months from now). The S&P is currently at 1,100, and the call exercise (i.e., exercise price) is at 1,200 and the put exercise is at 1,000.*

*The buyer has one month to observe the market trend and decide whether a bullish or a bearish outlook is more plausible. On the other hand, once the choice has already been made, the fund cannot benefit from the type of option that was not chosen. Hence, the price must be less than a double option, but more than a plain vanilla call or put option (because the buyer has more flexibility).*

## Traded vs. over-the-counter (OTC) options

If option contracts are standardised, i.e., with standard contract sizes, standard strike prices and standard contract terms, and are traded through an exchange, they are known as traded options. Most traded options markets use a clearing house system. Where an options contract is not executed through an exchange, it is an OTC option. Some OTC options markets, though not exchange-traded, have standard legal terms.

## Closing out in lieu of exercise

In a traded options market, it is not necessary to exercise an option in order to realise its value. Since options can be resold in the market, it is sufficient to take an offsetting position; a call buyer will sell a call, a put seller will buy a put, etc. The difference between the premium received and premium paid will be



https://doi.org/10.1017/9781108236041.013 Published online by Cambridge University Press

the profit or loss. Thus, the 'squaring up' approach used in futures is also used in traded options. For this reason, in traded options markets, the term 'price' is often used to refer to the premium.

*Example 10.5*

*On May 1, the price of gold is $1395. X, a gold jewellery manufacturer requires a certain volume of gold in the month of September. He has an apprehension that the price may rise considerably by then. He therefore purchases a call option on gold with a strike price of $ 1,400. (The strike price is the price which the option buyer has to pay the option seller for the commodity, if and when he exercises his right to buy or sell.) In the instant case, X acquires the right to buy gold at the pre-determined price (strike price or exercise price) of $1,400. On September 1, the price of gold has risen to $1,450. Clearly, it is to the advantage of X to exercise his option. X has two alternatives. The first and obvious alternative is to exercise his option and purchase the gold at the pre-determined strike price of $1,400 per ounce. If there is a liquid market (e.g., in a traded options market) there is a second alternative – that is to 'close out' or 'square up' the position by reselling the option in the exchange, and then buy the physical gold separately. An expiring option would have a premium of approximately nil. The difference in premium represents the profit. Either way, by entering into the options contract, he has gained $50 per ounce. No doubt, the final net gain is lower by the amount of premium paid to the option seller when the jeweller purchased the option. (The option writer correspondingly would have lost $50 but the loss would be reduced by the amount of the premium he collected.)*

*Example 10.6*

*All the facts are as in Example 10.5 except that on 1 September the price of gold is $1,350. At this price, it is cheaper for X to purchase gold from the market at the prevailing rate than to exercise his call option and pay $1,400. He therefore allows the option to lapse. The net cost of the option is the amount of premium. Since the option is not exercised, the premium amount represents an income for the option seller and a loss for the buyer (who would have been better off without buying the option – just as a person who never makes a claim would have been better off by not insuring. But, that is with the benefit of hindsight).*

*Example 10.7*

*On 1 May, the price of gold is $1,395. C is a gold mine owner whose income increases with the price of gold. C has an apprehension that the price may fall, by the time his production comes to market in July. Accordingly, C purchases a put option from D whereby C has the right to sell 100 ounces of gold at the predetermined price of $1,385 up to 1 July. On 1 July, the price of gold is $1,330. If C were to sell gold in the market, he would only get $1,330 per ounce. Since he has an option contract to sell at $1,385 he exercises the option and gets a price of $1,385. In this case, C has gained $55 per ounce by entering into the options contract. His gain is reduced by the amount of premium that he has paid to D. D has correspondingly*



https://doi.org/10.1017/9781108236041.013 Published online by Cambridge University Press

*lost $55 per ounce, but the loss is offset by the premium he has earned. (Alternatively, if the market were liquid, C could have closed out the position with the same net financial result.)*

*Example 10.8*

*The facts are as in Example 10.7 except that the price of gold on 1 July is $ 1400. In this case, C will get a better price by selling his gold in the market than by exercising his option. Therefore, he allows the option to lapse. The amount of option premium is a loss to C and gain to D.*

## Various option styles – American, European and Asian options

Options can be classified into American, European, Asian and Bermudan style options. This classification (known as 'option style') has nothing to do with the location of the options trade – 'American' options are traded in Europe and vice versa. They are only varieties of contracts.

- In an American style option, the option can be exercised any time up to the maturity date.
- In a European option, the right can be exercised only on the maturity date.
- Asian options (also known as 'average rate options') do not have a fixed strike price. Instead, they have a formula for determining the strike price, which would be the average of the spot price over a given period of time.
- Bermudan options can be exercised only on certain dates.

Asian and Bermudan options are relatively rare. The following examples illustrate some of the features of different styles.

*Example 10.9*

*On 1 March, the price of copper is $9,800 per ton. Person A expects a rise in price and buys an American option on June Copper (maturity date of 15 June and a strike price of $9,800). The prices subsequently are as follows:*

*15 May: $ 10,100*

*15 June: $ 9,700*

*As the option is an American option, A exercises it on 15 May (well before the expiry date), takes delivery of the copper at the strike price of $9,800 and then sells the copper in the spot market at a profit of $300 per ton. (It should be noted that in practice, if an American option*



https://doi.org/10.1017/9781108236041.013 Published online by Cambridge University Press

*is a traded option or has an active OTC market, it will usually be more cost effective to sell it than to exercise it, because the transaction costs of giving/taking delivery can be avoided.)*

*Example 10.10*

*All the other facts are as above, but the option is a European option. In this case, A cannot exercise the option on 15 May because he only has the right to do so on the maturity date. If it is not a traded option, he therefore does not have the profit opportunity that he had in the previous example. Therefore , an American option may have a higher profit potential than a European option for the buyer. This often leads to slightly higher premia for American options.*

*Example 10.11*

*Q Limited is an oil importer, requiring a regular monthly supply of oil. In August, it anticipates a drop in the price of oil, but wants to be hedged against a possible rise. It buys an Asian option on Brent Crude by which it has the right to buy from Y, 10,000 barrels at the average spot price from 15 August to 15 December. If the spot price on 15 December is lower than the three-month average, it is not worth exercising the option and vice versa.*

## Relationship between strike price and market price

It would have been clear from Examples 10.5 to 10.8 that the decision of an option buyer on option exercise depends on whether the strike price is above or below the market price. In market terminology:

- An option is said to be 'at-the-money' (abbreviated to ATM) if the current market price of the underlying is exactly equal to the option strike price.
- An option is said to be 'in-the-money' (abbreviated to ITM) when the strike price relates to the market price in such a way that there is an advantage in exercising the option. A call option will be 'in-the-money' if the strike price is below the current price (of the underlying). A put option will be 'in-the-money' if the strike price is above the current market price.
- An option is said to be 'out-of-the-money' (abbreviated to OTM) if the strike price relates to the market price in such a way that the buyer has no advantage in exercising the option. A call option is 'out-of-the- money' when the strike price is above the current market price, while a put option is 'out-of-the-money' when the strike price is below the current market price.

The premium for an option is the sum of intrinsic value and time value. An



https://doi.org/10.1017/9781108236041.013 Published online by Cambridge University Press

option is said to have intrinsic value when it is ITM. The more in-the-money an option is, the higher the intrinsic value. Intrinsic value is nil for ATM and OTM options. The time value, on the other hand, depends on the time to expiry, the volatility of the underlying asset, and the risk-free interest rate. Generally speaking, the longer the time remaining for expiry and the higher the volatility, the higher the time value.

As a simplification, the amount of intrinsic value is simply the *difference between the strike price and the current market price* of an in-the-money option. However, for a more precise formulation, it is necessary to take into account the fact that a European option can only be exercised *on* the maturity date and not before; this requires an adjustment for the discounted present value of the exercise price. By doing this and taking into account various arbitrage possibilities, it can be shown that:

- The intrinsic value of a call option (whether American or European) is the difference between the market price of the underlying and the discounted present value of the exercise price.
- The intrinsic value of an American put option is the difference between the exercise price and the market price of the underlying.
- The intrinsic value of a European put option is the difference between the discounted present-value of the exercise price and the market price of the underlying.
  (The discount rate to be used is the risk-free interest rate; the yield on Treasury Bills can be taken for this purpose, because Treasury securities issued by the government are free of the risk of default.)

### Options on futures

In many traded options markets, instead of the underlying asset being the spot commodity, a futures contract is used as the underlying. For instance, in the earlier examples a call option would give the right to buy 'one May futures gold contract' (rather than gold itself), while a put option would give the right to sell one gold futures contract.

## Comparison of options and futures: Options as one-sided hedges

Under a futures contract, the buyer or seller acquires both the right and the



https://doi.org/10.1017/9781108236041.013 Published online by Cambridge University Press

obligation to buy or sell, whereas in an options contract there is only a right without obligation. An options contract is therefore one sided or unilateral and the purchaser has more rights than the seller of the option. However, in order to acquire this right the option buyer has to pay a premium to the option seller, which is not required in a futures contract.

Options are conceptually very similar to insurance contracts where a fixed premium is paid in return for cover against adverse risks. (The key differences between an option and an insurance contract are the absence of need for an 'insurable interest' and the fact that options can be used to earn profits and not just to protect against an eventual loss, as in insurance contracts.) From the buyer's viewpoint, an option has a certain and limited loss (the amount of premium) with unlimited profit potential. From the point of view of options sellers, an option has a certain and limited profit potential with virtually unlimited loss potential.[1] A futures contract has an unlimited loss and profit potential for both parties.

Earlier we saw that futures and forward contracts could be used as hedges. Options can also be used as hedges. Hedging through options has different payoffs (i.e., profit/ loss outcomes) as compared to hedging with futures or forwards, or 'linear' derivatives in general.[2] A farmer hedging his crops by selling futures 'locks in' the future price. While he is protected against price falls, he also misses out on any increase in prices. The same farmer can have protection as well as keep the 'upside' (i.e., profit potential) by buying a put option. If, for the purposes of simplicity, we assume that a farmer buys an ATM European put (that is, where the current price is equal to the strike price[3]), then any decrease in prices is compensated for by the increasing value of the put option. On the other hand, any increase in prices is welcome and only the premium is lost. An option is thus a one-sided hedge. Table 10.2 makes a comparison between futures and options as hedging instruments.

1 Mathematically, the loss potential for call sellers is unlimited since the price can rise to infinity, while for put sellers it is limited only by the fact that the price cannot fall below zero.

2 Linear derivatives are those where the relationship between the profit/loss and the price of the underlying can be expressed as, or approximates to, a linear equation.

3 In practice, an adjustment for the time value of money has to be made, but for short periods of time and at low interest rates, this can be ignored.

**Table 10.2:** Comparison between futures/forwards and options as hedging instruments

| Issue | Futures | Options |
|---|---|---|
| Unfavourable (downside) price risk | Is avoided | Is avoided |
| Favourable (upside) price risk | Is forgone (hedger gets no net benefit if the price of the underlying moves in a favourable direction). | Is retained (hedger gets the benefit if the price of the underlying moves in a favourable direction). |
| Premium | Does not arise. | Is payable and hedger has to forgo the interest that could have been earned on this amount. |
| Initial margin | Is payable: hedger has to pay a portion of the value of the contract as margin and has to forgo the interest that could have been earned on this amount. | Does not arise. |
| Risk of additional margin calls | Hedger may have to pay additional margin when a margin call is made, i.e., when the price moves in an adverse direction. Thus, the hedger will have to be able to come up with more cash when necessary in order to sustain the hedge; if he is not able to provide the margin call, the position will be closed out and the hedge will no longer be effective. | Does not arise. Hedge remains effective for the duration of the contract. |

## Options as speculative instruments

While the examples above had depicted the options buyer as a hedger, options can also be used purely as speculative vehicles. The simplest options trading strategies involve the purchase or sale of 'naked' options. (A naked option is one which is not accompanied by an opposite or 'covering' position in the underlying or in some other option.) More complex strategies involve combinations of an option with a position in the underlying itself or a combination of different options.



https://doi.org/10.1017/9781108236041.013 Published online by Cambridge University Press

## Speculation through options purchase

Buying options is a 'limited liability' method of speculating on price. The profit potential ('upside') on buying an option is unlimited whereas the loss potential ('downside') is limited to the premium.

It is sometimes felt that an option is nothing but a futures contract accompanied by a 'stop loss' order. However, an option is actually safer than a futures contract with a stop loss order for three reasons. Firstly, stop losses may not actually be executed at the prescribed price because markets sometimes move so fast that it may not be possible to carry out the stop loss order at the stipulated price.

*Example 10.12*

*X purchases one gold futures contract at $1,400 with a stop loss order to sell it if the price falls to $1,300. On a particular day, the price falls suddenly from $1,310 to $1,265 without any trade being executed at $1,300. In this case, despite the stop loss order, A will suffer a much bigger loss than he has anticipated, since the stop loss will be executed only at $1,265.*

The second difference is that once a stop loss order is activated, the participant cannot share in any subsequent beneficial price move. In Example 10.12, we saw that the price had dropped to $ 1,265. If it subsequently moves up to $ 1,420, the speculator will not get any benefit because he has already closed out his transaction. (This is sometimes known as the 'whipsaw' risk.) This risk does not occur in an options contract.

Thirdly, in a futures contract, one may have to pay margin calls if there are adverse charges in price. This creates uncertainty in cash flows. In an options contract, no margin calls are levied on the buyer, once the premium has been paid.

Among the option buying strategies, the speculator has some choices to make. If she expects a major price move, she can get 'more bang for her buck' by buying out-of-the-money puts and calls which will be relatively cheap (the more deeply out-of-the-money the cheaper), with no extra downside risk.

For a speculator who buys options, the nominal break-even prices (i.e., the price at which the option premium is recovered) are as follows:

a. For call purchase:

   Break-even price of underlying = Strike price + Premium

b. For put purchase:

   Break-even price of underlying = Strike price – Premium.



https://doi.org/10.1017/9781108236041.013 Published online by Cambridge University Press

## Speculation through options selling

Speculators *can also sell options* but the key difference is that it involves unlimited loss potential with a limited and fixed potential for gain. Naked option selling is thus unsuitable for most investors.

## Basic options strategies

The following table lists the strategy that would generally be apt for various expectations of a speculator:

| **Speculator's opinion on market prices** | **Appropriate option strategy** |
|---|---|
| Very bullish | Buy a call |
| Moderately bullish | Write a put |
| Moderately bearish | Write a call |
| Very bearish | Buy a put |

Of these strategies, it is worth repeating that *those involving writing an option carry unlimited risk*.

Table 10.3 illustrates the position of the (speculative) buyer and seller in a put option and call option, *vis-à-vis* a short and long position in futures respectively.

**Table 10.3:** Options vs. futures: Gains and losses in different circumstances

| | **Call buyer** | **Long futures** | **Call seller** | **Put buyer** | **Short futures** | **Put seller** |
|---|---|---|---|---|---|---|
| Price rises | Unlimited gain | Unlimited gain | Unlimited loss | Limited loss | Unlimited loss | Limited gain |
| Price falls | Limited loss | Unlimited loss* | Limited gain | Unlimited gain | Unlimited gain | Unlimited loss* |
| Price unchanged | Limited loss | No gain or loss | Limited gain | Limited loss | No gain or loss | Limited gain |

Transaction costs are ignored.

*Since the price of any asset cannot go below zero, there is technically a 'limit' to the gain/loss when the price falls. For practical purposes, this is largely irrelevant.



https://doi.org/10.1017/9781108236041.013 Published online by Cambridge University Press

## Options price tables

For all traded options and for active OTC options, price quotations are published.

Table 10.4 is an example of an option 'chain' with the Nifty share index as the underlying. The table shows the prices on end of day 12 August 2016 for index options having an expiry date of 26 August 2016. For ease of reference for the reader, column numbers from one to 15 have been added.

- Column eight is the key column giving the strike prices of the various options being traded in the exchange for the 30 August maturity.
- To the left of column eight are the values relating to call options.
- On the right of column eight are the values pertaining to put options.
- Column one reflects the open interest (OI). This figure is the total number of call options with a given strike price and expiry that were not settled as of 12 August 2016, i.e., options that are still 'open'. (Higher open interest generally represents higher liquidity.)
- The 'LTP' in column two refers to the last traded price (i.e., price of the option, not the underlying) for the different strike prices (of the underlying). For example, the LTP of the call option for a strike price of 8700 is 62.55. This means that as on 12 August, the premium (price) payable by a buyer/receivable by a seller of a call option on Nifty with a strike price of 8700 and exercise date of 26 August is ₹ 62.55.
- Similarly, on the right hand side, LTP (column 14) for a put option can be seen, and the OI is reflected in column 15.

The calls in the shaded boxes (on the left and top of the image) are the 'in-the-money' (ITM) calls. The puts in the shaded boxes (on the right and bottom of the image) are the ITM puts.

The various bid and ask prices and quantities are also shown in the table. The 'ask' price is the price payable by buyers while the 'bid' price is the price receivable by sellers. The difference between these two (known as the 'bid-ask spread') is the profit margin of the dealers. The bid quantities in columns four and nine are the volumes (in number of contracts of standard size) of bids for calls and puts respectively while the ask quantity in columns seven and 12 are the ask quantities for calls and puts respectively.

Below, in Tables 10.5 and 10.6, are abridged tables for the Microsoft



https://doi.org/10.1017/9781108236041.013 Published online by Cambridge University Press

**Table 10.4:** NIFTY option as on 12 August 2016 for options with expiry 25 August 2016

(Underlying price: 8,672.15)

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| OI | LTP | Net chng | Bid qty | Bid pr | Ask pr | Ask qty | Strike pr | Bid qty | Bid pr | Ask pr | Ask qty | Net chng | LTP | OI |
| 1500 | 331.15 | 54.75 | 75 | 311.1 | 343.65 | 75 | 8350 | 225 | 9.7 | 9.85 | 375 | -7.2 | 9.8 | 205650 |
| 649800 | 278 | 46.85 | 75 | 278.05 | 279.9 | 75 | 8400 | 375 | 13.35 | 13.4 | 75 | -10.15 | 13.7 | 5050425 |
| 5925 | 238.35 | 43.85 | 750 | 225.8 | 243.3 | 750 | 8450 | 75 | 17.4 | 17.7 | 375 | -14.5 | 17.55 | 782850 |
| 1497675 | 192 | 39.7 | 150 | 191.6 | 192.3 | 225 | 8500 | 5100 | 25.2 | 25.3 | 2175 | -18.45 | 25.45 | 5617125 |
| 62700 | 155 | 35.35 | 75 | 151.4 | 154.95 | 150 | 8550 | 2850 | 34.5 | 34.65 | 300 | -24.15 | 35 | 712200 |
| 2529225 | 117.45 | 27.45 | 75 | 118.7 | 119 | 150 | 8600 | 75 | 49.25 | 49.4 | 225 | -29.7 | 49.65 | 4476375 |
| 507150 | 87.95 | 22.5 | 75 | 87.05 | 87.8 | 75 | 8650 | 75 | 66.9 | 67.85 | 600 | -35.25 | 67 | 480075 |
| 4571625 | 62.55 | 16.25 | 10275 | 63 | 63.2 | 600 | 8700 | 75 | 90.8 | 90.9 | 600 | -40.25 | 91.9 | 2095125 |
| 631950 | 42.35 | 10.15 | 75 | 42.55 | 42.65 | 75 | 8750 | 825 | 118.35 | 120.3 | 75 | -42.95 | 122.95 | 66075 |
| 5668875 | 28.85 | 8.1 | 75 | 28.45 | 28.6 | 3750 | 8800 | 150 | 153.6 | 154.35 | 375 | -52.4 | 154 | 1011150 |
| 372450 | 18.55 | 4.8 | 225 | 17.8 | 18 | 300 | 8850 | 300 | 192.2 | 196.05 | 600 | -55.85 | 192.95 | 10875 |
| 3934650 | 11.65 | 2.7 | 2550 | 11.5 | 11.6 | 1725 | 8900 | 2250 | 236.1 | 236.95 | 75 | -56.15 | 237 | 221475 |
| 232125 | 7.1 | 1.2 | 75 | 6.95 | 7 | 150 | 8950 | 5250 | 235.65 | 308.1 | 2925 | - | - | - |
| 6320175 | 4.95 | 0.8 | 12225 | 4.8 | 4.9 | 5250 | 9000 | 75 | 325.7 | 327 | 75 | -59 | 326 | 778425 |

***Source:*** NSE website, nseindia.com.

stock option in the United States (August 2016 and September 2016 expiries respectively) as on 12 August 2016. On that day, Microsoft shares were quoted at approximately $57.94 per share.

**Table 10.5:** Microsoft (MSFT) option chain, August 2016 expiry

| Last trade | Change | Call bid | Call ask | Strike price | Last trade | Change | Put bid | Put ask |
|---|---|---|---|---|---|---|---|---|
| 3.92 | 0.48 | 3.25 | 3.45 | 54.5 | 0.09 | 0.01 | 0.03 | 0.08 |
| 2.7 | -0.59 | 2.92 | 2.95 | 55 | 0.11 | 0.04 | 0.07 | 0.1 |
| 2.35 | -0.33 | 2.42 | 2.45 | 55.5 | 0.16 | -0.03 | 0.09 | 0.14 |
| 1.77 | -0.54 | 1.92 | 1.95 | 56 | 0.22 | -0.01 | 0.17 | 0.2 |
| 1.39 | -0.57 | 1.44 | 1.47 | 56.5 | 0.3 | 0.08 | 0.25 | 0.28 |
| 1 | -0.4 | 1 | 1.03 | 57 | 0.46 | 0.12 | 0.4 | 0.42 |
| 0.58 | -0.43 | 0.65 | 0.7 | 57.5 | 0.66 | 0.15 | 0.58 | 0.6 |
| 0.37 | -0.23 | 0.39 | 0.41 | 58 | 0.99 | 0.29 | 0.85 | 0.88 |
| 0.21 | -0.19 | 0.2 | 0.23 | 58.5 | 0.95 | -0.02 | 1.19 | 1.22 |
| 0.1 | -0.11 | 0.09 | 0.13 | 59 | 1.7 | 0.22 | 1.57 | 1.61 |
| 0.16 | 0.08 | 0.04 | 0.07 | 59.5 | 0 | 0 | 1.96 | 2.03 |
| 0.03 | -0.04 | 0.02 | 0.04 | 60 | 2.5 | 0.47 | 2.43 | 2.47 |
| 0.04 | 0.01 | 0.02 | 0.04 | 60.5 | 0 | 0 | 2.97 | 3.05 |
| 0.05 | 0 | 0.01 | 0.03 | 61 | 5.35 | 0.45 | 3.45 | 3.55 |

***Source:*** Marketwatch.com website.

The market value of the underlying Microsoft stock (US$57.94) must be kept in mind. The August call in Table 10.5 with a strike price of 55 can be bought at 2.95, and its intrinsic value is $(57.94–55.00) =$ 2.94 per share. Therefore, the time value is just $0.01 per share. However, the time value for September expiry is higher as expected. It can be calculated by subtracting the intrinsic value from the option price. Checking the figures in Table 10.6, that comes to (3.10 - (57.94-55.00)) = (3.10-2.94) =US$ 0.16.



https://doi.org/10.1017/9781108236041.013 Published online by Cambridge University Press

**Table 10.6:** Microsoft (MSFT) option chain, September 2016 expiry

| Last trade | Change | Call bid | Call ask | Strike price | Last trade | Change | Put bid | Put ask |
|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 3.4 | 3.55 | 54.5 | 0.46 | 0 | 0.42 | 0.45 |
| 3.05 | 0 | 3 | 3.1 | 55 | 0.53 | 0 | 0.48 | 0.52 |
| 2.69 | 0 | 2.68 | 2.75 | 55.5 | 0.66 | 0 | 0.58 | 0.62 |
| 0 | 0 | 2.29 | 2.33 | 56 | 0.78 | 0 | 0.7 | 0.74 |
| 1.94 | -0.29 | 1.93 | 1.98 | 56.5 | 0.93 | 0 | 0.88 | 0.9 |
| 1.49 | 0 | 1.62 | 1.67 | 57 | 0 | 0 | 1.04 | 1.08 |
| 1.28 | -0.28 | 1.29 | 1.32 | 57.5 | 1.39 | 0 | 1.22 | 1.26 |
| 1.03 | -0.27 | 1.05 | 1.09 | 58 | 1.6 | 0 | 1.46 | 1.49 |
| 0.79 | -0.26 | 0.82 | 0.84 | 58.5 | 0 | 0 | 1.76 | 1.79 |
| 0.61 | -0.3 | 0.63 | 0.66 | 59 | 0 | 0 | 2.03 | 2.13 |
| 0.47 | -0.12 | 0.46 | 0.56 | 59.5 | 0 | 0 | 2.36 | 2.43 |
| 0.35 | -0.2 | 0.33 | 0.38 | 60 | 0 | 0 | 2.79 | 2.85 |
| 0.4 | 0 | 0.23 | 0.28 | 60.5 | 0 | 0 | 3.15 | 3.3 |
| 0.29 | 0 | 0.15 | 0.24 | 61 | 3.82 | 0 | 3.55 | 3.75 |

***Source:*** Marketwatch.com website.

The August put for the same strike (55) is out-of-the-money and so has a premium (entirely time value) of around $0.10 per share. For September expiry, the put option for the same strike (55) can be bought for $0.52. Intrinsic value is still the same (zero) but time value has now increased. This is because there is a longer time left for expiry.

Yet another format of options price table is given in Table 10.7. In this format, for a single strike price, options premia for different expiry months are given.

**Table 10.7:** Index options with same strike and varying expiry

| LTP | Net chng | Call bid qty | Call bid price | Call ask price | Call ask qty | Expiry date | Put bid qty | Put bid price | Put ask price | Put ask qty | Net chng | LTP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 62.55 | 16.25 | 10,275 | 63 | 63.2 | 600 | 25-Aug-16 | 75 | 90.8 | 90.9 | 600 | -40.25 | 91.9 |
| 169 | 26.95 | 150 | 169.4 | 170.35 | 75 | 29-Sep-16 | 75 | 152 | 152.85 | 75 | -29.35 | 153 |



https://doi.org/10.1017/9781108236041.013 Published online by Cambridge University Press

| LTP | Net chng | Call bid qty | Call bid price | Call ask price | Call ask qty | Expiry date | Put bid qty | Put bid price | Put ask price | Put ask qty | Net chng | LTP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 235 | 26.3 | 225 | 231.3 | 238 | 150 | 27-Oct-16 | 150 | 174.05 | 185.45 | 150 | -37.15 | 176 |
| 350 | - | 750 | 333.05 | - | - | 29-Dec-16 | 1,500 | 185.5 | - | - | - | - |
| 1,530.00 | - | - | - | - | - | 29-Jun-17 | 750 | 210.05 | - | - | - | 332 |
| 750 | - | - | - | - | - | 28-Dec-17 | - | - | - | - | - | 580 |
| 1,354.50 | - | - | - | - | - | 28-Jun-18 | 75 | 318.6 | - | - | - | 900 |
| 2,569.45 | - | - | - | - | - | 27-Dec-18 | 75 | 295.45 | - | - | - | - |
| - | - | - | - | - | - | 27-Jun-19 | 75 | 530 | 590 | 7,500 | -5 | 590 |
| 2,002.85 | - | - | - | - | - | 26-Dec-19 | - | - | - | - | - | - |

***Source:*** nseindia.com. Underlying NIFTY 8672.15 12/8/16. STRIKE 8700.

Quotations are arranged in ascending order of expiry for the 8,700 strike price (NIFTY: with the underlying at 8,672), with maturity months arranged vertically. The reader will notice that premia tend to increase from top to bottom for both calls and puts - this reflects the time value of the option. The prices for the December 2018 and June 2019 options are exceptions; they may indicate illiquidity (poor trading volume) and the prices may reflect the situation on earlier dates when the underlying price was different.

## Exotic options

Apart from the 'straightforward' put and call options enumerated above, several 'exotic' options have been developed which have special features. Some of these (like capped options on shares – see below) are exchange-traded while others are custom-made or OTC options.



https://doi.org/10.1017/9781108236041.013 Published online by Cambridge University Press

## Limit-dependent or barrier options

These are options, which come into force /go out of force if and when a particular price limit is reached, as illustrated in examples below.

*Example 10.13*

*In July, the price of gold is $1,400. X, who needs gold in October, wants protection against a rising gold price. However, he feels (based on his technical analysis) that if the price falls below $1,390, then it will not rise above $1,400 before October. He therefore buys an October barrier call option on gold with a strike price of $1,400 with a 'knock-out' price of $1,390. If, any time before expiry, the gold price touches $1,390, the call option will be automatically cancelled – this is known as the knock-out feature as the option gets 'knocked out'.*

*Example 10.14*

*In July, the price of gold is $1,400. Y, who needs gold in October, feels the price is not likely to rise, and he feels he can absorb minor price increases. However, his technical analysis shows that if the price rises above $1,415, then a bull run is likely to commence which would be too much for him to absorb. He therefore buys an October barrier call option with a strike price of $1,400 but a 'knock-in' price of $1,415. If at any time before expiry, the gold price touches $4,115, he will automatically get a call option.*

Barrier options are cheaper than ordinary options (which is the advantage to the buyer) because they offer less risk protection. However, the risk to the buyer, particularly in knock-out options, is that the price may move in an erratic manner, i.e., 'hit' the barrier but then reverse the trend. (This is the whipsaw risk referred to earlier.) In the previous example, suppose the price drops to $1,385 in August; the option is 'knocked out'. If, suddenly, in September the price soars to $1,420, X would be unprotected. Because the existence/extinction of the option depends on the path taken by the price, these are known as path-dependent barrier options.

## Capped options

A capped option is an option, which will be automatically exercised if the underlying (commodity or financial instrument) touches a particular predetermined price prior to the expiry of the option. If the 'cap' is not reached during the validity of the option, it can be exercised at the end of the period like a European option.'

*Example 10.15*

*The share price of XYZ Limited is trading at ₹460 in May. An investor purchases a capped September call option with an exercise price of 460 and a cap price of 490. This means that if any time before September the price of the share of XYZ Limited touches the 490 level, the capped option will get automatically exercised. On 6 June, the share price touches ₹491. The option is exercised on that day.*

There is a specialised terminology applicable to capped options. The 'cap interval' is the difference between the exercise price and the cap price. In the above example, the cap interval is ₹ 30. In exchange- traded capped options, there are standardised cap intervals fixed by the options exchange and capped options can only be purchased/sold using these standardised intervals.

In the above example, it was simply assumed that the underlying price had 'touched' a pre-determined cap price. The precise method of determining whether the cap has been touched or not, is specified by the options exchange. The exchange would decide, which is the 'automatic exercise value.' For example, it may be decided that the closing price of the share in a specified stock exchange is the automatic exercise value; if the cap value is reached during the day, but the closing price does not exceed the cap, then the cap is deemed not to have been touched.

Most capped options are 'cash settled', i.e., instead of delivering the underlying interest, the cash value of the difference between market price and exercise price on the date of exercise is paid. The advantage of a capped (cash-settled) option for the buyer is that exercise takes place automatically once a pre-determined level of profit has occurred, without risk of reversal in the price trend later. From the point of view of the option seller, a capped option has the advantage of limiting the maximum risk possible. The disadvantage to the buyer is that the option is exercised automatically even if the option buyer would like to hold on to it in the anticipation of further favourable price changes in the underlying interest.

## Flexibly structured options

Flexibly structured options are those in which some of the terms are not standardised. When a flexibly structured option is purchased and sold, the parties have the flexibility (subject to the limits decided by the options exchange) to decide certain terms of the options. In flexibly structured options,



https://doi.org/10.1017/9781108236041.013 Published online by Cambridge University Press

some of the terms are standardised while the others are to be decided by the parties. The terms which are left to be decided by the parties are called 'variable terms'.

As an example of a flexibly structured option, a company may be able to engage in an option transaction with a maturity date of a non-standard nature. For example, the standard September Gold option may have a maturity date of 30 September , while the August option has a maturity date of 31 August. A particular company may require an option expiring on 12 September. Normally the company will have to use either the August or September option for hedging with resulting timing differences. However, if flexibly structured options are available, the company may be able to get an option with an expiry date of 12 September. In this case, the expiration date is the 'variable term'.

Normally, the options exchange itself will decide which of the terms can be treated as variable terms in a flexibly structured option. Since flexibly structured options are not standardised, there is a lesser likelihood of having a secondary market in such options. This means they are more risky in terms of marketability. Options exchanges generally fix a higher minimum monetary value for flexibly structured options. Sophisticated investors or hedgers seeking to manage highly specific portfolio or trading risks may use these options.

## Rainbow options

These are options where, in return for payment of a premium, the purchaser of the option gets the right to buy or sell the best performer out of a number of different assets. For example, a rainbow call option on stock indices might give the buyer the right to buy either the FTSE 100 index or the Standard and Poor's 500 index at predetermined prices, depending on which had performed better during the option period. This is called a two-colour rainbow option. If the same option gave the investor the right to buy the best out of three indices it would be called a three-colour rainbow option and so on. These options are relatively rare, and are custom-made OTC options.

## Real options

While this book will be dealing primarily with financial options,[4] it is important to realise that one is always surrounded by various options in real life, quite separate from the derivative markets. 'Real options' are discussed in chapter 13.

4 In the context of this paragraph, 'financial' options include options on commodities.



https://doi.org/10.1017/9781108236041.013 Published online by Cambridge University Press

# Appendix 10.1

## Options and 'complete markets'

A discussion of the theory of complete markets and its relationship to derivatives is beyond the scope of this book, but a very brief conceptual introduction may be useful.

To understand the terminology let us take the example of a bet on a die throw. If the outcome is guessed correctly you win hundred rupees (say), otherwise you lose twenty. A bet on any number is a 'state-contingent claim', often simplified to 'state claim', i.e., a claim which is contingent on the state of the world.[5] In this case, there is a state claim with payoff of a hundred rupees if that number is the outcome, and payoff of minus twenty rupees if it is not. One, two, three, four, five and six are the 'states of the world' in this example. If you feel that the next throw will be a six, then that is your 'market view' and you can place a bet accordingly. When the dice is actually thrown, the actual state of the world will materialize and you will know whether your view was correct or wrong, and depending on that, you will gain a hundred or lose twenty rupees.

States of the world can be defined even more elaborately to take into account the time, place or environment. Cricketing records are an interesting example of state-contingent measurement. Take the case of a high score by a batsman. The score may be the 'highest score ever' or the 'highest score by an opener' or the 'highest score by an opener in an overseas game' or the 'highest score by an opener on this ground' or' the highest score by an opener in the second innings' or 'the highest score by an opener in the second innings on this ground' or the 'highest score by an opener in the second innings while playing overseas' and so on.

In economic terms, the price of a good or service is always somewhat dependent on the prevailing state of the world – time, place, environment etc. It can be shown by complex mathematics that in a perfectly competitive world with perfect information and complete markets and where certain other assumptions are fulfilled, economic welfare is maximized. (Complete markets

5 The word state in this context refers to condition (e.g.,'what is the state of a person's health'), rather than to a political or geographic unit.



https://doi.org/10.1017/9781108236041.013 Published online by Cambridge University Press

imply that a market exists in every possible good or service for every possible state of the world; thus not only would there be a market for potatoes, but there would be a market for potatoes for each time,[6] place and environment.) On this basis, some influential economists argued that economic welfare is improved whenever there is an incremental move towards more complete markets and hence that the creation of new derivatives markets is, by definition, beneficial to the economy.

Derivatives have allowed all kinds of 'states of the world' to be 'bet' on or against. Futures contracts themselves introduce new (more complete) markets by allowing bets on prices at future dates. Options go even further. Options allow speculators to bet on the probability distribution of the expected future price. Other derivatives allow claims to be based on specific circumstances or combinations of circumstances, i.e., based on various states of the world.

For example, consider a pharmaceutical stock in the United States that is awaiting a crucial decision on some clinical trials by the Food and Drug Administration (FDA). The result is expected to either increase the stock price by around 30 per cent or decrease it by 30 per cent. Changes, in absolute magnitude of less than 20 per cent or more than 40 per cent are very improbable. In such a case, the futures contract with the shortest maturity (the 'nearest' futures contract) could be near the stock price, but the options at 30 per cent ITM and OTM could be more expensive than usual, and the options at 20 per cent or 40 per cent ITM/OTM could be much cheaper than usual. 'Usual' here refers to option prices calculated based on an approximately normal distribution of stock returns, whereas the return distribution expected in this special case is bimodal. Thus, not only do options allow market participants to hedge and leverage, they allow them to express very specific and unique views on each market for different states of the world.

However, the theory that derivatives markets are automatically beneficial because they incrementally lead to 'completion of markets' stands on a weak footing. The underlying assumption is that since 'complete markets' are desirable in a perfect or ideal world, any incremental improvement towards complete markets is also always good. Contrary to such an assumption propagated by some economists, other economists have shown clearly (in the 'Theory of Second Best') that if the utopian conditions of perfection are

6 And for all times in the future.

not attained, then a partial movement towards more complete markets is not necessarily beneficial and can even be harmful. Hence, one cannot conclude automatically that creating new derivatives markets is necessarily beneficial to the economy as a whole. For a detailed discussion of this topic, readers may refer to Chapter 4 of The Economics of Derivatives by Somanathan and Nageswaran, cited in the Bibliography.



https://doi.org/10.1017/9781108236041.013 Published online by Cambridge University Press