

Chapter 3

Introduction to futures and options

In recent years, derivatives have become increasingly important in the field of finance. While futures and options are now actively traded on many exchanges, forward contracts are popular on the OTC market. In this chapter we shall study in detail these three derivative contracts.

3.1 Forward contracts

A forward contract is an agreement to buy or sell an asset on a specified date for a specified price. One of the parties to the contract assumes a long position and agrees to buy the underlying asset on a certain specified future date for a certain specified price. The other party assumes a short position and agrees to sell the asset on the same date for the same price. Other contract details like delivery date, price and quantity are negotiated bilaterally by the parties to the contract. The forward contracts are normally traded outside the exchanges.

The salient features of forward contracts are:

- They are bilateral contracts and hence exposed to counter-party risk.
- Each contract is custom designed, and hence is unique in terms of contract size, expiration date and the asset type and quality.
- The contract price is generally not available in public domain.
- On the expiration date, the contract has to be settled by delivery of the asset.
- If the party wishes to reverse the contract, it has to compulsorily go to the same counterparty, which often results in high prices being charged.

However forward contracts in certain markets have become very standardized, as in the case of foreign exchange, thereby reducing transaction costs and increasing transactions volume. This process of standardization reaches its limit in the organized futures market.

Forward contracts are very useful in hedging and speculation. The classic hedging application would be that of an exporter who expects to receive payment in dollars three months later. He is exposed to the risk of exchange rate fluctuations. By using the currency forward market to sell

dollars forward, he can lock on to a rate today and reduce his uncertainty. Similarly an importer who is required to make a payment in dollars two months hence can reduce his exposure to exchange rate fluctuations by buying dollars forward.

If a speculator has information or analysis, which forecasts an upturn in a price, then he can go long on the forward market instead of the cash market. The speculator would go long on the forward, wait for the price to rise, and then take a reversing transaction to book profits. Speculators may well be required to deposit a margin upfront. However, this is generally a relatively small proportion of the value of the assets underlying the forward contract. The use of forward markets here supplies leverage to the speculator.

3.2 Limitations of forward markets

Forward markets world-wide are afflicted by several problems:

- Lack of centralization of trading,
- Illiquidity, and
- Counterparty risk

In the first two of these, the basic problem is that of too much flexibility and generality. The forward market is like a real estate market in that any two consenting adults can form contracts against each other. This often makes them design terms of the deal which are very convenient in that specific situation, but makes the contracts non-tradable.

Counterparty risk arises from the possibility of default by any one party to the transaction. When one of the two sides to the transaction declares bankruptcy, the other suffers. Even when forward markets trade standardized contracts, and hence avoid the problem of illiquidity, still the counterparty risk remains a very serious issue.

3.3 Introduction to futures

Futures markets were designed to solve the problems that exist in forward markets. A futures contract is an agreement between two parties to buy or sell an asset at a certain time in the future at a certain price. But unlike forward contracts, the futures contracts are standardized and exchange traded. To facilitate liquidity in the futures contracts, the exchange specifies certain standard features of the contract. It is a standardized contract with standard underlying instrument, a standard quantity and quality of the underlying instrument that can be delivered, (or which can be used for reference purposes in settlement) and a standard timing of such settlement. A futures contract may be offset prior to maturity by entering into an equal and opposite transaction. More than 99% of futures transactions are offset this way.

The standardized items in a futures contract are:

- Quantity of the underlying
- Quality of the underlying

Merton Miller, the 1990 Nobel laureate had said that “financial futures represent the most significant financial innovation of the last twenty years.” The first exchange that traded financial derivatives was launched in Chicago in the year 1972. A division of the Chicago Mercantile Exchange, it was called the International Monetary Market (IMM) and traded currency futures. The brain behind this was a man called Leo Melamed, acknowledged as the ‘father of financial futures’ who was then the Chairman of the Chicago Mercantile Exchange. Before IMM opened in 1972, the Chicago Mercantile Exchange sold contracts whose value was counted in millions. By 1990, the underlying value of all contracts traded at the Chicago Mercantile Exchange totaled 50 trillion dollars.

These currency futures paved the way for the successful marketing of a dizzying array of similar products at the Chicago Mercantile Exchange, the Chicago Board of Trade, and the Chicago Board Options Exchange. By the 1990s, these exchanges were trading futures and options on everything from Asian and American stock indexes to interest–rate swaps, and their success transformed Chicago almost overnight into the risk–transfer capital of the world.

Box 3.5: The first financial futures market

Table 3.1 Distinction between futures and forwards

Futures	Forwards
Trade on an organized exchange	OTC in nature
Standardized contract terms hence more liquid	Customised contract terms hence less liquid
Requires margin payments	No margin payment
Follows daily settlement	Settlement happens at end of period

- The date and the month of delivery
- The units of price quotation and minimum price change
- Location of settlement

3.4 Distinction between futures and forwards contracts

Forward contracts are often confused with futures contracts. The confusion is primarily because both serve essentially the same economic functions of allocating risk in the presence of future price uncertainty. However futures are a significant improvement over the forward contracts as they eliminate counterparty risk and offer more liquidity. Table 3.1 lists the distinction between the two.

3.5 Futures terminology

- *Spot price*: The price at which an asset trades in the spot market.
- *Futures price*: The price at which the futures contract trades in the futures market.

- *Contract cycle:* The period over which a contract trades. The index futures contracts on the NSE have one-month, two-months and three-months expiry cycles which expire on the last Thursday of the month. Thus a January expiration contract expires on the last Thursday of January and a February expiration contract ceases trading on the last Thursday of February. On the Friday following the last Thursday, a new contract having a three-month expiry is introduced for trading.
- *Expiry date:* It is the date specified in the futures contract. This is the last day on which the contract will be traded, at the end of which it will cease to exist.
- *Contract size:* The amount of asset that has to be delivered under one contract. For instance, the contract size on NSE's futures market is 200 Nifties.
- *Basis:* In the context of financial futures, basis can be defined as the futures price minus the spot price. There will be a different basis for each delivery month for each contract. In a normal market, basis will be positive. This reflects that futures prices normally exceed spot prices.
- *Cost of carry:* The relationship between futures prices and spot prices can be summarized in terms of what is known as the cost of carry. This measures the storage cost plus the interest that is paid to finance the asset less the income earned on the asset.
- *Initial margin:* The amount that must be deposited in the margin account at the time a futures contract is first entered into is known as initial margin.
- *Marking-to-market:* In the futures market, at the end of each trading day, the margin account is adjusted to reflect the investor's gain or loss depending upon the futures closing price. This is called marking-to-market.
- *Maintenance margin:* This is somewhat lower than the initial margin. This is set to ensure that the balance in the margin account never becomes negative. If the balance in the margin account falls below the maintenance margin, the investor receives a margin call and is expected to top up the margin account to the initial margin level before trading commences on the next day.

3.6 Introduction to options

In this section, we look at the next derivative product to be traded on the NSE, namely options. Options are fundamentally different from forward and futures contracts. An option gives the holder of the option the right to do something. The holder does not have to exercise this right. In contrast, in a forward or futures contract, the two parties have committed themselves to doing something. Whereas it costs nothing (except margin requirements) to enter into a futures contract, the purchase of an option requires an up-front payment.

3.7 Option terminology

- *Index options:* These options have the index as the underlying. Some options are European while others are American. Like index futures contracts, index options contracts are also cash settled.

Although options have existed for a long time, they were traded OTC, without much knowledge of valuation. The first trading in options began in Europe and the US as early as the seventeenth century. It was only in the early 1900s that a group of firms set up what was known as the put and call Brokers and Dealers Association with the aim of providing a mechanism for bringing buyers and sellers together. If someone wanted to buy an option, he or she would contact one of the member firms. The firm would then attempt to find a seller or writer of the option either from its own clients or those of other member firms. If no seller could be found, the firm would undertake to write the option itself in return for a price.

This market however suffered from two deficiencies. First, there was no secondary market and second, there was no mechanism to guarantee that the writer of the option would honor the contract.

In 1973, Black, Merton and Scholes invented the famed Black-Scholes formula. In April 1973, CBOE was set up specifically for the purpose of trading options. The market for options developed so rapidly that by early '80s, the number of shares underlying the option contract sold each day exceeded the daily volume of shares traded on the NYSE. Since then, there has been no looking back.

Box 3.6: History of options

- *Stock options*: Stock options are options on individual stocks. Options currently trade on over 500 stocks in the United States. A contract gives the holder the right to buy or sell shares at the specified price.
- *Buyer of an option*: The buyer of an option is the one who by paying the option premium buys the right but not the obligation to exercise his option on the seller/writer.
- *Writer of an option*: The writer of a call/put option is the one who receives the option premium and is thereby obliged to sell/buy the asset if the buyer exercises on him.

There are two basic types of options, call options and put options.

- *Call option*: A call option gives the holder the right but not the obligation to buy an asset by a certain date for a certain price.
- *Put option*: A put option gives the holder the right but not the obligation to sell an asset by a certain date for a certain price.
- *Option price/premium*: Option price is the price which the option buyer pays to the option seller. It is also referred to as the option premium.
- *Expiration date*: The date specified in the options contract is known as the expiration date, the exercise date, the strike date or the maturity.
- *Strike price*: The price specified in the options contract is known as the strike price or the exercise price.
- *American options*: American options are options that can be exercised at any time upto the expiration date. Most exchange-traded options are American.

- *European options*: European options are options that can be exercised only on the expiration date itself. European options are easier to analyze than American options, and properties of an American option are frequently deduced from those of its European counterpart.
- *In-the-money option*: An in-the-money (ITM) option is an option that would lead to a positive cashflow to the holder if it were exercised immediately. 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). If the index is much higher than the strike price, the call is said to be deep ITM. In the case of a put, the put is ITM if the index is below the strike price.
- *At-the-money option*: An at-the-money (ATM) option is an option that would lead to zero cashflow 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).
- *Out-of-the-money option*: An out-of-the-money (OTM) option is an option that would lead to a negative cashflow if it were exercised immediately. A call option on the index is out-of-the-money when the current index stands at a level which is less than the strike price (i.e. spot price < strike price). If the index is much lower than the strike price, the call is said to be deep OTM. In the case of a put, the put is OTM if the index is above the strike price.
- *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 $\text{Max}[0, (S_t - K)]$ 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 $\text{Max}[0, K - S_t]$, i.e. the greater of 0 or $(K - S_t)$. K is the strike price and S_t is the spot price.
- *Time value of an option*: The time value of an option is the difference between its premium and its intrinsic value. Both calls and puts have time value. An option that is OTM or ATM has only time value. Usually, the maximum time value exists when the option is ATM. The longer the time to expiration, the greater is an option's time value, all else equal. At expiration, an option should have no time value.

3.8 Futures and options

An interesting question to ask at this stage is - when would one use options instead of futures? Options are different from futures in several interesting senses. At a practical level, the option buyer faces an interesting situation. He pays for the option in full at the time it is purchased. After this, he only has an upside. There is no possibility of the options position generating any further losses to him (other than the funds already paid for the option). This is different from futures, which is free to enter into, but can generate very large losses. This characteristic makes options attractive to many occasional market participants, who cannot put in the time to closely monitor their futures positions.

Buying put options is buying insurance. To buy a put option on Nifty is to buy insurance which reimburses the full extent to which Nifty drops below the strike price of the put option. This is attractive to many people, and to mutual funds creating "guaranteed return products".

Options made their first major mark in financial history during the tulip-bulb mania in seventeenth-century Holland. It was one of the most spectacular *get rich quick* binges in history. The first tulip was brought into Holland by a botany professor from Vienna. Over a decade, the tulip became the most popular and expensive item in Dutch gardens. The more popular they became, the more Tulip bulb prices began rising. That was when options came into the picture. They were initially used for hedging. By purchasing a call option on tulip bulbs, a dealer who was committed to a sales contract could be assured of obtaining a fixed number of bulbs for a set price. Similarly, tulip-bulb growers could assure themselves of selling their bulbs at a set price by purchasing put options. Later, however, options were increasingly used by speculators who found that call options were an effective vehicle for obtaining maximum possible gains on investment. As long as tulip prices continued to skyrocket, a call buyer would realize returns far in excess of those that could be obtained by purchasing tulip bulbs themselves. The writers of the put options also prospered as bulb prices spiralled since writers were able to keep the premiums and the options were never exercised. The tulip-bulb market collapsed in 1636 and a lot of speculators lost huge sums of money. Hardest hit were put writers who were unable to meet their commitments to purchase Tulip bulbs.

Box 3.7: Use of options in the seventeenth-century

Table 3.2 Distinction between futures and options

Futures	Options
Exchange traded, with novation	Same as futures.
Exchange defines the product	Same as futures.
Price is zero, strike price moves	Strike price is fixed, price moves.
Price is zero	Price is always positive.
Linear payoff	Nonlinear payoff.
Both long and short at risk	Only short at risk.

The Nifty index fund industry will find it very useful to make a bundle of a Nifty index fund and a Nifty put option to create a new kind of a Nifty index fund, which gives the investor protection against extreme drops in Nifty. Selling put options is selling insurance, so anyone who feels like earning revenues by selling insurance can set himself up to do so on the index options market.

More generally, options offer “nonlinear payoffs” whereas futures only have “linear payoffs”. By combining futures and options, a wide variety of innovative and useful payoff structures can be created.

3.9 Index derivatives

Index derivatives are derivative contracts which derive their value from an underlying index. The two most popular index derivatives are index futures and index options. Index derivatives have become very popular worldwide. Index derivatives offer various advantages and hence have become very popular.

- Institutional and large equity-holders need portfolio-hedging facility. Index–derivatives are more suited to them and more cost–effective than derivatives based on individual stocks. Pension funds in the US are known to use stock index futures for risk hedging purposes.
- Index derivatives offer ease of use for hedging any portfolio irrespective of its composition.
- Stock index is difficult to manipulate as compared to individual stock prices, more so in India, and the possibility of cornering is reduced. This is partly because an individual stock has a limited supply, which can be cornered.
- Stock index, being an average, is much less volatile than individual stock prices. This implies much lower capital adequacy and margin requirements.
- Index derivatives are cash settled, and hence do not suffer from settlement delays and problems related to bad delivery, forged/fake certificates.

Solved Problems

Q: Which of the following cannot be an underlying asset for a financial derivative contract?

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|-----------------|---------------------|
| 1. Equity index | 3. Interest rate |
| 2. Commodities | 4. Foreign exchange |

A: The correct answer is 2

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Q: Which of the following exchanges was the first to start trading financial futures?

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|--------------------------------|--|
| 1. Chicago Board of Trade | 3. Chicago Board Options Exchange |
| 2. Chicago Mercantile Exchange | 4. London International Financial Futures and Options Exchange |

A: The correct answer is 2.

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Q: In an options contract, the option lies with the

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|-----------|-------------|
| 1. Buyer | 3. Both |
| 2. Seller | 4. Exchange |

A: The option to exercise lies with the buyer. The correct answer is number 1.

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Q: The potential returns on a futures position are:

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|--------------|--|
| 1. Limited | 3. a function of the volatility of the index |
| 2. Unlimited | 4. None of the above |

A: The correct answer is number 2.

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Q: Two persons agree to exchange 100 gms of gold three months later at Rs.400/gm. This is an example of a

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|---------------------|----------------------|
| 1. Futures contract | 3. Spot contract |
| 2. Forward contract | 4. None of the above |

A: The correct answer is number 2.

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Q: Spot value of Nifty is 2140. An investor buys a one month nifty 2157 call option for a premium of Rs.7. The option is

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|-----------------|----------------------|
| 1. in the money | 3. out of the money |
| 2. at the money | 4. None of the above |

A: The correct answer is number 3.

●●

Q: A call option at a strike of Rs.176 is selling at a premium of Rs.18. At what price will it break even for the buyer of the option?

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|-----------|-----------|
| 1. Rs.196 | 3. Rs.187 |
| 2. Rs.204 | 4. Rs.194 |

A: To recover the option premium of Rs.18, the spot will have to rise to $176 + 18$. The correct answer is number 4.

●●

Q: Typically option premium is

- | | |
|---|---|
| 1. Less than the sum of intrinsic value and time value | 3. Equal to the sum of intrinsic value and time value |
| 2. Greater than the sum of intrinsic value and time value | 4. Independent of intrinsic value and time value |

A: The correct answer is number 3.

●●

Q: A stock is currently selling at Rs.70. The call option to buy the stock at Rs.65 costs Rs.9. What is the time value of the option?

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|---------|---------|
| 1. Rs.4 | 3. Rs.3 |
| 2. Rs.5 | 4. Rs.2 |

A: The correct answer is number 1.

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Q: Spot value of S&P CNX Nifty is 2200. An investor bought a one-month S&P CNX Nifty 2220 call option for a premium of Rs.10. The options is

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|-----------------|----------------------|
| 1. In-the-money | 3. Out-of-money |
| 2. At-the-money | 4. None of the above |

A: The correct answer is number 3.

●●

Q: A stock currently sells at 120. The put option to sell the stock sells at Rs.134 costs Rs.18. The time value of the option is

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|----------|----------|
| 1. Rs.18 | 3. Rs.14 |
| 2. Rs.4 | 4. Rs.12 |

A: The correct answer is number 2.

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