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The Derivatives Market

Chapter Objectives

This chapter will enable you to develop an understanding of the following:

1. *Meaning of derivatives*
2. *Economic benefits of derivatives*
3. *History of derivatives trading*
4. *Need for financial derivatives*
5. *Types of financial derivatives*
6. *Distinctive features of the derivatives market*
7. *Exchange-traded versus OTC derivatives markets*
8. *Traders in the derivatives market*
9. *The derivatives market in India*
10. *Forwards and futures—need for futures markets, futures terminology, and pricing futures*
11. *Futures trading strategies*
12. *Options—types, salient features, terminology, option greeks, comparing futures and options, benefits of options, payoff profile of put and call options, and Black–Scholes option pricing model*
13. *Options trading strategies*
14. *Derivatives trading in India*

INTRODUCTION

Derivatives are one of the most complex of instruments. The word 'derivative' comes from the verb 'to derive.' It indicates that it has no independent value. A derivative is a contract whose value is derived from the value of another asset, known as the underlying, which could be a share, a stock market index, an interest rate, a commodity, or a currency. The underlying is the identification tag for a derivative contract. When the price of this underlying changes, the value of the derivative also changes. Without an underlying, derivatives do not have any meaning. For example, the value of a gold futures contract derives from the value of the underlying asset, *i.e.*, gold.

To understand the meaning of derivatives, let us take the example of a commodity such as cotton, which is the raw material for the textile industry. It may so happen that the price of cotton rises before and after the harvest but falls at the time of harvest. The farmer, who is exposed to such price fluctuations, can eliminate this risk by selling his harvest at a future date by entering into a forward, or futures, contract. This forward, or futures, contract takes place in the 'derivatives' market. The prices in the derivatives market are driven by the spot or cash market price of the underlying asset, which is cotton in this example.

Derivatives are very similar to insurance. Insurance protects against specific risks, such as fire, floods, and theft. Derivatives, on the other hand, take care of market risks—volatility in interest rates, currency rates, commodity prices, and share prices. Derivatives offer a sound mechanism for insuring against various kinds of risks arising in the world of finance. They offer a range of mechanisms to improve redistribution of risk, which can be extended to every product existing, from coffee to cotton and live cattle to debt instruments.

In this era of globalization, the world is a riskier place and exposure to risk is growing. Risk cannot be avoided or ignored. Man, however, is 'risk-averse.' This risk-averse characteristic of human beings has brought about growth in derivatives. Derivatives help the risk-averse individual by offering a mechanism for hedging risks.

Derivative products, several centuries ago, emerged as hedging devices against fluctuations in commodity prices. Commodity futures and options have had a lively existence for several centuries. Financial derivatives came into the limelight in the post-1970 period; today they account for 75 per cent of the financial market activity in Europe, North America, and East Asia. The basic difference between commodity and financial derivatives lies in the nature of the underlying instrument. In commodity derivatives, the underlying is a commodity; it may be wheat, cotton, pepper, turmeric, corn, oats, soyabeans, orange, rice, crude oil, natural gas, gold, silver, and so on. In financial derivatives, the underlying includes treasuries, bonds, stocks, stock index, foreign exchange, and currency.

The market for financial derivatives has grown tremendously both in terms of variety of instruments and turnover. Derivatives can be futures, options, swaps, forwards, puts, calls, swap options, and index-linked derivatives. The value of the underlying assets of these derivatives is more than USD 16 trillion (more than ₹50 lakh crore), which is about three times the value of stocks traded on the New York Stock Exchange (NYSE) and twice the size of the United States GDP. The explosive growth of derivatives in the developed centuries is fuelled by the following:

- The increased volatility in global financial markets.
- The technological changes enabling cheaper communications and computing power.
- Breakthrough in modern financial theory, providing economic agents a wider choice of risk management strategies and instruments that optimally combine the risk and returns over a large number of financial assets.
- Political developments, wherein the role of the government in the economic arena has become more of a facilitator and less of a prime mover. Thus, the move towards market-oriented policies and the deregulation in financial markets has led to an increase in financial risk at the individual participants' level.
- Increased integration of domestic financial markets with international markets.

Economic Benefits of Derivatives

Benefits of Derivatives

- Reduce risk.
- Enhance liquidity of the underlying asset.
- Lower transaction costs.
- Enhance price discovery process.
- Portfolio Management
- Provide signals of market movements.
- Facilitates financial markets integration.

- Derivatives reduce risk and thereby increase the willingness to hold the underlying asset. They enable hedging, which is the prime social rationale for future trading. Hedging is also the equivalent of insurance facility against risk from market price fluctuations.
- Derivatives enhance the liquidity of the underlying asset market. A liquid market is a market with enough trading activity to allow traders to readily trade goods for a price that is close to its true value. The trading volume increases in the underlying market as derivatives enable participation by a large number of players.
- Derivatives lower transaction costs. These costs associated with trading a financial derivative are substantially lower than the cost of trading the underlying instrument.
- Derivatives enhance the price discovery process. Price discovery is the revealing of information about future cash market prices through the futures market. The prices in the derivatives market reflect the perception of market participants about the future, and lead the prices of the underlying to the perceived future level. The prices of derivatives converge with the prices of the underlying at the expiration of a derivatives contract. Thus, derivatives help in the discovery of future as well as current prices.
- Derivatives can help the investors to adjust the risk and return characteristics of their stock portfolio carefully. For instance, a risky stock and a risky option may be combined to form a riskless portfolio. They also provide a wide choice of hedging structures each with a unique risk/return profile to meet the exact requirements of each market participant.
- Derivatives provide information on the magnitude and the direction in which various market indices are expected to move. The cash markets lookout to the futures market for signals that could give market players information as to where the markets are heading. The measures that are widely tracked by the markets include Nifty discounts, which implies a lower value for Nifty futures contract compared to the cash price; open interest outstanding which is the total number of shares outstanding in the futures market; put–call ratios, which is the ratio of put options outstanding for every call option; and FII purchases and sales in the derivatives segment.

Derivatives Defined Under the Securities Contracts (Regulation) Act, 1956

The Securities Contracts (Regulation) [Act SC(R)A], 1956, defines derivatives in the following manner. Derivatives include the following:

- 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.
- A contract which derives its value from the prices or index of prices of underlying securities.

History of Derivatives Trading

Forward delivery contracts, stating what is to be delivered for a fixed price at a specified place on a specified date, existed in ancient Greece and Rome. Roman emperors entered forward contracts to provide the masses with their supply of Egyptian grain. These contracts were also undertaken between farmers and merchants to eliminate the risk arising out of uncertain future prices of grains. Thus, forward contracts have existed for centuries for hedging price risk.

The first organized commodity exchange came into existence in the early 1700s in Japan. The first formal commodities exchange, the Chicago Board of Trade (CBOT), was formed in 1848 in the US to deal with the problem of 'credit risk' and to provide centralized location to negotiate forward contracts. From 'forward' trading in commodities emerged the commodity 'futures.' The first futures type contract was called 'to arrive at.' Trading in futures began on the CBOT in the 1860s. In 1865, CBOT listed the first 'exchange-traded' derivatives contracts, known as the futures contracts. Futures trading grew out of the need for hedging the price risk involved in many commercial operations. The Chicago Mercantile Exchange (CME), a spin-off of CBOT, was formed in 1919, though it did exist before in 1874 under the names of 'Chicago Produce Exchange' and 'Chicago Butter and Egg Board.' The first financial futures to emerge were the currency futures in 1972 in the US. The first foreign currency futures contracts were traded on May 16, 1972, on the International Monetary Market (IMM), a division of the CME. The currency futures traded on the IMM were the British pound, the Canadian dollar, the Japanese yen, the Swiss franc, the German mark, the Australian dollar, and the euro-dollar. Currency futures were followed soon by interest rate futures. Interest rate futures contracts were traded for the first time on the CBOT on October 20, 1975. Stock Index futures and options emerged in 1982. The first stock index futures contracts were traded on Kansas City Board of Trade on February 24, 1982.

The first of the several networks, which offered a trading link between two exchanges, was formed between the Singapore International Monetary Exchange (SIMEX) and the CME on September 7, 1984.

Options are as old as futures. Their history also dates back to ancient Greece and Rome. The first account of options and its creator, Thales was published in Aristotle's *Polities* in 332 BC. Thales used a small amount of money to secure the right to use olive presses during harvest season. During olive-picking time, he sold his options for a great deal more than he paid for them.

Options were very popular with speculators in the tulip craze of seventeenth century Holland. Tulips, the brightly coloured flowers, were a symbol of affluence; owing to a high demand, tulip bulb prices shot up. Dutch growers and dealers traded in tulip bulb options. There was so much speculation that people even mortgaged their homes and businesses. These speculators were wiped out when the tulip craze collapsed in 1637 as there was no mechanism to guarantee the performance of the option terms.

The first puts and calls options were invented by an American financier, Russel Sage, in 1872. These options were traded over the counter. Agricultural commodities options were traded in the nineteenth century in England and the US. Options on shares were available in the US on the over-the-counter (OTC) market only until 1973 without much knowledge of valuation. A group of firms known as Put and Call Brokers and Dealers' Association was set up in early 1900s to provide a mechanism for bringing buyers and sellers together.

On April 26, 1973, the Chicago Board Options Exchange (CBOE) was set up at the CBOT for the purpose of trading stock options. It was in 1973 again that Black, Merton, and Scholes invented the famous Black–Scholes option formula. This model helped in assessing the fair price of an option which led to an increased interest in trading of options. With the options markets becoming increasingly popular, the American Stock Exchange (AMEX) and the Philadelphia Stock Exchange (PHLX) began trading in options in 1975.

The market for futures and options grew at a rapid pace in the 1980s and 1990s. The collapse of the Bretton Woods regime of fixed parities and the introduction of floating rates for currencies in the international financial markets paved the way for development of a number of financial derivatives, which served as effective risk management tools to cope with market uncertainties.

The CBOT and the CME are the two largest financial exchanges in the world on which futures contracts are traded. The CBOT now offers 48 futures and options contracts (with the annual volume at more than 211 million in 2001). The CBOE is the largest exchange for trading stock options. The CBOE trades options on the S&P 100 and the S&P 500 stock indices. The Philadelphia Stock Exchange is the premier exchange for trading foreign exchange options.

The most traded stock indices include S&P 500, the Dow Jones Industrial Average, the Nasdaq 100, the Nikkei 225. The US indices and the Nikkei 225 trade almost round the clock. The N225 is also traded on the Chicago Mercantile Exchange.

Eurex, the German Swiss derivatives exchange, was the world's biggest financial futures exchange at the end of 2001. Eurex closed 2001 with a record volume of more than 556 million contracts accounting for a 18.8 per cent share among the international futures and options exchanges. Chicago Mercantile Exchange (CME), the biggest US futures market, was the next in line, trading 333 million contracts in 2001 (11.3 per cent share) while the CBOE traded 276 million contracts and London's International Financial Futures Exchange (LIFFE) traded 177 million contracts.

History of Derivatives: A Time Line

The Ancient: Derivatives

1400s	Japanese rice futures
1600s	Dutch tulip bulb options
1800s	Puts and calls options

The Recent: Financial Derivatives Listed Markets

1972	Financial currency futures
1973	Stock options
1977	Treasury bond futures
1981	Eurodollar futures
1982	Index futures
1983	Stock index options
1990	Foreign index warrants and leaps
1991	Swap futures
1992	Insurance futures
1993	Flex options

OTC Markets

1981	Currency swaps
1982	Interest rate swaps
1983	Currency and bond options
1987	Equity derivatives markets
1988	Hybrid derivatives

Source: Fortune India, September 16–30, 1993, p. 5.

Major Derivatives Exchanges

Exchange	*Underlying*	*Exchange*	*Underlying*
American Stock Exchange	Hang Seng, Nikkei	Manila International Futures Exchange	Sugar, Soyabean, Coffee
Chicago Board Options Exchanges	NASDAQ 100, S&P 100, S&P 500	Mid-America Commodity Exchange	Silver, Wheat, Treasury Bonds
Chicago Board of Trade	Corn, Oats, Wheat, Silver, Treasury Bonds, Treasury Notes, Municipal Bonds Index	Minneapolis Grain Exchange	Wheat
		Osaka Futures Exchange	Nikkei
		New York Cotton Exchange	Cotton
Chicago Mercantile Exchange	Cattle, Hog, Treasury Bills, LIBOR, Eurodollar Yen, Deutsch Mark, Canadian Dollar, Franc Sterling, S&P 500 Index, S&P Midcap 400 Nikkei-225	New York Futures Exchange	NYSE Composite Index
		New York Mercantile Exchange	Platinum, Palladium, Crude Oil, Gasoline, Natural Gas
		New York Stock Exchange	Select Scripts
Commodity Exchange	Copper, Gold, Silver, Eurotop100 Index	New Zealand Futures Exchange	Barclays-5-year NZ $ Bonds, NZ $ Bank Bills
Coffee Sugar & Cocoa Exchange	Cocoa, Coffee, Sugar, Cotton	Pacific Stock Exchange	Select Scrips
		Philadelphia Stock Exchange	Select Scrips, Gold, Silver
Hong Kong Futures Exchange	Hang Seng, Gold	Singapore International Monetary Exchange	Nikkei 225, Yen, Deutsche Mark, Eurodollar
International Petroleum Exchange of London	Brent Crude, Gas Oil	Sydney Futures Exchange	All Ordinaries Share Price Index.
Kansas City Board of Trade	Wheat, KC Value Line Index	Tokyo Stock Exchange	10-Year Yen Bonds
London International Financial Futures Exchange	Sterling, Long Gilt, Euromark, Euroswiss	Winnipeg Commodity Exchange	Barley, Canola, Flaxseed, Wheat
	German Government Bonds, Italian Govt. Bonds		

Source: Business Today, March 22, April 6, 1995, pp. 170.

Need for Financial Derivatives There are several risks inherent in financial transactions and asset liability positions. Derivatives are risk-shifting devices; they shift risk from those 'who have it but may not want it' to 'those who have the appetite and are willing to take it.'

- Derivatives are a mechanism to hedge market, interest rate, and exchange rate risks.

The three broad types of price risks are as follows:

- **Market risk:** Market risk arises when security prices go up due to reasons affecting the sentiments of the whole market. Market risk is also referred to as 'systematic risk' since it cannot be diversified away because the stock market as a whole may go up or down from time to time.
- **Interest rate risk:** This risk arises in the case of fixed income securities, such as treasury bills, government securities, and bonds, whose market price could fluctuate heavily if interest rates change. For example, the market price of fixed income securities could fall if the interest rate shot up.
- **Exchange rate risk:** In the case of imports, exports, foreign loans or investments, foreign currency is involved which gives rise to exchange rate risk.

To hedge these risks, equity derivatives, interest rate derivatives, and currency derivatives have emerged.

Types of Financial Derivatives

In recent years, derivatives have become increasingly important in the field of finance. Forwards, futures, options, swaps, warrants, and convertibles are the major types of financial derivatives. A complex variety of composite derivatives, such as swaptions, have emerged by combining some of the major types of financial derivatives.

- **Forwards:** A forward contract is a contract between two parties obligating each to exchange a particular good or instrument at a set price on a future date. It is an over-the-counter agreement and has standardized market features.
- **Futures:** Futures are standardized contracts between the buyers and sellers, which fix the terms of the exchange that will take place between them at some fixed future date. A futures contract is a legally binding agreement. Futures are special types of forward contracts which are exchange traded, that is, traded on an organized exchange. The major types of futures are stock index futures, interest rate futures, and currency futures.
- **Options:** Options are contracts between the option writers and buyers which obligate the former and entitles (without obligation) the latter to sell/buy stated assets as per the provisions of contracts. The major types of options are stock options, bond options, currency options, stock index options, futures options, and options on swaps.

  Options are of two types: calls and puts. A call option gives a buyer/holder a right but not an obligation to buy the underlying on or before a specified time at a specified price (usually called strike/exercise price) and quantity. A put option gives a holder of that option a right but not an obligation to sell the underlying on or before a specified time at a specified price and quantity.
- **Warrants:** Warrants are long-term options with three to seven years of expiration. In contrast, stock options have a maximum life of nine months. Warrants are issued by companies as a means of raising finance with no initial servicing costs, such as dividend or interest. They are like a call option on the stock of the issuing firm. A warrant is a security with a market price of its own that can be converted into a specific share at a predetermined price and date. If warrants are exercised, the issuing firm has to create a new share which leads to a dilution of ownership. Warrants are sweeteners attached to bonds to make these bonds more attractive to the investor. Most of the warrants are detachable and can be traded in their own right or separately. Warrants are also available on stock indices and currencies.
- **Swaps:** Swaps are generally customized arrangements between counterparts to exchange one set of financial obligations for another as per the terms of agreement. The major types of swaps are currency swaps, and interest-rate swaps, bond swaps, coupon swaps, debt–equity swaps.
- **Swaptions:** Swaptions are options on swaps. It is an option that entitles the holder the right to enter into or cancel a swap at a future date. Swaptions become operative at the expiry of the options. Instead of having calls and puts, swaptions have receiver swaption (an option to receive fixed and pay floating) and a payer swaption (an option to pay fixed and receive floating).

Distinctive Features of the Derivatives Market

- The derivatives market is like any other market,
- It is a highly leveraged market in the sense that loss/profit can be magnified compared to the initial margin. The investor pays only a fraction of the investment amount to take an exposure. The investor can take large positions even when he does not hold the underlying security.
- Market view is as important in the derivatives market as in the cash market. The profit/loss positions are dependent on the market view. Derivatives are double-edged swords.
- Derivatives contracts have a definite lifespan or a fixed expiration date. They are primarily a tool to employ short-term expectations about a stock or an index to hedge or trade.
- The derivatives market is the only market where an investor can go long and short on the same asset at the same time.
- Derivatives carry risks that stocks do not. A stock loses its value in extreme circumstances, while an option loses its entire value if it is not exercised.
- Derivatives contracts are flexible as they allow investors to translate a particular view into a variety of different trades, depending on their risk appetite and availability of capital. Suppose an investor is bullish on Infuses, then he can either buy Infuses futures or buy a call option or sell a put option. Moreover, investors can capitalise on a bearish view as well as either by selling futures or buying a put, or writing a call.
- Margin-based trading makes trading in derivative products attractive. The margin requirement is about 12 per cent for futures and 8 per cent for options. One can trade in derivatives by paying just a small fraction of the total value. So, by depositing, say ₹25,000, it may be possible to trade in Nifty futures worth ₹2 lakh.

Exchange-traded Versus OTC Derivatives Markets

There has been a sharp growth of around 40 per cent a year in the OTC derivatives markets globally. In the OTC market transactions take place via telephone, fax, and other electronic means of communication as opposed to the trading floor of an exchange. Information Technology (IT) has enabled this fast growth in the OTC derivatives markets. OTC derivatives contracts are more flexible than exchange-traded contracts. However, OTC derivatives markets are characterized by the absence of formal rules for risk (a prerequisite for market stability and integrity), the absence of formal centralized limits or individual positions, leverage or margining, and the absence of a regulatory authority. Moreover, certain features of OTC derivatives markets, such as the dynamic nature of gross/credit exposures, information asymmetries, the effect of OTC derivative activities on available aggregate credit, high concentrations of OTC derivative activities in major institutions, and the central role of OTC derivatives markets in the global financial system, give rise to instability in institutions, markets, and financial systems. The highly leveraged institutions and their OTC derivative positions were the main cause of turbulence in financial markets in 1998. Indian law considers OTC derivatives as illegal. The L. C. Gupta Committee on derivatives has recommended only exchange-traded derivatives and made no reference of OTC derivatives.

Traders in Derivatives Market

Traders in Derivatives Market

- Enable smooth functioning of the market.
- Provide liquidity and depth to the market.
- Enable price discovery.

There are three types of traders in the derivatives market:

- Hedger
- Speculator
- Arbitrageur

Hedger A hedge is a position taken in order to offset the risk associated with some other position. A hedger is someone who faces risk associated with price movement of an asset and who uses derivatives as a means of reducing that risk. A hedger is a trader who enters the futures market to reduce a pre-existing risk.

Speculator While hedgers are interested in reducing or eliminating risk, speculators buy and sell derivatives to make profit and not to reduce risk. Speculators willingly take increased risks. Speculators wish to take a position in the market by betting on the future price movements of an asset. Futures and options contracts can increase both the potential gains and losses in a speculative venture. Speculators

are important to derivatives markets as they facilitate hedging, provide liquidity, ensure accurate pricing, and help to maintain price stability. It is the speculators who keep the market going because they bear risks which no one else is willing to bear.

Arbitrageur An arbitrageur is a person who simultaneously enters into transactions in two or more markets to take advantage of the discrepancy between prices in these markets. For example, if the futures price of an asset is very high relative to the cash price, an arbitrageur will make profit by buying the asset and simultaneously selling futures. Hence, arbitrage involves making profits from relative mispricing. Arbitrageurs also help to make markets liquid, ensure accurate and uniform pricing, and enhance price stability.

All three types of traders and investors are required for a healthy functioning of the derivatives market. Hedgers and investors provide economic substance to this market, and without them the markets would become mere tools of gambling. Speculators provide liquidity and depth to the market. Arbitrageurs help in bringing about price uniformity and price discovery. The presence of hedgers, speculators, and arbitrageurs, not only enables the smooth functioning of the derivatives market, but also helps in increasing the liquidity of the market.

FORWARDS AND FUTURES

Forward Contracts

A forward contract is a customized contract between two parties where settlement takes place on a specific date in the future at a price agreed today. They are over-the-counter traded contracts. Forward contracts are private agreements between two financial institutions or between a financial institution and its corporate client.

- A forward contract is an over-the-counter customised agreement between two parties obligating each to exchange a particular good or instrument at a set price on a future date.

In a forward contract, one party takes a long position by agreeing to buy the asset at a certain specified date for a specified price and the other party takes a short position by agreeing to sell the asset on the same date for the same price.

The main features of forward contracts are as follows:

- They are bilateral contracts wherein all the contract details, such as delivery date, price, and quantity, are negotiated bilaterally by the parties to the contract. Being bilateral in nature, they are exposed to counter-party risk.
- Each contract is custom designed in the sense that the terms of a forward contract are individually agreed between two counter-parties. Hence, each contract is unique in terms of contract size, expiration date, and the asset type and quality.
- As each contract is customized, the contract price is generally not available in public domain.
- The contract has to be settled by delivery of the asset on the expiry date.
- In case, the party wishes to reverse the contract, it has to compulsorily approach the same counter-party, which being in a monopoly situation can command a high price.

Forward markets for some goods are highly developed and have standardized market features. Some forward contracts do have liquid markets. In particular, the forward foreign exchange market and the forward market for interest rates are highly liquid. Forward contracts' dominance is very high for the purposes of hedging foreign exchange exposures, particularly in Europe. Forward contracts help in hedging risks arising out of foreign exchange rate fluctuations. For instance, an exporter who expects to receive payments in dollars three months later can sell dollars forward and an importer who is required to make payment in dollars can buy dollars forward, thereby reducing their exposure to exchange-rate fluctuations.

Forward markets are not free from limitations. As these contracts are customized, they are non-tradeable. Moreover, there is a possibility of default by any one party to the transaction and this gives rise to counter-party risk which is a very serious issue worldwide.

- Futures are exchange-traded standardized contracts between two parties obligating each to exchange a particular good or instrument at an agreed price on a future date.

Futures Contracts

Futures are exchange-traded contracts, or agreements, to buy or sell a specified quantity of financial instrument/commodity in a designated future month at a price agreed upon by the seller and buyer. Futures contracts have certain standardized specifications, such as the following:

- Quantity of the underlying.
- Quality of the underlying (not required in financial futures).

- Date and month of delivery.
- Units of price quotation (not the price itself) and minimum change in price (tick size). A tick is a change in the price of a contract be it up or down.
- Location of settlement.

Futures is a type of forward contract. The structure, pay-off profile, and basic utility for both futures and forward are the same. However, futures contracts differ from forward contracts in several ways.

- Futures are exchange-traded contracts, while forwards are OTC contracts, not traded on a stock exchange.
- Futures contracts being traded on exchanges are standardized, that is, have terms standardized by the exchange. Only the price is negotiated. In contrast, all elements of forward contracts are negotiated and each contract is customized, that is, all the terms of a forward contract are individually agreed between two parties.
- Futures markets are transparent while the forward markets are not transparent, as forwards are over-the-counter instruments. The latter are private bilateral agreements and as these agreements are not visible to other parties, the forward market is not transparent. In futures market, everyone can see the prices available as they are exchange traded.
- Futures contracts are usually more liquid than forward contracts, because they are standardized and traded on futures exchanges. In contrast, most forward contracts, due to their customized nature, are less liquid.
- Futures contracts frequently involve a range of delivery dates whereas there is generally a single delivery date in a forward contract.
- Futures contracts are marked-to-market daily whereas forward contracts are not.
- Profits and losses on a futures contract are realized on a daily basis (via the marking to market process). The profit or loss from a forward is realized when the contract matures.
- Most futures contracts are closed prior to delivery whereas a forward contract is not usually settled until the end of its life. Hence, futures allow flexibility as to the date of closing out. Most forward contracts do lead to delivery of the physical onset or a cash settlement as they are not typically tradeable.
- A futures contract can be reversed with any member of the exchange whereas a forward contract can be reversed only with the same counter-party.
- The futures trading system has effective safeguards against defaults. Futures do not carry a credit risk, as there is a clearing house, which guarantees both payment and delivery. Forward contracts, on the other hand, are exposed to default risk by a counter-party as there is no such clearing house involved.
- Futures markets are regulated by a financial regulator, while forward contracts, in general, trade in an unregulated market.

Thus, forwards and futures are basically similar concepts. They differ only in terms of the institutional setting in which they trade, the degree of flexibility, and cost efficiency. Futures are recognized as the best and most cost-efficient way of risk hedging.

Need for Futures Markets

Futures markets exist for several reasons.

- Futures allow hedging against adverse price changes. Hedgers transfer price risk to speculators who willingly undertake risk to take advantage of fluctuations in prices.
- Futures help in price-discovery. By observing the current futures price, producers and consumers can estimate what the future spot price will be or what future supply and demand of a good will be.
- Futures prices contain and reflect information which helps in optimal allocation of resources.
- Futures make transactions across time easier, speedier, and less costly.

Futures Terminology

- *Futures:* A forward contract traded on an exchange.
- *Long:* A party is said to be long on an instrument when he or she owns the instrument. An investor who purchases stock with his own capital is said to be long stock. A long position indicates a net over bought position.

- *Short: A* party is said to be short if he or she has sold the contracts. An investor who sells a stock that he does not currently own is short stock. Short positions indicate an over-sold position.
- *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.
- *Expiry date:* The last day on which the contract will be traded, at the end of which it will cease to exist. The expiry day is the last Thursday of the expiry month or the previous trading day if the last Thursday is a trading holiday.
- *Contract size:* The amount of asset that has to be delivered under one contract. For instance, the contract size on the NSE's futures market is 200 Nifties.
- *Contract cycle:* The period over which a contract trades. The index futures contracts on the NSE have one (near) month, two (next) months and three (far) months expiry cycles which expire on the last Thursday of the month. On the Friday following the last Thursday, a new contract having a three-month expiry would be introduced for trading.
- *Marking-to-market:* The practice of periodically adjusting a margin account by adding or subtracting funds based on changes in market value to reflect the investors' gain or loss. This is to ensure there are no defaults.
- *Margin:* An amount of money deposited by both buyers and sellers of futures contracts to ensure performance of the terms of the contract. The aim of margin money is to minimize the risk of default by either counter-party. The payment of margin ensures that the risk is limited to the previous day's price movement on each outstanding position. However, even this risk is offset by the initial margin holdings. There are different types of margins such as initial margin, variation margin, maintenance margin and additional margin.
- *Initial margin:* The amount that must be deposited in the margin account at the time a futures contract is first entered into. The purpose of initial margin is to cover the largest potential loss in one day. Both buyer and seller have to deposit margins. The technique of value-at-risk (VaR) is used for calculating this margin. This margin is calculated on the basis of variance observed in daily price of the underlying over a specified historical period. The margin is kept in a way that it covers price movements more than 99 per cent of the time. Usually three sigma (standard deviation) is used for this measurement.
- *Maintenance margin:* The amount that is set aside to ensure that the balance in the margin account never becomes negative is called maintenance margin. It is usually lower than the initial margin. If the balance in the margin account falls below the maintenance margin, the investor receives a margin call.
- *Variation or mark-to-market margin:* The amount that is deposited as a further collateral to meet daily losses. This margin is required by the close of business, the following day. Any profits on the contract are credited to the client's variation margin account.
- *Additional margin:* The amount that may be called for by the exchange in case of sudden higher-than-expected volatility. This is a preemptive move by the exchange to prevent breakdown.
- *Hedge ratio:* The number of futures contracts required to buy or sell to offset risk. If the instrument to be hedged shows high volatility, then a larger number of future contracts are required than in the case of a more stable instrument. This depends on the value of a futures contract, value of the portfolio to be hedged, and sensitivity of the movement of the portfolio price to that of the index called beta. The hedge ratio is closely linked to the correlation between the asset (portfolio of shares) to be hedged and the underlying (index) from which futures is derived. When a stock index futures contract is used to hedge a position in a portfolio of stocks or a position in an individual stock, the optimal number of futures contracts is equal to the beta of the position times the ratio of the value of the portfolio to the futures contract price.
- *Closing out contracts:* A long position in futures can be closed out by selling futures while a short position in futures can be closed out by buying futures on the exchange. The net difference is settled in cash without any delivery of the underlying. Most contracts are not held till expiry, but closed out before that. If held until expiry, some are settled for cash and others for physical delivery.
- *Basis:* The difference between spot price of an asset and its futures price. Even through the spot and futures prices generally move in tandem with each other, the basis is not constant. Changes in interest rates or expected dividends cause unexpected changes in basis. Unexpected changes in basis render hedges imperfect. Basis decreases with time and, on expiry, it is zero, and futures price equals spot price.
- *Contango:* Under normal market conditions, futures contracts are priced above the expected future spot price. This is known as contango.

- *Backwardation:* When futures price prevail below the expected future spot price, it is known as backwardation. This situation may prevail when the cost of carry is negative or when the underlying asset is in short supply in the cash market but there is an expectation of increased supply in future.
- *Maturity periods for futures contracts:* In India, there are different maturity periods for the futures contract—one, two, and three months with the last Thursday of the month serving as expiry date. Suppose at the end of July the one-month contract comes to an end, the August contract automatically becomes a one-month contract, the September contract, a two-month contract and the October contract, a three-month contract. In the futures market, the broker through whom the futures was bought has to be retained throughout the contract or till the conclusion of the contract.
- *Settlement basis:* The settlement basis is mark-to-market and final settlement is cash settled on T + 1 basis.
- *Settlement price:* Daily settlement price is the closing price of the futures contracts for the trading day and the final settlement price is the closing price of the underlying asset on the last trading day.

Role of Clearing House/Corporation

A clearing house/corporation acts as a counter-party to all deals in the derivatives market and guarantees settlement. A clearing corporation performs full novation, that is, it interposes itself between both legs of every trade, becoming the legal counter-party to both or alternatively provides an unconditional guarantee for settlement of all trades. It matches the transactions, reconciles sales and purchases, and does daily settlement. It also undertakes risk management of its members and carries on inspection, surveillance, and so on. Besides collecting margin capital, it also monitors the net worth requirements of the members.

The National Securities Clearing Corporation Limited (NSCCL) undertakes clearing and settlement of all deals executed on the NSE's F&O (derivatives) segment. NSCCL has an online position monitoring system which monitors all clearing members' open positions on a real time basis.

Pricing Futures

- Factors that affect futures prices are the spot price, expected future spot price, the basis, the spreads, and the cost of storage.

The study of futures prices is essential for understanding all features of the futures market. Futures prices bear important relationships with the spot price, expected future spot price, the basis, the spreads, and the cost of storage. These are fundamental factors that affect futures prices.

Spot Price The price of a good for immediate delivery. It is also referred to as the cash price or the current price.

Basis The difference between cash price and the futures prices of a particular good.

$$\text{Basis} = \text{Current cash price} - \text{Futures price}$$

As the futures contract approaches maturity, the basis narrows. At the maturity of the futures contract, the basis is zero. This behaviour of the basis over time is known as convergence, *i.e.*, convergence of futures price towards the spot price. The basis is much more stable than the futures price or the cash price. The futures price or the cash price may vary widely when considered in isolation, but basis tends to be relatively stable. Hence, basis is important for speculation and hedging. Arbitrage opportunities can also arise if the basis during the life of a contract is incorrect.

Spreads A spread is the difference between two futures prices. Spreads may be classified as intra-commodity spread and inter-commodity spread. If the two futures prices that form a spread are futures prices for futures contracts on the same underlying good but with different expiration dates, the spread is an intra-commodity spread. An intra-commodity spread indicates the relative price differentials for a commodity to be delivered at two points in time. If two futures prices that form a spread are futures prices for two underlying goods, such as silver futures and gold futures, then the spread is an inter-commodity spread.

Spreads are important for speculators. Spreads are more stable when compared to futures prices. Arbitrage opportunities can arise if the spreads are incorrect.

Expected Future Spot Price The expectations of market participants also help in determining the futures prices. If market participants believe that silver will sell for ₹7,000 per kg in three months, then the price of the futures contract for delivery of silver in three months cannot be ₹9,000 per kg.

Cost of Storage The price for storing the good underlying the futures contract also affects futures prices. The cost of storing is the cost of storing the underlying good from the present to the delivery date. It is the cost of carry related arbitrage that drives the behaviour of the futures prices.

Cost of Carry Model of Futures Prices The cost of carry model determines futures prices in such a way that no arbitrage opportunities arise.

The assumptions of this model are as follows:

- Markets are perfect
- All assets are infinitely divisible
- There are no transaction costs
- No bid-ask spread exists
- There are no restrictions on short selling
- Forward and futures prices are equal
- Borrowing and lending rates are equal
- There are no limitations to storing

The price of the contract defined under this model is:

$$F = S + C$$

$$\text{Futures price} = \text{Spot price} + \text{Carry costs}$$

The above equation can also be expressed as:

$$F = S\,(1+r)^T$$

where

F = Futures prices
S = Spot price
r = Cost of financing
T = Time till expiration

If the above equation holds true, then there will be no arbitrage opportunities. If $F < S\,(1+r)^T$ or $F > S\,(1+r)^T$, arbitrage opportunities would exist.

Carrying costs are the total costs to carry an asset forward in time. In other words, they are costs incurred for buying and holding on to the deliverable asset. The components of carrying costs are storage costs, insurance costs, transportation costs, and financing costs. Storage cost is the cost of warehousing the asset. Insurance cost is the cost of protecting the asset against fire, water, and other dangers. Transportation cost is the cost of transporting the asset to different locations. Financing cost is the cost of financing the asset. The cost of financing may be interest on borrowings for financing the asset.

- Carrying costs are costs incurred for buying and holding on to the deliverable asset. They include storage, insurance transportation, and financing costs.

These components may vary with contracts on different times and may even be negative. The holding cost for commodity futures is a sum total of all the four components. In the case of some financial futures, such as equity futures, the holding cost is the cost of financing minus the carry return. The carry return consists of the future value of the cash inflows that the deliverable asset provides to its holder. For example, dividend returns, actual or accrued interest income, and so on. Hence, for some financial futures,

$$F = S + C - CR$$

where CR = Carry return.

The cost of carry model gives a good idea about the futures price but does not provide a complete determination of futures prices due to market imperfections.

Cost of Carry Model for Stock Index Futures

Stock index futures gives its owner the right and obligation to buy or sell the portfolio of stocks characterized by the index. Stock index futures are cash settled as there is no delivery of the underlying stock. Equity index futures differ from commodity futures in two ways. No costs of storage are involved in holding equity and equity comes with a dividend stream, which is a negative cost if the investor is long the

stock and a positive cost if the investor is short the stock. Hence, stock index futures face one complication, namely, dividends. Therefore, in stock index futures,

$$\text{Cost of carry} = \text{Financing cost} - \text{Dividends}$$

where financing cost is the cost of financing the purchase of the portfolio underlying the index; dividends are the present value of dividends obtained from the stocks in the index portfolio. As dividends are a crucial aspect of stock index futures, there should be an accurate forecast of dividends. If the dividend flow throughout the year is uniform, then it would be easier to calculate the annual dividend yield. Index futures, therefore, can be priced when given the expected dividend yield.

$$F = S[1 + (r - d)^T]$$

where

F = Futures prices of index
S = Spot index value
r = Cost of financing
d = Expected dividend yield on the index portfolio
T = Number of days in the funding period, that is, n/365 days or n/12 months

The excess of the financing cost of holding the stock over the dividend receipts constitutes the net cost of carry.

Consider a one-month futures contract traded on the NSE. The spot value of Nifty is ₹1,150. The cost of financing is 11 per cent per annum and the Nifty gives a dividend yield of 1 per cent per annum. The fair value of the futures contract is $= 1{,}150\ [(1 + (0.11 - 0.01)^{12}] = ₹1{,}159$.

A steady rise in cost of carry is a bullish signal as it suggests investors are ready to incur this extra cost for buying long positions. In other words, it suggests creation of long positions in stock futures using index futures as a hedging tool (short position)

FUTURES TRADING STRATEGIES

Strategies are game plans created by an investor. These game plans are based on an investor's expectations of how the market will move. Usually, there are four views that an investor can take on market movements: bullish, bearish, volatile, and neutral.

Bullish: The investor anticipates a price rise.

Bearish: The investor anticipates a price decline.

Volatile: The investor anticipates a significant and rapid movement either in the market or scrip but he is not clear of the direction of the movement.

Neutral: The investor believes that market or scrip will not move significantly in any direction. It is opposite of the volatile view.

Different strategies are available for different views on market movements. These strategies can be classified into three groups as follows:

- Hedging strategies
- Speculative trading strategies
- Arbitrage strategies

Hedging with Index Futures

Futures contracts in India are available on two stock indices—the S&P CNX Nifty and the BSE Sensex. A hedge reduces the price risk of an existing or anticipated position in the cash market. A hedge can help lock in existing profits. Hedging does not mean maximization of return! Its purpose is to reduce the volatility of a portfolio by reducing the risk. Stock index futures are used to reduce stock market risk in the anticipation that any losses arising from movements in stock prices are offset by gains from parallel movements in futures prices. Hedgers sell futures when they are long the cash asset and buy futures when they are short the cash asset.

In stock index futures, there is no delivery and receipt of stock. Stock index futures contracts are cash settled.

It is necessary to know the beta of a stock to measure the extent to which it moves in line with the market index. The market index is assumed to have a beta (P) one (1). A stock with a beta of 0.5 is half as volatile as the market index and a stock with 2 is one with double the degree of volatility. If the P of a

stock is 1.2, then the stock tends to change by 20 per cent more than the stock index. The relatively large losses (or profits) arising from high volatility require correspondingly large offsetting profits (or losses) from futures contracts and thus a large number of futures contracts.

Stock index futures are of immense importance to mutual funds.

Some examples where hedging strategies are useful for mutual funds are as follows:

- Reducing the equity exposure of a mutual fund by selling index futures.
- Investing funds raised by new schemes in index futures so that market exposure is immediately taken.
- Partial liquidation of portfolio by selling the index future instead of the actual shares where the cost of transaction is higher.

Besides mutual funds, stock index futures help in neutralizing market volatility, arising out of sudden changes from the FII flow of funds.

There are four hedging strategies in case of index futures:

- Long stock, short index futures
- Short stock, long index futures
- Hedging a portfolio with short index futures
- Hedging with long index futures

Long Stock, Short Index Futures An investor might be a skilled stock picker but a poor market timer. He might feel that the stock is intrinsically undervalued but the entire market may move against his thinking even though it is correct. His understanding that the stock is intrinsically undervalued is wrong and the stock is not worth more than the market price. Hence to remove risk from fluctuations of the market index, he takes a long position in a stock plus short position in index. With this strategy, he has hedged his index exposure.

Suppose an investor adopts a position of ₹2 lakh long Infosys on September 1, 2001. He plans to hold the position till September 25, 2001. Suppose the beta of Infosys is 1.2. Hence the size of the position that he needs on the index futures to completely remove the hidden index exposure (risk) is $1.2 \times 2,00,000 = ₹2,40,000$. On September 1, 2001, Nifty is 1000 and the nearest futures contract (with expiration November 25, 2001) trading at about 1,020. Suppose each market lot of the futures is 200 Nifties. Hence this market lot is worth ₹2,04,000. The investor sells 200 Nifties to get the position. On September 21, 2001, Nifty crashed because of the terrorist attack on the World Trade Centre. The investor unwinds both his positions. He has suffered a loss in the position on Infosys as the market price dropped but he earns a profit on short Nifty futures and thereby makes an overall gain.

Consider an investor who buys 1,000 shares of Reliance at ₹200 and hedges by shorting 300 Nifties at ₹992 each. He closes out his position at the closing price of the next day when Reliance has dropped 5 per cent and the Nifty futures have dropped 4 per cent. His Reliance position loses ₹10,000 (₹2,00,000 − ₹1,90,000) and the short position on the Nifty earns him ₹11,904 (₹2,97,600 − ₹2,85,696). His overall profit on the position is ₹1,904.

Short Stock, Long Index Futures If an investor feels that the stock was intrinsically overvalued, then he should take a short position in the cash market and a long position in the index. This position is short stock plus long index and helps him to hedge his index exposure.

Consider an investor who sells 1,000 shares of Reliance at ₹200 each and hedges by buying 300 Nifties at ₹992 each. He closes out his position at the closing price of the next day when Reliance has risen by 5 per cent and the Nifty futures have risen by 4 per cent. His Reliance position loses ₹10,000 and the long position on Nifty earns him ₹11,904 leading to an overall profit of ₹1,904.

Hedging a Portfolio with Short Index Futures An investor with a portfolio of shares may have a view that stock prices will fall in the near future. Every portfolio contains a hidden index exposure. Hence, the investor may hedge his portfolio by selling index futures. This strategy makes sense for short periods of time when he anticipates a short-term market volatility. This hedging strategy is designed to reduce budget-related volatility. Market volatility increases one week before and two weeks after a budget. Hence, many investors can avoid these fluctuations by hedging their portfolio with short index futures.

Consider an investor who has a portfolio consisting of five shares and the total portfolio value is ₹1,90,000. The portfolio's beta is 0.95. For complete hedging, he needs to sell $0.95 \times 1,90,000$ of the futures, that is, ₹1,80,500. On February 10, 2002, the Nifty is at 1,125. So he will sell 200

Nifties and his short position on the Nifty futures will expire on March 10, 2002, worth ₹2,25,000. On March 5, 2002, the Nifty falls to 963. This drop was due to the budget announcement on February 28, 2002. On March 5, 2002, he buys back his futures thus ending his hedging. His portfolio value came down to ₹1,55,000 and his loss on portfolio amounted to ₹35,000. His profits on the futures hedging are ₹32,400 (₹2,25,000 – ₹1,92,600). Hence, his net loss is ₹2,600. Had he not hedged his portfolio, his loss would have been ₹35,000. If the budget announcement had led to a rise in the Nifty, then the investor would have gained.

This strategy of selling index futures may be of great help to a balanced mutual fund scheme which decides to reduce its equity exposure. If the mutual funds actually sells its equity holdings, then such selling would depress equity prices to the disadvantage of the scheme and increase cost and time taken. Instead of actually selling the required portfolio, the mutual fund can opt for selling index futures at much less cost and with a low impact on the cash market. The mutual fund can then, on the one hand, undertake actual sale of its holdings, depending on market conditions, and realise best possible prices. On the other hand, the mutual fund can reduce or unwind the short index futures position correspondingly.

Another advantage of this strategy for mutual funds is that they can preserve the value of portfolio during times of market stress.

Hedging with Long Index Futures There are situations in which a person has funds or anticipates funds in the near future and wants to invest in equity shares. However, investing in the stock market is a time consuming process as a person may need to do equity research and decide his portfolio. Moreover, certain mutual funds, such as a closed-ended fund, which has received funds through its initial public offering, or an open-ended fund, which has received funds by selling fresh units, require time for stock selection and investment. During this time, however, the index may rise. Hence, the investor/fund may have to purchase shares at unusually high prices. This risk can be hedged by buying index futures. Later, the investor/fund can gradually acquire shares and thereby reduce the long index position corresponding. This strategy, therefore, enables the investor/fund to choose shares carefully and spend more time in placing aggressive limit orders.

Strategies for Speculation

There are two strategies for speculation. If the speculator is bullish about the index, then he can buy index futures. If the speculator is bearish about the index, then he can sell index futures.

Long Index Futures If the speculator thinks that the index will go up, he should buy the index futures. Once a speculator is long index, using the futures market, he gains if the index rises and loses if the index falls.

Consider a speculator who feels that the index will rise. He buys on August 1, 2002, 200 Nifties with expiration date on August 31, 2002. On August 1, 2002, the Nifty August contract cost him ₹950 and hence his position is worth ₹1,90,000. On August 16, 2000, Nifty rose to ₹957 and the Nifty's August contract rose to ₹970. He sells off his position at ₹970 to make a profit of ₹4,000.

Short Index Futures If the speculator thinks that the market index will fall, he should sell the index futures. Once a speculator is short index using the futures market, he gains if the index falls and loses if the index rises.

Futures are available at different expirations. Longer dated futures are suitable for long-term forecasts of index movement and shorter dated futures are more liquid (*i.e.*, one with the highest bid–ask spread). The most overpriced futures contract should be sold. There is also a third strategy available for speculating, which is referred to as basis trading.

Basis Trading This is a strategy of playing the spreads, in which case the speculator trades the 'basis.' When a basis risk is taken, the speculator primarily bets on the cost of carry, which is the interest rate in case of index futures going up or going down. In case of the cost of carry going up, the speculator will pay the basis, and in case of the cost of carry going down, the speculator will receive the basis.

Paying the basis implies going short on a future with near month maturity while at the same time going long on a future with longer term maturity. Receiving the basis implies going long on a future with near month maturity while at the same time going short on a future with longer term maturity.

Arbitrage Strategies

The index arbitrage is the arbitrage between the index value and the prices of the underlying stocks.

- If an investor has funds, he can lend this money in the stock market. But he faces two types of risk, namely, price risk of shares and credit risk of default. To avoid these risks, the lender can buy all stocks of Nifty in the cash market and simultaneously sell them at a future date on the futures market. The price risk is completely hedged and there is no default risk as the National Securities Clearing Corporation Limited (NSCCL) acts as a counter-party.
- Similarly, if an investor has securities, he can lend these securities and earn a rate of return on them. This mechanism is provided by the index futures market wherein the investor sells off all 50 stocks in Nifty and buys them back at a future date, using index futures. The money received from the sale of securities can be invested until the futures expiration. The NSE offers the NEAT software through which an investor can take buy or sell position.
- Arbitrage opportunities exist if the futures price is less than or greater than the spot price plus the cost of carry. If $F > S\ (1+r)^T$, arbitrageurs will borrow funds, buy the spot with these borrowed funds, sell the futures contract, and carry the asset forward to deliver against the futures contract. This is called cash-and-carry arbitrage. If $F < S\ (1+r)^T$, arbitrageurs will sell the asset, invest the proceeds from this sale, and buy futures cheap. This is called reverse cash-and-carry. This process continues till the prices are at equilibrium.
- Arbitrage opportunities arise when the basis between spot and futures or the spread between two futures contracts is incorrect. When the spread between the two futures contracts narrows, the arbitrageur buys the far month contract and sells the near month contract. When the spread between two futures contracts widens, the arbitrageur sells the far month contract and buys the near month contract. This mispricing is wiped off as soon as the market arrives at an equilibrium.

If investors expect a good budget and the market is already long on the March futures, then one could sell the March futures as March futures are already overvalued and buy the cheapest near month future. The market will then converge to its fair value.

Calendar spreads is a good strategy if the traders have a time-bound view. For instance, if a good monsoon is expected then one could buy the near month and sell the distant month futures.

Similarly, if it is anticipated that the interest rates will come down then one can buy the near month and sell the distant month futures. The distant month value could fall and/or the near month value could rise due to a change in the carrying cost.

OPTIONS

Options are contracts that give the holder the option to buy/sell specified quantity of the underlying assets at a particular (strike) price on or before a specified time period. The word 'option' implies that the holder of the options has the right but not the obligation to buy or sell underlying assets. The underlying may be physical commodities such as wheat/rice/cotton/oilseeds/gold, or financial instruments such as equity shares, stock index, bonds and so on. In a forward or futures market, the two parties commit to buy and sell, while the option gives the holder of the option the right to buy or sell. However, the holder of the options has to pay the price of the options, termed as the 'premium.' If the holder does not exercise the option, he loses only the premium. Hence, options are fundamentally different from forward or futures.

- Options are contracts that give the holder the right but not the obligation to buy or sell underlying assets.

Types of Options

Options are of two basic types—'call' option and 'put' option. A call option is a right to buy an underlying asset at a specified price on or before a particular day by paying a premium. A 'put' option is a right to sell an underlying asset at a specified price on or before a particular day by paying a premium.

There are two other important types of options: European-style options and American-style options. European-style options can be exercised only on the maturity date of the option, which is known as the expiry date. American-style options can be exercised at any time before and on the expiry date. The American option permits early exercise while a European option does not. Both these types are traded throughout the world. European options are easier to analyse than American options and properties of an American option are frequently deduced from those of its European counterpart.

- European-style options can be exercised only on the expiry date while American-style options can be exercised at any time before and on the expiry date.

Options can be over the counter and exchange traded. Over-the-counter (OTC) options are private agreements between two parties and are tailor-made to the requirements of the party buying the option. Exchange-traded options are bought and sold on an organized exchange and are standardized contracts. Most exchange-traded options are American-style options.

Salient Features of Options

- Options have a fixed maturity date on which they expire; this is termed expiry date. European-style options can be exercised only on the expiry date while American-style options can be exercised on any day before the expiry date. The expiry date is also known as the exercise date, the strike date, or the maturity date.
- The price at which the option is exercised is called the exercise price, or strike price. The exercise price is specified in the contract.
- The person who writes the option is the 'option writer.' The seller of an option is usually referred to as 'writer.' The option writer is obliged to buy/sell the shares if the holder (buyer) exercises his option. The writer of a call, option is generally bearish and writer of a put option is generally bullish. The writer of a call option must deliver the stock and the writer of a put option must buy the stock at the strike prices if the option buyer or seller chooses to exercise his right. The profits/losses of options writers equal the losses/profits of the buyers. The maximum profit for the writer in case of an option unexercised is the premium received. The writer of a call has unlimited loss potential, while the writer of a put has limited loss potential. Option writing is risky and hence it requires a higher degree of understanding risk management ability and an active, regular presence in the derivatives market regularly.
- The option premium is the price paid for the option by the buyer to the seller.
- The value of option (premium) depends on the exercise price, the time of expiration, the price of the asset involved, the variance of returns of the asset concerned, the risk free rate, and the dividends expected during the life of the option. The value of a call generally increases as the current stock price, the time to expiration, the volatility, and the risk free interest rate increase. The value of a call decreases as the strike price and expected dividends increase. The value of a put generally increases as the strike price, the time to expiration, the volatility, and the expected dividends increase. The value of a put decreases as the current stock price and the risk free interest rate increases. The non-quantifiable factors affecting the value of the option premium are market participants' varying estimates of the underlying assets' future volatility, an individual's varying estimates of future performance of the underlying asset based on fundamental or technical analysis, the effect of supply and demand both in the options market place and in the market for the underlying asset and the depth of the market for that option—the number of transactions and the contract's trading volume on any given day.

  Option pricing models have been developed to assist the traders in keeping the prices of calls and puts in proper numerical relationship to each other and helping the trader make bids and offer quickly. The Black–Scholes option pricing model and the binomial model are the two most popular models used to determine the value of an option.
- An intermediary, usually a clearing house, interposes between the writer and the buyer, and guarantees performance of the contract. It acts as the opposite party to any transaction. The parties can terminate their position at any time by making an off-setting transaction.

Box 9.1 Value of Option

A call option represents a long position in a stock and a put option represents a short position; therefore, an increase in the stock price increases the value of a call option and reduces the value of a put. The difference between the stock price and the exercise price is known as payoff. The payoff from exercising a call option increases when the stock price increases and the exercise price declines. Hence, call options with a lower strike price and put options with higher strike price are valuable. Moreover, the longer the time to expiration, higher are the opportunities for the option holder to exercise his option. Hence, both American calls and puts become more valuable as the time to expiration increases. Volatility is a measure of the degree of price movement in a particular stock. The increase in volatility is beneficial to the option holder as his downside is limited to the price he has paid for the option. An increase in the risk-free interest rate increases the expected return required by investors in the stock and this leads to an increase in the value of a call option but decreases the value of a put. A dividend payment reduces the stock price and if higher the expected dividend during the life of the option, lower is the call option's value and higher is the put option's value.

Example of a call option: An investor buys a call option to buy 100 Reliance shares at a price of ₹300 on October 15, 2002. The current price is ₹250 and the premium (price) for the option is ₹25 per share. The investor will have to pay ₹2,500 as the premium for buying the call option, which is also referred to as the initial investment. He is entitled to get 100 shares of Reliance at a price of ₹300 on October 15, 2002. If the market price of Reliance goes up to ₹400, the investor will exercise his right by paying ₹30,000, the original contract price. He can sell these shares in the market at the current price of ₹400 and get ₹40,000. The net gain to the investor is ₹7,500 [(spot price − strike price) − premium], that is, [(₹40,000 − ₹30,000) − ₹2,500]. Suppose, the price of Reliance shares goes down to ₹200 by October 15, the investor will not exercise his option as he is under no obligation to buy the shares. His loss will be only ₹2,500, the premium he had paid to buy the call option.

A call option has unlimited profit potential as there is no upper limit to the stock price.

Example of a put option: An investor buys a put option to sell Reliance shares at a price of ₹300 by October 15, 2002. He pays a premium of ₹25 per share to buy this option. Now if the share price of Reliance goes down, to say, ₹200, the investor can exercise his right to sell these 100 shares at the strike price of ₹300. He will buy 100 shares at ₹200 per share to sell them at ₹300 per share. His net gain is ₹7,500 [(strike price − spot price) − premium)], *i.e.*, [(₹30,000 − ₹20,000) − ₹2,500]. Suppose, the share price of Reliance goes up to ₹350, the investor will not exercise his option and his loss will be ₹2,500 he had paid as premium. It is worthwhile exercising a put option only if the market price of the stock turns out to be lower than the strike price. If the strike price is greater than the stock price, the option has an intrinsic value. The buyer of an option pays a premium which consists of the intrinsic value, if any, plus time value. The maximum profit from buying a put option is limited only by the fact that the stock price cannot fall below zero.

At any point, several puts are quoted in the market. For instance, Reliance 320, 300, 280, 260, and 220. There are minimum of five strike prices available. On volatile scrips, the number of strike prices are around seven on an average. In case of puts, higher strike prices carry a higher premium and lower strike prices carry a lower premium. With lower strike puts, the protection starts late and the investor should be willing to bear loss till the scrip reaches the strike price. With higher strike puts, protection starts the moment the scrip quotes below the strike price.

Margins Applicable on Options

Option buyers have to merely pay the premium and no margins are applicable to them. The exchanges levy margins on option writers as they face unlimited losses.

The margining system currently adopted by India is a sophisticated mechanism based on SPAN software, a program developed by Chicago Mercantile Exchange. This program creates 16 imaginary scenarios for each option position. These scenarios are based on varying levels of price movements and volatility movements. After accounting for all these, the maximum possible loss that an investor can incur is calculated. This maximum possible loss is the margin amount to be paid by an investor. An option writer should be prepared to bring in margins of around 20–40 per cent of the Notional Contract Value. If volatility of a scrip is high, margins are also high.

The investor has to pay this margin to his broker in cash or cash equivalents or equity securities. Cash equivalents comprise government securities, debt securities, bank guarantees, fixed deposits, and treasury bills.

	Call Options	*Put Options*
Option Buyer or Option Holder	Buys the Right to Buy the Underlying Asset at the Specified Price.	Buys the Right to Sell the Underlying Asset at the Specified Price.
Option Seller or Option Writer	Has the Obligation to Sell the Underlying Asset (to the Option Holder) at the Specified Price	Has the Obligation to Buy the Underlying Asset (From the Option Holder) at the Specified Price.

Options Terminology

Underlying: The specific security/asset on which an option contract is based. It is the asset whose price movement determines the value of the option.

Option premium: The price paid by the buyer to the seller to acquire the right to buy or sell.

Strike price: The pre-decided price at which the option may be exercised. It is also known as the exercise price.

The strike price is linked to the price of the underlying asset in the cash market. The SEBI has stipulated a minimum of three strike prices—one near the spot price of the asset, one above, and one below. But both the BSE and the NSE offer options at five strike prices—one close to the spot price, two above, and two below.

Strike price intervals: The difference between two strike prices, which is a constant, is called strike price interval. The NSE has set a strike price interval of 20 points on its Nifty options while the BSE has set strike price intervals of 50 points on its Sensex options. If Nifty, closes at ₹1,100 on 26 September (the last Thursday of the month), then on 27 September, the NSE will offer strike price of 1,060, 1,080, 1,100, 1,120, and 1,140 on the Nifty December option series. The stock intervals of stocks in case of stock options is linked to stock price and a slab structure has been developed by the NSE. For instance, if stock price is below ₹100, the strike price interval in case of stock options is ₹5; if stock price is ₹100 to ₹200, the strike price interval is ₹10, and so on.

Expiration date: The date on which the option expires is known as the expiration date. On the expiration date, either the option is exercised or it expires worthless.

Exercise date: The date on which the option is actually exercised. In case of European options, the exercise date is same as the expiry date while in case of American options, the options contract may be exercised any day between the purchase of the contract and its expiry date.

Open interest: The total number of options contracts outstanding in the market at any given point of time. In other words, open interest represents the total number of option contracts that have not yet been exercised, expired, or squared off. A change in open interest in a stock indicates fresh positions being initiated or positions being closed. Open interest has to be read in conjunction with the change in price of the stock as well as volume. An increase in open interest with rising prices indicates a fresh entry of longs and a decrease of open interest with rising prices indicates profit booking by long position holders. While an increase in open interest with falling price indicates an increase of fresh short positions and decrease in open interest with declining prices, indicates profit booking by short position holders.

Option holder: One who buys an option which can either be a call or a put option. He enjoys the right to buy or sell the underlying asset at a specified price on or before specified time. His upside potential (profit) is unlimited while losses are limited to the premium paid by him to the option writer.

Option seller/writer: One who is obligated to buy (in case of a put option) or to sell (in case of a call option) the underlying asset in case the buyer of the option decides to exercise his option. His profits are limited to the premium received from the buyer while his downside is unlimited.

Option class: All listed options of a particular type (*i.e.*, call or put) on a particular underlying instrument. For example, all Sensex call options or all Sensex put options.

Option series: A series that consists of all the options of a given class with the same expiry date and strike price. For example BSXCMY 300 is an option series which includes all Sensex call options that are traded with a strike price of ₹300 and expiry in May [BSX stands for BSE sensex (underlying asset), C for call option, May is expiry date, and strike price is ₹300].

Assignment: The process in which a randomly selected option seller is assigned the obligation to honour the underlying contract when the holder of an option exercises his right to buy/sell.

Put–Call Ratio: It is the ratio of puts (right to sell) to calls (right to buy) traded in the market. This ratio represents the number of bearish versus bullish participants. A fall in the put–call ratio (PCR) implies a higher number of call buyers in the market which indicates that the market sentiment is bullish. It can be computed in two ways—as the ratio of the number of puts traded to the number of calls traded, or the number of puts outstanding to the number of calls outstanding. The PCR can be calculated for a particular stock (say, Infosys), or index (Nifty) or the market as a whole (all stocks in the derivatives segment). An increase in the PCR can be caused by a rise in the number of puts traded/outstanding or a fall in the number of calls traded/outstanding.

Moneyness: An option concept that refers to the potential profit or loss from the exercise of an option. An option may be in the money, out of the money, or at the money.

In-the-money (ITM) option: When the underlying asset price (S) is greater than the strike price (X) of the call option, that is, $S > X$. An in-the-money option would lead to a positive cash flow to the holder if it were exercised immediately. For example, a Sensex call option with strike of 4,900 is in the money when the spot Sensex is at 5,100 as $S > X$. The call holder has the right to buy a Sensex at 4,900 and sell it at

5,100 and make a profit. If the index is much higher than the strike price, the call is said to be deep in the money. In case of a put option, the put is in the money if the index is below the strike price.

Out-of-the-money option: When the underlying asset price (S) is less than the strike price (X of the call option), that is, S < X. An out-of-the-money option would lead to a negative cash flow if exercised immediately. If, in the above example, the Sensex falls to 4,700, the call option no longer has positive exercise value. The call holder will not exercise the option to buy Sensex at 4,900 when the current index is 4,700. If the index is much lower than the strike price, the call is said to be a deep out-of-the-money option. In the case of a put option, the put is out of the money if the index is above the strike price.

At-the-money option: When the option's underlying asset price is equal to the option's strike price, that is, S = X. It would lead to zero cash flow if exercised immediately.

Consider an investor who buys a one-month Nifty 1,160 call option for a premium of ₹10. The spot value of Nifty is 1,140. Hence, the option is out of the money. If the Nifty crosses 1,160, the option is in the money.

	Call Option	*Put Option*
In-the-money	Spot Price of Underlying Asset > Strike Price (S > X).	Spot Price of Underlying Asset < Strike Price (S < X).
At-the-money*	Spot Price of Underlying Asset = Strike Price.	Spot Price of Underlying Asset = Strike Price.
Out-of-the-money	Spot Price of Underlying Asset < Strike Price (S < X).	Spot Price of Underlying Asset > Strike Price (S > X).

* When the market price is very near to the strike price, the option is called near-the-money option.

The option premium can be broken down into two components—intrinsic value of an option and time value of an option.

Intrinsic Value of Options The intrinsic value of an option is the greater of zero, or the amount that is in-the-money. Only in-the-money options have intrinsic value. It is defined as the amount by which an option is in the money, or the immediate exercise value of the option when the underlying position is marked-to-market.

For a call option: Intrinsic value = Spot price − Strike price
For a put option: Intrinsic value = Strike price − Spot price

The intrinsic value of an option must be a positive number or zero. It cannot be negative. For a call option, the strike price must be less than the price of the underlying asset for the call to have an intrinsic value greater than zero. In other words the intrinsic value of a call is max (S − X, O), which means the intrinsic value of a call is the greater of S − X or O. For a put option, the strike price must be greater than the underlying price for it to have intrinsic value. In other words, the intrinsic value of a put is max (X − S, O).

Time Value of Options The time value of an option is the difference between its premium and its intrinsic value. Time value is the amount option buyers are willing to pay for the possibility that the option may become profitable prior to expiration due to favourable change in the price of the underlying. Thus, it is a payment for the possibility that the intrinsic value might increase prior to the expiry date. The magnitude of the options' time value reflects the potential of the option to gain intrinsic value during its life. Prior to expiration, options will almost have some time value, the exceptions are deep in-the-money European options. When an option is sold, rather than exercised, time value is received in addition to the intrinsic value. Time value cannot be negative. An option loses its time value as its expiration date nears. Time value premium decreases at an accelerated rate as the option approaches maturity. At expiration, an option is worth only its intrinsic value.

A call that is out of the money or at the money has only time value. Usually, the maximum time value exists when the option is at the money.

One of the factors that determine time value is the market expectation of price volatility. If the market expectation of price volatility of an underlying asset is high, the time value will also be high, reflecting the strong possibility of a substantial increase in intrinsic value.

Time value premium is maximum when the stock price and the strike price are the same. When stock price is far above or below the strike price, the option is worth only its intrinsic value. Consider a stock which is currently selling at ₹50. The call option to buy the stock at ₹49 costs ₹4. Here, the call premium

is ₹4, which is a sum of both the intrinsic value and time value. The intrinsic value of the option is ₹1 (50 – 49). The time value is ₹3 (4 – 1).

Cash settled: When the investor is paid the difference between the strike price and the market price on expiry it is referred to as 'cash settled'. Index options are always cash settled as physical settlement of the index itself is impractical.

Delivery-based settlement: When a put buyer delivers the scrips on the day of expiry and the seller is paid the expiry price, it is referred to as a 'delivery-based settlement.' In case of calls, the buyer of a call gets the delivery of the scrips and makes the payment. Delivery-based settlement is expected to be introduced in India in the coming future.

LEAPS (Long-term Equity Anticipation Securities): In India, options generally expire within three months or less. LEAPS are a variation of standard option contracts in the sense that they are long dated with an expiration date upto three years into the future. These long-term options provide the holder the right to purchase (in case of a call), or sell (in case of a put), a specified amount of the underlying stock at a pre-determined price for a specified period of time, which can be upto three years in the future. LEAPS enable investors to trade for the long-term without making an outright stock purchase.

- Option Greeks are tools to measure the sensitivity of the option price to certain factors, such as stock price, time to expiry, volatility interest rate and amount and timing of dividends.

Option Greeks: Tools to measure the sensitivity of the option price to certain factors, such as stock price, time to expiry, volatility, interest rate, and amount and timing of dividends. Sometimes options become complicated when used in combinations or two or more factors affect option price simultaneously which lead to complications in analysis. Analytical tools are available, which help in simplifying complicated option position. These analytical tools are collectively referred to as Greeks and individually as *delta*, *theta*, *gamma*, *rho* and *vega*. Greeks are used by professional traders for trading and managing the risk of large positions in options.

The various option Greeks are as follows:

- *Delta:* Measures the sensitivity of an option's premium/price to a change in the value of the underlying asset. Delta is the ratio of the change in an option's price for a small change in the price of the underlying asset. An option's delta may be positive or negative. An option that has a positive delta will increase in value as the underlying asset increases in value; it will decrease in value as the underlying asset decreases in value. A negative delta means that an option's price moves in an opposite direction from that of the underlying asset's price. A long call and short put have a positive delta as their values rise and fall along with the underlying asset. A long put and a short call have negative deltas.
- *Gamma:* Measures the change in delta of an option for a change in the price of the underlying asset. Gamma is expressed as a number between zero and one for both calls and puts. Gamma can be positive or negative. A positive gamma means that an options' delta rises and falls along with the underlying asset. A negative gamma means that the delta of an option will decrease with the increase in the underlying price and will increase with the decrease in the underlying price. The long call and the long put have a positive gamma as their delta increase and decrease with the underlying asset. The short put and the short call have a negative gamma.
- *Theta:* Measures the rate at which an option's time premium diminishes as time passes. The theta of an option is expressed as a negative number so as to reflect the losing theoretical value of an option. Theta is always negative for both calls and puts as with a decrease in the time to maturity, the option loses value. Theta is the most negative for at-the-money option and low for deep in or out-of-the-money option. However, theta can be high for out-of-the-money options with high implied volatility. In a delta-neutral portfolio, theta is used as a proxy for another option Greek, gamma. Options that have a negative theta have a positive gamma and vice versa. Both, theta and gamma together provide useful information concerning the risks of holding the position over time.
- *Rho:* Measures the change in the option price for a change in the risk-free interest rates. In other words, it measures the sensitivity of option prices to changes in interest rates. Rho is a positive number for calls and a negative number for puts. Long-term options have greater rhos than short-term options. Hence, the greater the amount of time to expiry the greater the effect of change in interest rates. Rho is usually ignored as a measure of risk as interest rates change slowly and in small magnitudes.
- *Vega:* Measures the sensitivity of an option's price to a change in its implied volatility. The options that have the same strike prices but have longer time to expiry have larger vega as volatility has more opportunities to make its presence felt. Vega is the rate of change of the option price with respect to volatility of the stock. A high vega implies that the option is highly sensitive to small changes in volatility. Volatility enhances the value of an option as an increase in volatility increases the chances of a higher return but does not affect risk in an options contract. Vega has the same sign for both calls and puts—they gain value when volatility increases and lose value when volatility falls.

Comparing Futures and Options

Both futures and options come into existence only if they are bought and sold. If they are not traded, they will not exist. The profit of one trader is the loss of another.

However, futures and options are significantly different from each other in the following ways:

- Futures are contracts to buy or sell specified quantity of underlying assets at an agreed price on or before a specified time. Both the buyer and seller are committed or obligated to buy/sell the underlying asset. By contrast, in case of options, the buyer enjoys the right and not the obligation to buy or sell the underlying asset. Thus, options are rights for buyers and obligation for sellers.
- Futures contracts have symmetric risk profile for both the buyer as well as the seller, whereas options have an asymmetric risk profile. In case of options, for a buyer or holder of the option, the downside is limited to the premium he has paid while the profits may be unlimited. For a seller or writer of an option, the downside is unlimited while profits are limited to the premium received from the buyer.
- Futures contracts prices are affected mainly by the prices of the underlying assets. Option prices are influenced not only by the prices of the underlying asset but also by the time remaining for expiry of the contract and volatility of the underlying asset. Thus, options provide exposure to a number of dimensions.
- It costs nothing to enter into a futures contract whereas there is a cost of entering into an options contract, termed as premium.
- Regulatory complexities are greater with options as compared to futures contract. Moreover, options trading strategies can be highly complicated as compared to futures trading strategies.

Both, financial futures and options are available world over as they together provide the users with a wide array of hedging instruments.

Benefits of Options

Options are versatile derivative instruments. Options have helped to revolutionize finance. Corporations use them in their financing decisions to control risk.

Options are a means of insurance against adverse price movement. A call option is a means of ensuring a maximum purchase price and a put option provides a minimum selling price. A hedger uses options when the price movement is uncertain. So, options supply the insurance needed to overcome the uncertainty in prices.

Options provide high leverage as with a small investment in the form of premium, one can take exposure in the underlying asset of much greater value.

There is a pre-known maximum risk and a large profit potential for an option buyer.

Employers stock options (ESOPs) have become a popular compensation tool with more and more companies offering the same to their employees. ESOPs are subject to lock-in periods, which could reduce capital gains in falling markets. An ESOP holder can buy put options in the underlying stock and exercise the same if the market falls below the strike price and lock-in his sale price.

Many investors trade options to speculate on the price movements of the underlying stock.

Institutional investors, such as mutual funds and pension funds, use options to adjust the risk-and-return characteristics of their portfolio.

Trading in options is cheaper than trading in stocks due to lower transaction costs in options trading.

Options provide a means of taking a short-position on a stock by buying puts or writing calls. Options allow speculators to take views on the direction of stock price movements, on the speed and extent of such movements, and on changes in market expectations and extent of price volatility.

Options help creating synthetic products which reveal and increase the trading potential of otherwise not traded assets/contract.

Pay-off Profile of Call Options

The pay-off from exercising a call option is the difference between the stock price and the strike price. (Figure 9.1)

Call Option Buyer A call option gives the buyer of that option the right, but not the obligation, to buy the underlying asset at a particular price, known as the exercise, or strike price. The buyer of an option has to pay a premium at the time the option is bought. As the buyer is not obliged to exercise an option, he can simply disregard it or not exercise it, in which case he loses the premium paid. His risk or maximum loss

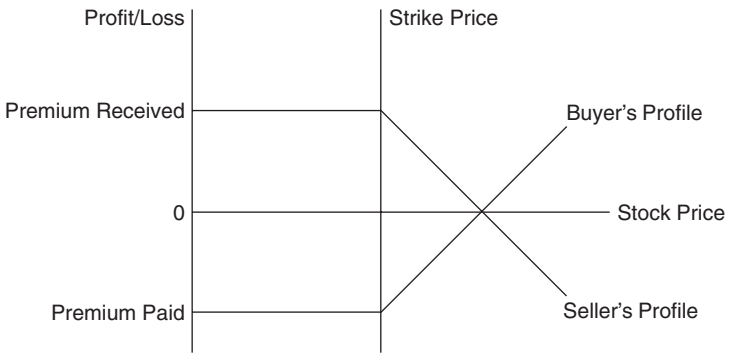

Figure 9.1 Pay-off Profile of Call Options

is limited to the extent of the premium paid. But there is no upper limit to his potential profits if prices of the underlying asset go up. His break-even point is equal to the strike price plus premium.

Consider a share whose strike price is ₹100 per share and the call premium is ₹6 per share. If, at expiration, the share price is ₹100 or lower, the option expires worthless. The call buyer will lose the premium of ₹6 per share. If the share price on the expiration date is ₹106, the call buyer breaks even (₹100 strike price plus ₹6 premium less ₹106 share price on expiration). At any share price above ₹106, the call buyer will profit. Hence, for every one rupee rise in the stock price, the call is worth ₹1 more.

The buyer of a call option is said to have a long call position. There are no margin requirements for a call option buyer. Time affects the call buyer adversely as with passage of time the value of the call option falls to nearly zero.

Call Option Seller For every buyer of an option, there must be a seller who is usually referred to as the writer. The seller of the call option is said to have a short call position. The seller is moderately bearish as he expects the prices of the underlying asset to go down. As options are zero-sum games, profits of the buyer must equal losses of the seller, and vice versa. The seller or writer of a call option must deliver the stock at the strike price agreed upon if the buyer chooses to exercise the option. The call option seller receives the premium from the buyer. He is subject to margin requirement. This margin can change on a day-to-day basis, depending predominantly on the price of the scrip itself. The call option seller's risk profile is unlimited, if prices go up. His profit potential or maximum profit is limited to the premium received. His break-even point is equal to the strike price plus premium received. A call option will fall in value if the underlying scrip or index falls. The investor, in such a case, should buy it back and earn profits. Suppose, Reliance is quoting at ₹285 and the Reliance 280 call is quoting at ₹20. If Reliance falls to ₹265 in a week, the call might have moved down to ₹10. The investor, on buying it back, earns a profit of ₹10.

Pay-off Profile of Put Options

Put Option Buyer A put option gives the buyer of the option the right, but not the obligation, to sell the underlying asset. The buyer of an option can exercise it or allow it to expire worthless at expiration. The buyer of an option pays a premium and exercises this option only if the market price of the underlying asset turns out to be lower than the strike price.

Consider a put option with an exercise price of ₹200 and at a premium of ₹8. If the underlying stock price exceeds ₹200, say ₹210 at expiration, the holder cannot exercise profitably. This involves surrendering a stock worth ₹210 and receiving an exercise price of ₹200 and losing the premium of ₹8. If the stock price at expiration is less than ₹200—say ₹190—there will be a profit. This involves surrendering a stock worth ₹190, receiving ₹200 exercise price and paying a premium of ₹8. The net gain is ₹2.

There are no margin requirements for a put option buyer. His profit potential is unlimited if prices of the underlying asset go down. But practically the maximum profit is limited as the price of the underlying cannot fall below zero. The maximum profit from a put option is the strike price minus the premium paid. His risk profile is limited as the premium paid is the maximum loss the buyer of the option can incur.

The put option will rise in value as the underlying (scrip or index) drops. If an investor buys a put option and the scrip falls as per his expectation, he can sell at a later date. Suppose Reliance 280 put is quoting at ₹25 when Reliance is quoted at ₹285. If Reliance falls to ₹265 in a week, the put will move up to ₹35. The investor makes a profit of ₹10 if he sells the put.

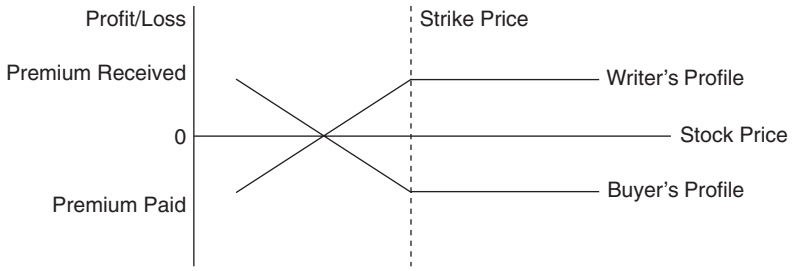

Figure 9.2 Pay-off Profile of Put Options

Put Option Seller The seller or writer of a put option has an obligation to buy the underlying asset at strike price if the option is exercised. The put option seller receives premium and is subject to margin requirements. His profit is potential is limited to the extent of premium received. His risk profile is practically limited as the price of the asset cannot go below zero. Hence, his maximum loss is equal to strike price minus premium received (Figure 9.2).

Pricing Options

Options values or prices are derived from theoretical models. The Black–Scholes option pricing model is the most popular model which provides the theoretical price of options. The other popular models are the binomial model developed by Cox, Ross, and Rubinstein and the Addison Whaley model. These are slightly more sophisticated than the Black–Scholes model but option values derived from these models are not significantly different. The Black–Scholes option calculators are available on various websites, and spreadsheets come with a built in Black–Scholes options pricing formula. Hence, an investor need not memorise the formula; he needs to just key in the basic parameters of the formula.

Black–Scholes Option Pricing Model This model was originally developed for European-style options on non-dividend paying stocks by Fischer Black and Myron Scholes.

The Black–Scholes pricing model assumes that percentage change in the price of underlying follows a normal distribution. This model uses lognormal rather than normal distributions to avoid the possibility of negative stock prices. A variable with a normal distribution can take any positive or negative value, while a lognormal distributed variable can take only positive values. A normal distribution is symmetrical, a lognormal distribution is skewed with the mean, median, and mode all different. According to Black and Scholes, stock returns have a lognormal distribution meaning that the logarithm of the stock's return will follow the normal (bell-shaped) distribution.

Although not the first, the pricing model was the first model to reduce the number of computations necessary for deriving the values.

The factors affecting the determination of options pricing are the underlying stock price, the exercise price, time to expiry, volatility, and the risk-free rate.

- *Underlying stock price:* The underlying stock price does not remain constant. Any future changes in the underlying stock price may affect the value of an option, hence the underlying stock price is important for determining the value of an option.
- *Strike/exercise price:* The strike price remains fixed throughout the life of an option and never changes.
- *Time until expiration:* An option's expiration date is fixed for the life of the option. There is a direct relationship between an option's price and amount of time until the option's expiration. Options that have a distant expiry date trade at a premium relative to those that are approaching expiry. The theoretical value of the option decreases as the time to expiry decreases.
- *Interest rates:* The interest rate is the cost of carrying the option. The higher the interest rate, the higher the call price and the lower the put price. The lower the interest rate, the lower the call price and the higher the put price. The theoretical value of an option is affected by the correlation between a change in interest rates and the amount of time until expiry.
- *Volatility:* Volatility is the fluctuation in the price of the underlying. It is a measure of the speed and magnitude at which the underlying stock price changes. If the movement in the price of a security is quite high as compared to the index, the security is more volatile than the index. Volatility is the standard deviation of the daily returns on an underlying. Volatility is a very important variable affecting an options price. The higher the volatility, the higher the option premium.

- Volatility is a measure of the degree of the price movement in the underlying security.

The other inputs or factors are readily determinable but determining volatility is a difficult task. Moreover, as exposure to all other inputs or factors can be hedged away, the price of the option then entirely depends on volatility.

There are different ways to measure volatility.

- Historical volatility is a measure of actual changes in an underlying over a specific period in the past. It is often referred to as actual volatility or realized volatility. It measures how active a stock price is over a certain period of time. Short-term traders use shorter time periods such as 5-day, 10-day, 20-day and 30-day while intermediate and long-term investors use 60-day, 180-day or 360-day for measuring historical volatility. The most common measure of volatility is standard deviation. It is calculated by taking the daily percentage price changes in a stock and finding the average of the deviations from the mean. The average is then expressed as an annualized percentage by multiplying the daily standard deviation by the square root of 250, which is the average number of trading days in a year.
- Forecast volatility is an estimate of expected changes in an underlying over a specific period in the future.
- Implied volatility is the market's assessment of the expected volatility of the underlying. It acts as a proxy for option value. Options with different strike prices and expiration dates will have a different implied volatility. Even within the same expiration, options with different strike prices will have a different implied volatility. Implied volatility can be derived by entering the current market price of an option into the pricing model along with other factors. The number that is derived is the volatility that the market is using to price the option—the implied volatility. Hence, an option trader will first of all find out the historical volatility of a stock and factor into the historical volatility his anticipations of the future to arrive at a best guess of future volatility of the stock.

After arriving at his best estimate of future volatility of the stock, the trader will compare his estimate with the volatility determined by the market known as the implied volatility.

Implied volatility might or might not be equal to the trader's estimate of future volatility. If the implied volatility is greater than the trader's estimate, it implies that either the market is expecting the future volatility to increase or that the market is mispricing the option or that there is some good news about the company that could move the price favourably. If the implied volatility is less than the trader's estimate, it implies that the option is underpriced or the market believes that the stock will now trade at a low level or there is some bad news which might affect the price of the stock adversely.

Hence, volatility serves as a benchmark for knowing overpriced and underpriced options and the extent of mispricing.

In the Black–Scholes option pricing model, only two of the above factors are allowed to change, namely, the time to expiry and the underlying stock price.

Black and Scholes use the stochastic calculus to define how the option price changes when stock price and time to expiry are changed.

The Black–Scholes model relating to non-dividend paying stocks can be expressed as follows:

where

$$C = S.N(d_1) - Ke^{-rT}.\ N(d_2)$$
$$P = Ke^{-rT}\ N(-d_2) - SN(-d_1)$$

where

$$d_1 = \text{In}\ S/K + (r + \sigma^2/2)^T/\sigma\sqrt{T}$$
$$d_2 = d_1 - \sigma/\sqrt{T}$$

where

C is the call price.
P is the put option price.
S is stock price.

Box 9.2 Implied Volatility

Implied volatility is a measure of the future volatility of the cash market as expected by market participants and reflected in the derivatives market.

The implied volatilities of calls and puts show a distinct pattern, called the volatility skew. Implied volatility tends to be higher for out-of-the-money options as compared to at-the-money options. The risk of out-of-the-money options increases on large movements of prices and hence to compensate for this risk, they tend to be priced higher.

$N()$ is the cumulative normal distribution. $N(d_1)$ is called the delta of the option which is a measure of change in the option price with respect to change in the price of the underlying.

K is the strike price.

e is the exponential (which has the constant value of 2.7182818 and appears on most hand-held calculators).

r is the risk-free annualized interest rate as a decimal. If annual risk free rate is 12% then r is In 1.12 or 0.1133.

T is the time to expiry in years. If T is given in days or months, it has to be converted into years. If time to expiry is 22 days, then T in the formula should be $22/365 = 0.06$.

σ is the annualized standard deviation of stock returns (volatility) as a decimal. When daily sigma are given they need to be converted into annualized sigma. σ annual $= \sigma$ daily $\times \sqrt{\text{Number of trading days in a year}}$. On an average, there are 250 trading days in a year. If daily σ is 1.95, then annualized sigma is $1.95 \times \sqrt{1.95} = 31$ per cent or 0.31. e^{-rT} is a discount term similar to $1(1+r)^T$ and it discounts the present value of a future sum of money on a continuous basis.

Assumptions Underlying the Black–Scholes Option Pricing Model

- There are no transactions costs or taxes. All securities are perfectly divisible.
- There are no dividends on the stock during the life of the options.
- There are no riskless arbitrage opportunities.
- Security trading is continuous.
- Investors can borrow or lend at the same risk-free rate of interest.
- The short-term risk-free rate of interest, r, is constant.

The Black–Scholes option pricing model is an analytical model that helps in pricing options within the framework of its assumptions.

With Black–Scholes option calculators available, an investor has to key in the basic parameters, such as current share price, option strike price, time left for expiry, volatility, and interest rate. This model helps in assessing the fair price of an option, risks that are associated with a position and how an option's value changes as market conditions change. The theoretical value of an option arrived at with the help of this model is then compared with the actual market price prevailing and the difference between the two reflects whether the option is underpriced or overpriced.

OPTIONS TRADING STRATEGIES

Option Spreads

The risk profile of option buyers and sellers is different. Option buyers are exposed to unlimited profits and limited losses position and option sellers are exposed to unlimited losses and limited profits position. Spreads create a limited profit and loss profile for both buyers and sellers. An option spread involves taking a position in two or more options of the same type (*i.e.*, two or more calls or two or more puts). For example, buying a call and selling another call either with a different strike or a different expiration is termed as a spread. A spread is used to take a bull position or a bear position, or to finance the purchase of other options. Option spreads are important for speculators.

- A spread that is designed to profit if the price goes up is called a bull spread.

There are different types of spreads and the degree of risk reduction differs among the different types of spreads. Option spreads may be categorized as vertical spread, horizontal spread and diagonal spread.

Vertical Spreads Vertical spreads involve the simultaneous buying and selling of options on the same underlying instrument for the same expiration date but with different exercise prices. Vertical spreads are also called price spreads.

1. Bull spread: A spread that is created by buying a low strike price option and selling a high strike price option on the same stock. It is designed to profit if the price goes up. When an investor thinks that the market is more likely to rise than fall, he enters into a bull spread hoping that the market price will increase. A bull spread can be created with calls or with puts.

The buyer of a bull spread buys a call with an exercise price below current index and sells a call option with an exercise price above the current index. He hopes to profit from a rise in the index and hence the

spread is termed as a bull spread. This bull spread limits both the upside potential as well as the downside risk. The pay-off is the difference between the strike price of a call option bought and the strike price of the call option sold (Figure 9.3).

Suppose an investor buys one market lot of February 1,100 Nifty calls at ₹96 a call and sells one market lot of February 1,200 Nifty calls for ₹60 a call. If Nifty closes between 1,100 and 1,200, the pay-off is the amount by which the index exceeds 1,100. In this case, suppose the index closes at 1,160 on the expiration date, then the pay-off is ₹60. The cost of setting up the spread is ₹36 (96 – 60)—the difference between the call premium paid and received. The net profit from the position is ₹24 (60 – 36).

The bullish option spread (with calls) produces a net initial debit since a low strike price option is more expensive than a high strike price option.

The maximum profit is equal to the higher strike price less the lower strike price less net premium paid; the maximum loss is equal to lower strike premium less higher strike premium (or net premium paid). The breakeven price is equal to lower strike price plus net premium paid.

There are three types of bull spreads:

- Both calls initially out of the money.
- One call initially in the money, the other call initially out of the money.
- Both calls initially in the money.

The first type is the most aggressive bull spread as it costs very little to set up and has a small probability of giving a relatively high pay-off. The second type is not so aggressive a bull spread while the third type is the least aggressive most conservative bull spread. The decision as to which of the three spreads to undertake depends upon how much risk the investor is willing to take.

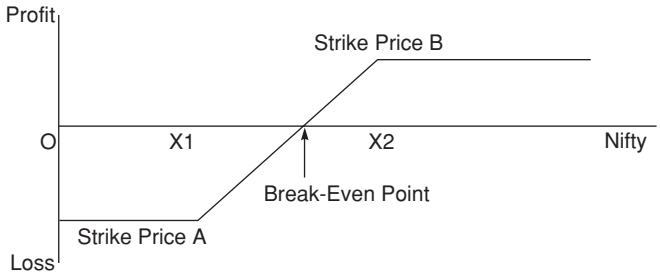

Figure 9.3 Bull Spread—Pay-off Using Call Options

In case of put options, the bull spread consists of buying a put with a lower exercise price and selling a put with a higher exercise price. It produces a net initial credit as the high strike price option is more expensive than the low strike price option. The maximum profit is equal to the net option premium income (or net credit); the maximum loss is equal to the higher strike price less the lower strike price less net premium received. Break-even price is equal to the higher strike price less the net option premium income.

The margins on call-based bull spreads will be far lower than that on put-based bull spreads. The possibility of losses in call-based spreads is negligible as the differential premium is paid upfront.

An investor can create 42 spreads on one scrip in one month series—21 spreads on calls and 21 on puts.

- A spread that is designed to profit if the price goes down is called a bear spread.

2. Bear spread: An investor who enters into a bear spread has mild to moderate bearish perspective, *i.e.*, he is hoping that the prices will decline. A spread that is designed to profit if the price goes down is called a bear spread. Bearish vertical spreads are created by buying a high strike option and selling a low strike option. Bearish spreads can be created with calls or with puts.

Bearish vertical spreads with calls are created by the sale of a call with a low strike (exercise) price and purchase of call with a high strike (exercise) price. It produces a net credit strategy since a low strike price option is more expensive than a high strike price option. The maximum profit is equal to the net premium received and the maximum loss is equal to the higher strike option price less the lower strike option price less the net premium received. The break-even price is equal to lower strike price plus net premium received. Thus, the bear spread with call options not only limits the trader's risk but it also limits the profit potential, *i.e.*, it limits both the upside potential as well as the downside risk (Figure 9.4).

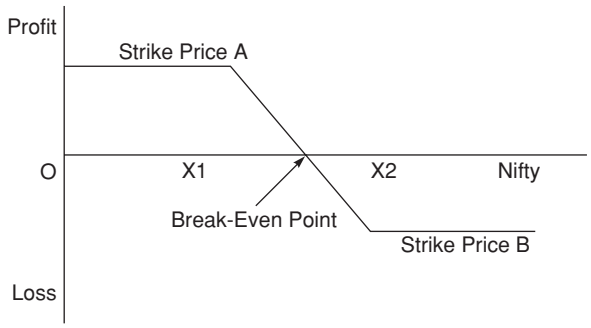

Figure 9.4 Bear Spread—Pay-off Using Call Options

Suppose an investor buys one market lot of February 1,500 Nifty calls at ₹60 a call and sells one market lot of February 1,400 Nifty calls for ₹96 a call. If Nifty closes at 1,420 on the expiration date, his profits gets reduced to the extent it falls short of the lower strike. In this case, the index falls short of the lower strike by 20. Hence, his pay-off is ₹96 − 60 − 20 = ₹16.

In case of bearish option spreads with puts, the investor buys a put with a high strike price and sells a put with a low strike price. This produces a net debit strategy as a high strike price option is more expensive than a low strike price option. The maximum profit is equal to the higher strike price option less the lower strike price option less the net premium paid. The maximum loss is equal to the net premium paid. The break-even price is equal to the higher strike price less the net premium paid. Thus, the upside potential and downside risk is limited.

A vertical spread is used by an investor when he believes that the prices will move only to the strike price that generates maximum profit.

Horizontal or Calendar Spread A horizontal or calendar spread is a spread where the options used have the same strike price but different expiration dates. A calendar spread trading strategy is used by an investor who thinks that the market will be weak in the short-term but rally in the long-term. The investor makes an attempt to gain from the declining time value of options. Calendar spread can be created with call options as well as put options.

- A horizontal or calendar spread is a spread where the options used have the same strike price but different expiry dates.

A calendar spread can be created by selling a short maturity call option with a certain strike price and buying a longer maturity call option with the same strike price. The two option series would be identical in every respect except the expiry month. The short option position is a liability while a long option position is an asset. The value of the liability declines more quickly than the value of the asset. Hence, the option should be allowed to run to the expiry date. As the longer maturity option is expensive, a calendar spread requires an initial investment. The investor makes a profit if the stock price at the expiration of the short maturity option is close to the strike price of the short maturity option, otherwise a loss is incurred. The downside risk is limited to the initial debit incurred for establishing the spread. The break-even point at expiry is the strike price plus premium. There is a risk of the sold option being called, *i.e.*, exercised. A calendar spread can be created with call options as well as put options.

In a calendar spread with put options, the investor buys a long maturity put option and sells a short maturity put option. In a bullish calendar spread, a strike price higher than the current stock price is chosen while a bearish calendar spread involves a lower strike price. In a reverse calendar spread, the investor buys a short maturity option and sells a long maturity option.

Diagonal Spreads This spread combines both vertical and horizontal features. In a diagonal spread, both the expiration date and the strike price of the calls are different.

- A diagonal spread combines the features of both vertical and horizontal spreads.

A diagonal bull spread is adopted when the investor is bearish in the immediate near term and bullish in the long-term. In other words, the investor thinks that the market will be weak in the short-term but then rally later. Hence, a near-dated call option is sold and a longer dated out-of-the-money call option is bought. The upside potential is unlimited if the bought option is held after the short option expires. The downside risk is limited to the difference in strikes plus/minus the initial debit/credit when establishing the spread. But there is a risk of the sold options being called or exercised.

A diagonal bearish strategy is adopted when the investor thinks that the market will be flat or rise only slightly in the short-term, but will then fall later. In this strategy, a near-dated put option is sold and a longer-dated out-of-the-money put is bought. The upside potential is large if the bought option is held after the short option expires. The downside risk is limited to the difference in strikes plus/minus the initial debit/credit when establishing the spread but there is a risk of the sold options being called.

Volatility Trading

Volatility trading is taking positions on changes in market expectations of price volatility. The main strategies for trading volatility are straddles, strangles, and butterflies. Straddles and strangles are examples of 'combinations' which are option trading strategies that involve taking a position in both calls and puts on the same stock.

- Straddle is a strategy of buying a put and call with the same price and expiry dates.

Straddle Straddle is a position of buying a put and call with the same price and expiration date. Straddle is an expensive strategy as the trader pays two premiums. But a price swing in either direction compensates this high cost.

The investor believes that the price of the underlying asset will either rise or fall significantly but does not know the direction of the price movement. Major pronouncements such as divestment, budget time, acquisitions announcement by companies, and lawsuits to be decided on a particular day are good times to buy straddles.

A long straddle is buying one put and one call option simultaneously on the same stock at the same exercise (strike) price with same maturity. A short straddle is a simultaneous sale of two such options at the same strike price and expiration date (Figure 9.5).

The long straddle is also referred to as bottom straddle and short straddle as a top straddle. The purchaser of a long straddle takes the view that volatility will be high in the future, whereas the seller of a straddle takes the view that volatility will be low (marginal). The profit potential on a long straddle is unlimited on the upside and limited on the downside, while profit potential on a short straddle is limited to the receipt of the premium, which occurs if the price at the expiration is the same as the strike price of the options. The maximum loss on long straddle is the loss of premium paid and occurs if the price at the expiration is the same as the strike price of the options while loss on a short straddle is unlimited on the upside and limited on the downside. A short straddle is a highly risky strategy.

Suppose an investor feels that the stock price is likely to move significantly in the next three months. The stock is currently trading at ₹690. A three-month call with a strike price of ₹700 costs ₹40 while a three-month put with the same strike price costs ₹30. The trader buys both the put and the call. If the stock price is ₹700 in three months, the strategy costs the trader ₹70 (₹40 plus ₹30). The buyer will profit from this strategy only if the stock price moves further away from ₹700. Suppose the stock price is ₹900 the strategy leads to a profit of ₹130 (₹900 – ₹700 – ₹70). If the stock price moves down to ₹550, the strategy leads to a profit of ₹80.

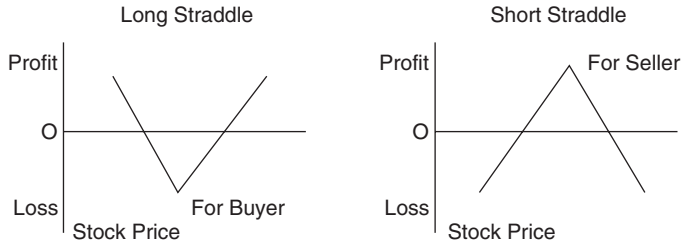

Figure 9.5 Pay-off Profile of Straddles

- Strangle is a strategy of buying/selling a combination of one call option and one put option with same maturity but with different exercise prices.

Strangle Like a straddle, a strangle is the buying/selling of a combination of one call option and one put option with same maturity. But unlike straddle, strangle has different exercise prices. In a strangle, the call has an exercise price above the stock price and the put has an exercise price below the stock price.

A long strangle is buying one put and one call option at different strike prices as the trader expects a significant movement in prices. A long strangle is an aggressive form of straddle position. The profit potential is unlimited on the upside and limited on the downside while the maximum loss is the loss of premium paid.

A short strangle is selling one call and one put option at different strike prices. The seller expects that the market prices will move marginally or be less volatile. This is a conservative form of straddle position. The profit potential is limited to the receipt of the premium and the loss is unlimited on the upside and limited on the downside (Figure 9.6).

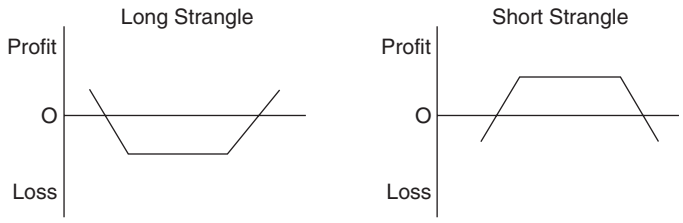

Figure 9.6 Pay-off Profile of Strangle

Butterfly Spreads A butterfly spread is a combination of a bull and bear spread. This strategy is used when the investors expect that the stock prices will not significantly rise or decline by expiration. This position is created by buying two call options, one with a relatively low strike price X1, and the other with a relatively high strike price, X3 and selling two call options with a strike price X2, half way between X1 and X3. Thus, X1 < X2 < X3.

Strike Price (₹)	*Call Price (₹)*
85	10
90	7
95	5

In a butterfly spread, risk and profits are limited. Maximum profit is realized if the stock price at expiration is close to X2 (Figure 9.7).

Suppose a stock is selling for ₹91. The prices of call options expiring in six months are quoted as follows:

The investor can create a butterfly spread by buying one call with a ₹85 strike price (X1), buying another call with a ₹95 strike price (X3) and selling two calls with a ₹90 strike price (X2). This costs the investor ₹10+₹5−(2×₹7)=₹ 1. The net loss would be equal to ₹1, if the stock price moves outside the range of ₹86 to ₹94, but would lead to a maximum profit of ₹4, if the stock price is ₹90 at the expiration date. If the stock price is ₹90, the long call with an exercise price of ₹95 loses its full purchase price of ₹5. The long call with an exercise price of ₹85 loses ₹5 (₹5 stock profit minus ₹10 purchase price). Together, the long calls lose ₹10. The short call gives a profit of ₹7 per option, for a profit of ₹14 on the two options. This gives a net profit of ₹4 if the stock price is ₹90.

By using put options, the investor buys two puts, one with a low strike price and another with a high strike price and sells two puts with an intermediate strike price.

A limitation of this strategy is that it may be difficult to execute it quickly.

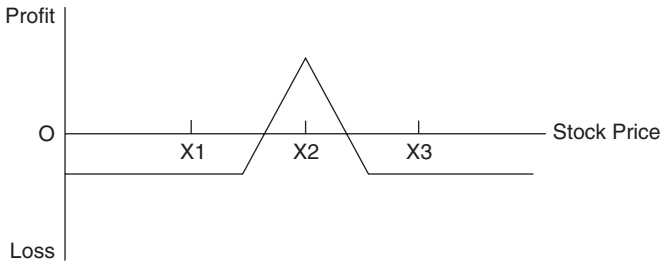

Figure 9.7 Pay-off from a Butterfly Spread

A butterfly spread can also be created with the help of only put or a combination of one call and one put.

Comparison of Volatility Trading Strategies

Straddles involve highest potential profits but also the greatest potential losses. In strangles there is a low maximum loss but likelihood of occurrence of losses is higher. Butterflies involve small potential losses but at the cost of limited profit possibilities. A butterfly spread resembles a short position in the straddle. Compared to the straddle, the risk of a large loss is reduced by the butterfly spread. A general rule underlying all volatility trading strategies is that higher potential profits are obtained at the cost of higher risk.

Arbitrage with Options

Pure arbitrage is the process of making riskless profits from mispricing without the arbitrageur's own resources being used. If the arbitrageur's own capital is used, the process is known as quasi-arbitrage. An arbitrageur buys/sells the derivative while simultaneously taking an opposite position on a synthetically constructed derivative. Arbitrage tends to maintain certain option–price relationships. A systematic price relationship must exist among the various assets that can be combined to create synthetic assets.

- Put–call parity explains the relationship between put, call, stock, and bond prices.

Put–Call Parity The put and the call prices are related by a condition called put–call parity. Put–call parity is nothing more than the observation that buying a put is equivalent to selling the underlying and buying a call. The put–call parity explains the relationship between put, call, stock, and bond prices. The put–call parity is a relationship between the price, c of a European call option on a stock, and the price, p, of a European put option on a stock. It is expressed as:

$$S + p = c + \frac{X}{(l + r)^T}$$

where,

S = Spot price of the underlying
p = Price of European put option
c = Price of European call option
X = Exercise price of options
T = Time to expiration
r = Risk-free rate of interest

According to the above equation, the value of a European call with a certain exercise price and exercise date can be deduced from the value of a European put with the same exercise price and date, and vice versa.

In other words, pay-off from holding a call plus an amount of cash equal to $\frac{X}{(l + r)^T}$ is the same as that of holding a put option plus the underlying.

If $S + p \neq c \frac{X}{(l + r)^T}$, then an arbitrage opportunity exists. Suppose S is Index, then we can think of index plus put as portfolio A and call plus cash $\left(\frac{X}{(l + r)^T}\right)$ as portfolio B. If portfolio A is overpriced relative to portfolio B, the arbitrageur would sell the securities in portfolio A and buy the securities in portfolio B.

Suppose Nifty stands at 1065, the risk free rate of interest is 12 per cent per annum, the price of a three-month Nifty 1060 call is ₹90.00 and the price of a three-month Nifty 1060 put is ₹60. In this case,

$$S + p = c + \left(\frac{X}{(1 + r)^T}\right)$$

$$1065 + 60 = 90 + \frac{1060}{(1.12)^{1/4}} = 1125 > 1120.43.$$

Portfolio A is overpriced relative to portfolio B.

Hence, to exploit the arbitrage, the arbitrageur should sell the index plus a put and buy a call. This strategy generates a positive cash flow of ₹1,035.00 (1,065+60.00−90.00). When invested at the risk-free interest rate of 12 per cent, this grows to ₹1,065.05. If the index at expiration of the option is greater than 1,060, the call will be exercised. If it is less than 1,060, the put will be exercised. In either case, the investor ends up buying the index at ₹1,060. Hence, the net profit on the entire transaction is ₹5.05 (*i.e.*, ₹1,065.05−₹1,060).

If portfolio B is overpriced relative to portfolio A, an arbitrageur can short the securities in portfolio B (sell a call) and buy the index and a put.

For a dividend paying stock, the put–call parity relationship is

$$c + \left(\frac{X}{(1 + r)^T}\right) + D = p + S.$$

Put–call parity does not hold for American options.

Arbitrage Beyond Upper and Lower Bounds There are six factors affecting the value of an option before expiration. They are: the price of the underlying stock, the exercise price of the option, the time

remaining until expiration, the risk-free rate of interest, the volatility of the underlying assets and dividends expected during the life of the option. These factors set the general boundaries for option prices. If the option price is above the upper bound or below the lower bound, there are profitable opportunities for arbitrageurs.

Upper bounds: A call option gives the holder the right to buy a stock or an index for a certain price. As the option can never be worth more than the stock/index, the stock price/index is an upper bound to the option price.

$C < S$, where
C = Price of call option
S = Current stock price/current index level

If the above relationship does not hold true, an arbitrageur can easily make a riskless profit by buying the stock and selling the call option.

A put option gives the holder the right to sell a stock/index for a price X. No matter how low the stock price/index level becomes, the option can never be worth more than X. Hence, $P \leq X$.

If the above relationship does not hold true, the arbitrageur would make a profit by writing puts.

Lower bounds: The lower bound for the price of a call option is $S - X(1+r)^{-T}$. If the price of a call is not worth at least this much, then it will be possible to make riskless profits.

If the call is available at a premium which is less than the lower bound, that is, if $S \# X(1+r)^{-T} < C$, the arbitrageur can buy the call and short the stock/index and earn riskless profits.

Consider a three-month Nifty call option with a strike price of 1,060. The spot index stands at 1,150. The risk-free rate of interest is 12 per cent per annum. In this case, the lower bound for the option price is $1150 - 1060\ (1+0.12)^{-0.25} = 1150 - 1030.40 = ₹119.60$. If the call premium falls below ₹119.60, arbitrage opportunities exist. Suppose the call is available at ₹115, an arbitrageur can buy the call and short the index. This provides a cash flow of ₹1150 − ₹115 = ₹1035. If ₹1035 is invested for three months at 12 per cent per annum, then ₹1035 grows to ₹1066.05. At the end of the expiry of the option, the index can be either above 1,060 or below 1,060. If the index is above 1,060, the arbitrageur exercises his option and buys back the index at 1,060 making a profit of ₹1,066.05 − 1,060 = ₹6.05. If the index is at say 1,050, the arbitrageur buys back the index at the market price, *i.e.*, 1,050 and makes a higher profit of ₹1,066.05 − 1,050 = ₹16.05.

The lower bound for the price of a put option is $X(1+r)^{-T} - S$.

The price of a put must be worth at least this, otherwise it will be possible to make riskless profit.

If the price of a put is not worth at least this, then it will be possible to make a riskless profit. If the put is available at a premium which is less than the lower bound, that is, if $X(1+r)^{-T} - S < P$, the arbitrageur can buy both the put and the stock/index by borrowing money and earn riskless profits.

Consider a two-month Nifty put option with a strike of 1,260. The spot index stands at 1,185. The risk-free rate of interest is 12 per cent per annum. The lower bound for the put option is $X(1+r)^{-T} - S = 1260\ (1+0.12)^{-0.166} - 1185 = ₹51.50$. Suppose the put is available at a premium of ₹40, the arbitrageur can borrow ₹1225 for two months to buy both the put and the index. At the end of the two months, the arbitrageur will be required to pay at 12 per cent per annum, ₹1249.50. At the end of the two months, the index can be either below 1,260 or above 1,260. If the index is below 1,260, the arbitrageur will exercise the option of selling the index at 1,260, repaying the loan amount of ₹1249.50 and thereby making a profit of ₹10.50. If the index goes upto 1,270, the arbitrageur will discard the option, sell the index at 1,270, repay the loan amount of ₹1249.50 and make a higher profit of ₹1270 − 1249.50 = ₹20.50.

Hedging with Options

Options are a means of hedging (insurance) against adverse price movement which have no directions. A call option is a means of ensuring a maximum purchase price and a put option ensures a minimum selling price. The purchase of a put option, or alternatively, selling of a call option are a means of hedging against a price fall. The purchase of a call option or, alternatively, selling of a put option are a means of protection from a price rise. The strategy of writing options is preferable if the price change is not significant or is modest whereas buying options is a better strategy if the price movement is significant or substantial.

Covered Writing Covered writing refers to selling call options corresponding to assets held or selling put options when the liquidity for the purchase of the underlying asset is held. Writing covered calls involves writing call options when the asset that might have to be delivered are already owned. For

example, a writer writes a call on Infosys and at the same time holds shares of Infosys so that if the call is exercised by the buyer, he can deliver the stock.

A call option that is not covered by an opposite position in the underlying asset is called a naked call. In case of a naked call, if the option holder exercises his right, the writer will have to purchase the underlying asset to meet his call obligation, his loss will be the excess of purchase price over the exercise price of the call reduced by the premium received for writing the call. However, in case of covered calls, the worst that can happen is that the investor is required to sell shares already owned at below their market value. Hence, covered calls are less risky than naked calls.

As the investor expects prices to remain stable/go mildly up, he establishes a position of long on underlying and short on call, *i.e.*, buying the stock and selling a call option on stock. It is similar to selling a put option. This strategy reduces the cost of acquisition, but the receipt of premium limits the upside potential. It offers an opportunity to earn while holding the underlying.

The reverse of writing a covered call is a short position in a stock combined with a long position in a call option.

- In a covered call, the investor covers his short option position by taking a position in the underlying share.

Covered Call This is a bearish strategy wherein the investor holds the underlying asset and sells a call. Through this strategy, he avoids unlimited losses by selling the underlying assets that he is holding, whenever the need arises. The number of call options sold will be determined by the investor's market view and the size of stock holding. The investor's maximum profit is equal to the strike price minus the market price plus the premium received. (Figure 9.8) Moreover, an investor is subject to margin requirements. Suppose an investor is currently holding Reliance, which is quoting at ₹280. He is bearish on Reliance and feels that the price of Reliance will fall to ₹250 in the next month. Hence, he sells a call with strike price of ₹270 for ₹25, which is his income. Suppose on the expiry date, the price of Reliance shoots up to ₹300 (against his expectations). Hence, he as a seller of the call will pay ₹30 (Reliance price on expiry and strike price, *i.e.*, ₹300 − ₹270). As he holds the shares of Reliance, his loss on call is offset by the appreciation of his holding, which is ₹20 (₹300 − ₹280). His overall profit is equal to income from sale of call plus appreciation in holding minus payout on exercise of call = ₹25 + ₹20 − ₹30 = ₹15.

This covered call strategy can also be used by an investor who is bullish on a scrip but expects that the price will not move beyond a particular limit. This strategy enables him to reduce his overall effective cost. Suppose Reliance is quoting at ₹285 and an investor believes that the price of Reliance will not move beyond ₹300 in the next month. The investor can buy the scrips or its futures for ₹285 and simultaneously sell a call on the scrip with strike price of ₹300 for ₹15. The investor thus reduces his effective cost of acquisition to ₹270 (₹285 less ₹15 premium received). But there is a risk of opportunity loss if the market rises. The investor gives up all appreciation benefits beyond ₹300.

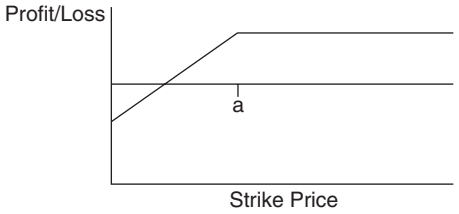

Figure 9.8 Covered Call: Long Stock, Sell Call

Protective Put Strategy This strategy involves buying a put option on a stock and the stock itself. A protective put consists of a long position in a put option combined with a long position in the underlying asset. It is equivalent to a long position in a call option plus a certain amount of cash. A protective put strategy is used when an investor expects market prices to go down. Protective put strategy escalates the cost of acquisition. But this escalated cost limits the downside risk.

DERIVATIVES MARKET IN INDIA

In India, commodity futures dates back to 1875. The government banned futures trading in many of the commodities in the 1960s and the 1970s. Forward trading was banned in the 1960s by the government despite the fact that India had a long tradition of forward markets. Derivatives were not referred to as options and futures but as *'tezi-mandi.'*

In exercise of the power conferred on it under Section 16 of the Securities Contracts (Regulation) Act, the government, by its notification issued in 1969, prohibited all forward trading in securities. However, the forward contracts in the rupee dollar exchange rates (foreign exchange market) are allowed by the RBI and used on a fairly large scale. Futures trading is permitted in 41 commodities. There are 18 commodity exchanges in India. The Forward Markets Commission, under the Ministry of Food and Consumer Affairs, acts as a regulator.

In the case of capital markets, the indigenous 125-year-old *badla* system was very popular among the broking and investor community. The advent of foreign institutional investors in the nineties and a large number of scams led to a ban on *badla.* The foreign institutional investors (FIIs) were not comfortable with this system and they insisted on adequate risk-management tools. Hence, the Securities and Exchange Board of India (SEBI) decided to introduce financial derivatives in India. However, there were many legal hurdles which had to be overcome before introducing financial derivatives. The preamble of the Securities Contract (Regulation) Act, states that the act was to prevent undesirable transactions in securities by regulating business of dealing therein, by prohibiting options, and by providing for certain other matters connected therewith. Section 20 of the act explicitly prohibits all options in securities. The first step, therefore, was to withdraw all these prohibitions and make necessary amendments in the act. The Securities Laws (Amendment) Ordinance, 1995, promulgated on January 25, 1995, withdrew the prohibitions by repealing Section 20 of the SC(R)A, and amending its preamble.

Later on, it was found that there was no regulatory framework to govern trading of derivatives. Hence, the SEBI set up a committee under the chairmanship of Dr L. C. Gupta on November 18, 1996, to develop a regulatory framework for derivatives trading in India. The committee submitted its report on March 17, 1998.

One of the major recommendations of the committee was to expand the definition of 'securities' to include derivatives within its ambit so that trading in derivatives could be introduced and regulated under SC(R)A. In order to make the necessary amendments in the act, the Securities Contracts (Regulation) Amendment Bill, 1998, was introduced in the Lok Sabha on July 4, 1998, which was then referred to the Standing Committee on Finance (SCF) on July 10, 1998, for examination and reporting thereon. This bill lapsed following the dissolution of the 12th Lok Sabha. A new bill, the Securities Laws (Amendment) Bill, 1999, incorporating the amendments proposed in the earlier bill and suggestions of the SCF was introduced in the Lok Sabha on 28 October 1999. The act inserted Clause (aa) in Section 2 to define derivatives to include (a) 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, and (b) a contract which derives its value from the prices or index of prices of underlying securities. It also inserted sub-Clause (ia) in Section 2(h) to include derivatives within the ambit of securities. The act allows only exchange-traded derivatives and prohibits over-the-counter traded derivatives.

In June 1998, the SEBI constituted a group under the Chairmanship of Prof. J. R. Verma to recommend measures for risk containment in the derivatives market to be followed by all exchanges. The group submitted its report in October 1998 and the main recommendations were accepted by the SEBI in March 1999.

On March 1, 2000, the government lifted the three-decade-old prohibition on forward trading in securities by rescinding the 1969 notification.

Derivatives trading formally commenced in June 2000 on the two major stock exchanges, the BSE and the NSE. Futures trading based on the Sensex commenced at the BSE on June 9, 2000, while futures trading based on the S&P CNX Nifty commenced at the NSE on June 12, 2000.

The SEBI set up a technical group to lay down the broad framework for risk management of index options. The trading in index options commenced in June 2001 and trading in options on individual securities commenced in July 2001. Trading in stock futures commenced in January 2002.

New products such as interest rate futures contracts and futures and options contracts were introduced in June 2003 and August 2003 respectively.

FIIs and NRIs have been permitted to invest in all exchange traded derivative contracts.

Exchange traded derivatives contracts on a notional 10-year government bond have been allowed for trading.

Stock brokers have been allowed to trade in derivatives.

The NSE is the leading stock exchange for both equity and derivatives trading. More than 99 per cent of the contracts take place on the NSE. The NSE has trained more than 11,200 investors in the intricacies of derivatives.

Derivatives Market at the NSE

Trading Mechanism The futures and options trading system of the NSE, called NEAT–F&O trading system, provides a fully automated screen-based trading for the S&P CNX Nifty futures on a nationwide basis and an online monitoring and surveillance mechanism. It supports an order-driven market and is

accessed by two types of users: trading members and clearing members. The trading members (TMs) have access to functions such as order entry, order matching, order and trade management while the clearing members (CMs) use the trader workstation for the purpose of monitoring the trading member(s) for whom they clear the trades. They can also enter and set limits to positions which a trading member can take. At present, there are more than 200 derivative members on the NSE. An investor has to sign a client–broker agreement with a member of the derivatives segment before undertaking derivatives trading. A fresh agreement is not needed for options trading if an agreement is already signed for index futures trading. The investor has to pay a commission to his broker-member on the value (strike price plus premium) of his contract. Brokerage rates range between 0.1 and 0.2 per cent of the contract value. An option buyer does not have to pay margins but an option seller has to pay daily marked-to-market margins to the exchange. The broker-member is required to give a contract note for all options and futures transactions done by an investor within 48 hours of the trade.

The minimum contract size in the derivatives market is ₹5 lakh and the market lot for every scrip is prescribed corresponding to the minimum size. A derivatives investor can deal only in multiples of the prescribed market lot. The market lot determines the margins or premium to be paid in order to enter into a derivatives contract.

- The lot size is the number of units that form one futures or options contract for a particular share or an index.

The NSE reduced the lot size for derivative trades in 24 stocks from April 1, 2005. The lot size was pruned as the stock prices of these scrips had gone up. As a result, the value of derivative contracts exceeded the prescribed minimum value of ₹2 lakh. In many scrips, the value of derivative contracts exceeded ₹4 lakh and this prohibited many investors to participate in the derivatives market. Hence, the derivative contracts with a contract size/value of more than ₹4 lakh were halved and the revised market lot size was arrived at by dividing the existing market lot by two. The lot size of the S&P CNX Nifty is 50, S&P CNXMINIFTY 20, Nifty Midcap 300, CNXIT 100, and Bank Nifty 50.

To start trading in the derivatives market, an investor has to make an initial deposit with a broker which may vary from ₹15,000 to ₹50,000 depending on the size of the positions he wishes to take and the instrument (futures/options) he is interested in. This deposit is collected by the broker to pay initial and mark-to-market margins. Margins have to be paid on all futures positions (long as well as short) and on short options positions. Buying options requires no margins, only the upfront premium is to be paid. Margins are comparatively lower on trading in index futures and options rather than on stock futures and options as volatility in the index is lower than in individual stocks. Brokerage rates in the derivatives market ranges from 5–25 paise, depending on the broker and the volume of business done.

Clearing and Settlement The National Securities Clearing Corporation Limited (NSCCL) undertakes clearing and settlement of all deals executed on the NSE's derivatives segment. It acts as a legal counterparty to all deals on the derivatives segment and guarantees settlement. NSCCL has developed a comprehensive risk containment mechanism for the derivatives market. The actual margining happens on a daily basis and online position monitoring on an intra-day basis.

Settlement System The Nifty Index futures are cash settled. Index options on the Nifty are European-style, which means that they can only be exercised upon maturity. In case of futures, settlement is done on a daily basis by marking to market all open positions on the basis of daily settlement price. Members are required to pay the mark-to-market losses by T + 1 day. The contracts are finally settled on the expiry of the Nifty Index Futures Contract. Index options contracts on the Nifty have a daily premium settlement and a formal settlement on the exercise day.

Mutual Funds and Derivatives The SEBI has permitted mutual funds to trade in derivatives. Mutual funds can use derivatives only for hedging and portfolio balancing. Mutual funds have to hold the cash or underlying security equal to the total exposure they take in derivatives. Hence, there is no scope for speculation. In other words, mutual funds cannot use leverage.

Other guidelines of the SEBI state that a fund's offer document has to clearly state that the fund can use derivatives. The fund has to keep its trustees updated (informed) regularly. The mutual fund has to take an approval of the shareholders to take positions in the derivatives market.

DERIVATIVES TRADING IN INDIA

Trading in stock index futures contracts started in June 2000. The BSE was the first exchange to commence derivatives trading on June 9, 2000, followed by the NSE on June 12, 2000. Exactly after a year, trading in index options and trading in individual stock options commenced in June 2001 and July 2001,

respectively. Then in November 2001, futures trading in individual stocks was permitted. There are now four equity derivative products in the Indian market. Worldwide, the most successful equity derivative contracts are index futures, followed by index options and stock options.

The index futures and index options contracts traded on NSE are based on S & P CNX Nifty, CNXIT, and the CNX Bank Indices. Stock futures and options are available on 123 securities. While the index options are European style, stock options are American style.

Stock Index Options

- While the index options are European-style, stock options are America-style.

Stock index options are options where the underlying asset is a stock Index. For example, the S&P CNX Nifty or the BSE Sensex are the underlying securities. Index options were first introduced by the Chicago Board of Options Exchange (CBOE) in 1983 on its index S&P 100. The CBOE is the largest exchange for trading stock options. In index options, one buys or sells the 'entire stock market.' as a single entity. Index options give an investor the right to buy or sell the value of an index, which consists of a certain number of stocks.

Index options enable investors to gain exposure to a broad market with one trading decision and with one transaction. This reduces the transaction costs. The premium of index option, a percentage of the underlying value, is also low.

Both individual investors and professionals, such as mutual fund managers, use stock index options. Individual investors use stock index options to capitalize on market options (bullish, bearish, or neutral) by acting on their views of the broad market or one of its sectors. Professionals use stock index options as tools for enhancing market timing decisions and adjusting asset mixes for asset allocation.

In case of stock index options, an investor can exercise his option only on the last day. These are called European-style options. Stock index options are cash settled.

The index options contract has a minimum size of ₹5 lakh and a maximum maturity of 12 months with a minimum of three strikes: in the money, near the money, and out of the money. Both the NSE and the BSE offer seven strike prices. The lot size for Nifty and Sensex is 200 units and 100 units, respectively. A portfolio-based margining approach is adopted so that an integrated view of the risk involved in the portfolio of each client is possible. For instance, if the Nifty is 1,500 and if an investor is bullish on the market, he can buy one contract (of a lot size of 200) of Nifty October for say ₹20 each. The investor pays a premium of (₹20×200) ₹4,000. If the strike price is ₹1,550, the investor will break-even at the Nifty level of 1,570 (1,550+20). If at expiration, the Nifty rises by 5 per cent or rises to 1,575, the investor makes a profit of ₹5 per Nifty (1,575−1,570) and a total profit of ₹1000 (5×200). If Nifty goes to or below 1,570 at expiration, the investor will not exercise the option and will lose the entire premium of ₹4,000.

All futures and options on stocks are American-style, while the index options and futures are European-style. Currently, both index and stock options are cash settled.

Individual Stock Options Individual stock options are contracts where the underlying asset is an equity stock. They are mostly American-style options, *i.e.*, they can be exercised on any day during their tenure. Prices are normally quoted in terms of premium per share although each contract is for a larger number of shares.

Suppose an investor bought a June Infosys put (a right to sell) on April 3 at a strike price of ₹3,800 paying a premium of ₹650. On that day, spot Infosys was ₹3,300. The option is 'in the money' as the strike price is greater than the spot price. If it is exercised immediately, the investors profit of ₹500 (₹3,800−₹3,300) is less than the premium of ₹650 a shortfall of ₹150. The investor will make a profit when Infosys falls below ₹3,150. Stock options are exercised at the closing spot prices of the underlying stock.

Individual stock options provide a wide array of trading strategies to both hedgers and speculators. Investors can insure their portfolio of equity stocks by buying a protective put. Individual stock options enable investors to enjoy more leverage in the form of greater exposure by paying a small amount of premium. Individual stock options are beneficial to ESOP (Employee Stock Options) holders. ESOPs are subject to lock-in periods and this lock-in period could reduce capital gain in falling markets. Hence, an ESOP holder can buy a put option in the underlying stock and exercise the same if the market price falls below the price of the stock.

In India, options contracts on individual securities are American style and cash settled (Table 9.1). Cash settlement encourages large speculative practices. Cash settlement offers savings in delivery-related costs and induces time and effort for participants. But manipulators on taking large long or short positions

attempt to either inflate or depress the prices in the spot market. Hence, SEBI is planning to enforce delivery based settlement in option contracts on individual stocks.

Stock Index Futures Stock index represents a change in the value of a set of stocks over the base year. This set of stocks constitute the index. For example, the BSE Sensex is a weighted average of the prices of 30 shares and S&P CNX Nifty is a weighted average of the prices of 50 shares.

Stock index futures are futures contracts where the underlying asset is the index. Trading in stock index futures means that market participants are taking a view on the way the index will move. Stock index futures are merely a tool to guess the mood of the market over the period of the contract. The market participants buy the entire stock market instead of individual securities by taking a position on index futures. Index futures can be used for hedging, speculating, arbitrage, cash flow management, and asset allocation. Index futures are settled in cash but investors are required to pay a small fraction of the total contract as margins. With relatively small amount of margins, the investor can take a position that is higher than the value of the risk capital actually invested. This is known as leverage or gearing. Stock index futures enable shuffling of portfolios to change the composition of assets. It carries no risk of dishonour of commitment as the clearing corporation of the exchange is a counter-party to every trade.

Stock index futures are available on the BSE Sensex, S&P CNX Nifty, CNXIT, CNX Nifty Junior, CNX 100, Nifty Midcap 50 and the CNX Bank Indices (Table 9.2). The permitted minimum lot size

TABLE 9.1 Contract Specification for Stock Futures and Options

Particulars	*Stock Futures*	*Stock Options*
Security Description	FUTSTK	OPTSTK
Underlying	Individual Securities	
Style of Option	NA	American
Contract Size	As specified by SEBI; Currently minimum ₹5 lakhs at the time of introduction	
Price Steps	₹0.05	
Expiration Period	3 months	
Trading Cycle	A maximum of three month trading cycle—the near month (one), the next month (two), and the far month (three). New contract is introduced on the next trading day following the expiry of near month contract	
Last Trading/Expiration Day	Last Thursday of the expiry month or the preceding trading day, if last Thursday is a trading holiday	
No. of strike Prices	NA	7 strikes (3 ITM, 1 ATM, and 3 OTM) for every option type (*i.e.*, call and put)
Strike Price Interval	NA	Underlying Price / Strike Price Interval 0–50 / 2.5 50–250 / 5 250–500 / 10 500–1000 / 20 1000–2500 / 30 >2500 / 50
Settlement	In cash on T+1 basis	
Settlement Day	Last Trading day	
Final Settlement Price	Closing value of security on expiry day	Closing Price of security on exercise day or expiry day

Notes:
ITM: In-the-Money
ATM: At-the-Money
OTM: Out-of-the-Money
NA: Not Applicable
Source: NSE, *Factbook*, 2008–09.

TABLE 9.2 Contract Specification for Index Futures and Options

Particulars	*Index Futures*	*Index Options*	*Mini Index Futures*	*Mini Index Options*	*Long-Term Index Options*
Security Description	**FUTIDX**	**OPTIDX**	**FUTIDX**		**OPTIDX**
Underlying Index	S&P CNX Nifty/ CNX Nifty Junior CNX 100/Bank Nifty/ CNX IT/Nifty Midcap 50		S&P CNX Nifty		
Style of Option	NA	European	NA		European
Contract Size	As specified by SEBI, currently minimum ₹2 lakhs at the time of introduction.	As specified by SEBI currently minimum ₹1 lakh at the time of introduction.			As specified by SEBI currently minimum ₹2 lakhs at the time of introduction.
Price Step	₹0.05				
Last Trading/Expiration Day	Last Thursday of the expiry month or the preceding trading day, if last Thursday is a trading holiday.				
Expiration Period	3 months				Atleast 3 years
Trading Cycle	A maximum of three month trading cycle— • Near month (One) • Next month (Two) and • Far month (Three). New contract is introduced on the next trading day following the expiry of near month contract.				• 3 year month expiries • Three following quarterly expiries of the cycle (March, June, Sept & Dec) • After these 5 following half yearly expiries of cycle (June/Dec)
Settlement	In cash on T+1 basis				

Source: NSE, *Factbook*, 2008–09.

in case of the NSE's S&P CNX Nifty is 200 units and multiples thereof. Thus, if the index value is around 1,000, then the appropriate value of a single index futures contract is ₹2,00,000. In case of the BSE Sensex, the minimum market lot is fixed at 50 times the index. In other words, a minimum of 50 contracts of Sensex futures. If the index value is around 5,000, then the appropriate value of a single index futures contract on the BSE is ₹2,50,000. The minimum tick size for an index futures contract on NSE is 0.05 units and the minimum tick size on BSE is 0.1 Sensex points. Thus, a single move in the index value on the NSE would imply a price (gain or loss) of ₹10 (₹0.05×200 units) on an open position of 200 units. In case of BSE Sensex, the tick size is equivalent to ₹5 (tick size × multiplier, *i.e.*, 0.1×50).

Stock index futures are more suitable to institutional and large equity holders as they provide portfolio hedging facility. Pension funds in the US use stock index futures for risk hedging. Stock index is difficult to be manipulated as compared to individual stock prices. Moreover, stock index is much less than individual stock prices. Due to low volatility, capital adequacy and margin requirements are low, which induce more players to participate in the market.

Stock Futures Stock futures are futures contracts on the shares of individual companies. The contract specification for stock futures on NSE is given in Table 9.1. Stock futures are simple compared to stock options. Suppose an investor is bullish on Reliance which is currently quoting at ₹290 per share. The investor expects Reliance price to move up to ₹340 in the next month. If the investor buys Reliance for ₹290 and sells at ₹350 he makes a profit of ₹50 which turns out to be a return of 17 per cent in one month. Instead of buying the scrip if the investor buys stock futures, then he has to merely pay a margin of, say, 20 per cent and can earn a profit of ₹50 on an investment of ₹58. His rate of return is 86 per cent in one month.

As stock futures in India are not linked to delivery, an investor should buy stock futures when he predicts an upward price movement and sell futures when he anticipates a downward price movement. Stock futures provide the advantage of leverage. Traders can carry forward positions and investors can take a position in the market by paying a small amount called margins. The risks are that losses will also get leveraged or multiplied as profits do. A safe strategy for an investor is to go long on futures when they trade at a premium and short when the cost of carrying is negative.

Hedging effectiveness increases with stock futures rather than index futures. It is relatively easier to arbitrage the difference in the price of the underlying stock rather than hedge the index.

Stock futures have features similar to the *badla* system. In *vyaj badla*, the broker used to buy shares at lower rates and sell at higher rates. Similarly, in stock futures, investors take advantage of price differences in the cash market and the futures market. But stock futures are superior to *badla* as the cost of carrying futures (the interest or premium) is known to both the seller and the buyer at the time of entering into a contract. In *badla*, the returns were dependent on the demand-and-supply situation of stocks/funds, and decided on a weekly basis. Similarly stock futures can combine positions in futures as well as options to take advantage of upside profits and cover the downside losses as well.

The number of contracts provided in options on index is based on the range in previous day's closing value of the underlying index and applicable as per Table 9.3.

TABLE 9.3 Strike Price Intervals

Index Level	*Strike Interval*	*Strike Introduced*
Upto 2,000	50	4-1-4
>2,001 Upto 4,000	100	6-1-6
>4,001 Upto 6,000	100	6-1-6
>6,000	100	7-1-7

Source: NSE, *Factbook*, 2008–09.

The above strike parameters scheme are applicable for all long terms contracts also.

Individual stock futures are not very popular in some countries as price volatility in individual stocks is much higher than the index. High price volatility leads to higher risk of clearing corporation and levying of higher margins. Hence, individual stock futures in some countries suffer from lack of depth and trading. While, in India, due to its similarity with *badla* trading, stock futures have become popular and contribute to 32 per cent of the total turnover of the derivatives segment. Since January 2008, the average daily volume in stock futures in terms of the number of contracts being traded on the NSE is the highest in the world.

Review of Minimum Contract Size in Equity Derivatives Segment

The minimum contract size in equity derivatives segment was increased from ₹2 lakhs to ₹5 lakhs.

Accordingly, the framework for determination of lot size for derivatives contracts is as below:

(i) The lot size for derivatives contracts in equity derivatives segment shall be fixed in such a manner that the contract value of the derivative on the day of review is within ₹5 lakhs and ₹10 lakhs.

(ii) For stock derivatives, the lot size (in units of underlying) shall be fixed as a multiple of 25, provided the lot size is not less than 50.

However, if the contract value of the stock derivatives at the minimum lot size of 50 is greater than ₹10 lakhs, then lot size shall be fixed as a multiple of 5, provided the lot size is not less than 10.

(iii) For index derivatives, the lot size (in units of underlying) shall be fixed as a multiple of 5, provided the lot size is not less than 10.

The stock exchanges shall jointly ensure that the lot size is same for an underlying traded across exchanges.

The stock exchanges shall review the lot size once in every 6 months based on the average of the closing price of the underlying for last one month and wherever warranted, revise the lot size by giving an advance notice of at least 2 weeks to the market. If the revised lot size is higher than the existing one, it will be effective for only new contracts.

Derivative Products

Following products are available for trading in the equity derivative segment of exchanges;

Products	Settlement type
Index Futures	Cash Settled
Index Options	Cash Settled (European style)
Stock Futures	Cash/Physical Settled
Stock Options	Cash/Physical Settled (European style)

Presently, the minimum contract size in equity derivatives segment is ₹5 lakhs. Therefore, the lot size for derivatives contracts in equity derivatives segment is fixed in such a manner that the contract value of the derivative on the day of review is within ₹5 lakhs and ₹10 lakhs.

SEBI has prescribed eligibility criteria for introduction of derivatives on stocks and indices which includes the following:

(a) A stock to be part of Top 500 stocks in terms of average daily market capitalization and average daily traded value in the previous six months on a rolling basis.
(b) The stock's median quarter sigma order size over the last six months shall be not less than ₹10 Lakh and
(c) The market wide position limit (MWPL) in the stock shall not be less than ₹300 crores.

Participation in Derivatives Market by Mutual Funds

The existing schemes of the mutual funds, whose Scheme Information Documents (SIDs) do not envisage investments in derivatives, are required to obtain positive consent from majority of the unit holders before commencing investment in derivatives. An exit option has to be provided to the dissenting unit holders and such option is to be kept open for a period of one month prior to the scheme commencing trading in derivatives.

"Existing schemes of mutual funds, whose SIDs do not envisage investments in derivatives, may participate in derivatives market subject to the following conditions:

(i) The extent and the manner of the proposed participation in derivatives shall be disclosed to the unit holders.
(ii) The risks associated with such participation shall be disclosed and explained by suitable numerical examples.
(iii) Prior to commencing participation in derivatives, the scheme shall comply with the provisions of Regulation 18 (15A) of SEBI (Mutual Funds) Regulations, 1996 and all unit holders shall be given at least 30 days to exercise option to exit at prevailing NAV without charging of exit load."

The equity derivatives segment is the most vibrant, active and dominant segment not only in the Indian securities market but also occupies a significant place in the world derivatives market in terms of number of contracts traded, products traded as well as traded value.

NSE had 176 stocks and BSE had 173 stocks in the stock options as well as the futures segment. Index futures and options are allowed on ten and eight indices respectively at NSE while they are allowed on nine and five indices at BSE.

In the index derivatives segment at NSE, derivatives are offered on the following indices:

Nifty, Nifty Midcap 50, Nifty Bank, Nifty Infra, Nifty IT and Nifty PSE. Index derivatives are also allowed in three foreign indices: the Dow Jones index, S&P 500 and UK FTSE 100 index.

In BSE's index derivatives segment, derivatives are offered on the following indices:

S&P BSE Sensex, S&P BSE Bankex, S&P BSE oil and gas index, S&P BSE Teck index and S&P BSE100. At BSE, futures on foreign indices are available for the HSI index, MICEX index, FTSE/JSE top 40 and the Bovespa index.

NSE introduced futures contracts on India VIX in the futures and options segment of NSE, w.e.f., February 26, 2014. It is a volatility index based on the NIFTY index option prices. From the best bid-ask prices of NIFTY Options contracts, a volatility figure (in percentage) are calculated which indicates the expected market volatility over the next 30 calendar days. This volatility index is a measure of market expectations of near-term. The contract symbol is INDIAVIX and 3 weekly futures contracts were made available for trading. The contracts shall expire on every Tuesday. The tick size is 0.25 and lot size is 550.

Looking to the participant-wise share in NSE F&O turnover, proprietary trades account for an average 50 per cent share in the total turnover, FPIs account for a share of around 12 per cent in the total turnover, and the others category (comprising retail, HNIs and private and public companies) have an average share of 38 per cent in the total turnover while mutual funds constitute a miniscule share of 0.5 per cent.

According to the 2015, Report of the World Federation of Exchanges (WFE), NSE accounted for nearly 50 per cent of total global volumes in stock index options and its turnover to GDP ratio for 2015–16 stood at 511, which itself illustrates the kind of liquidity this market has.

The trading volumes in the equity derivatives market was 12 times that of the equity cash segment in February, 2017. Index options have gained a share among various derivatives products traded in the Indian derivatives markets. Options on index accounted for about 79 per cent of the total turnover in the F&O segment at NSE.

Index options and stock options dominate trading in the derivatives segment by accounting for 83.61 per cent of total trading in derivative segment. The possible reasons for greater trading interest in the options could be that the Security Transaction Tax (STT) on options is chargeable on option premium value, and thus could be lower in term of value than that of futures where it is chargeable on notional value and also the trading in options enable market participant's to deploy various trading strategies to earn upfront premium that may be used to off-set losses or enhance gains in their trading position in futures or in cash market.

Between the period FY 2004–05 to FY 2016–17, the compounded annual growth rate (CAGR) for turnover in cash market has been 11.39 per cent, whereas CAGR for turnover in equity derivatives has been 35.10 per cent. The market capitalization of listed companies (BSE) has grown by 17.82 per cent CAGR during this period. It is also observed that the ratio of turnover of equity derivatives to equity cash has increased from 1.54 to 15.59 during the aforesaid period. The increase in the turnover over the years may be attributed to various reasons including the higher index levels and increase in stock prices resulting in growth of national turnover, reduced STT on equity futures from 0.017 per cent to 0.01 per cent and introduction of commodity transaction tax at 0.01 per cent on non-agricultural commodity futures in the Budget 2013, etc. Over the years, more than 95 per cent of equity derivative trading in India happens on NSE.

Futures and options on NIFTY are available for trading in other jurisdictions, namely, Singapore Exchange Ltd. (SGX), Osaka Exchange Inc. (OSE), Chicago Mercantile Exchange Inc. (CME), London Stock Exchange and SENSEX on Hong Kong Exchange and Clearing Ltd, BM & BOVESPA SA, Brazil, Johannesburg Stock Exchange, SA, Public Joint Stocks Company MICEX RTS, Moscow, The Korea Exchange Incorporated, Dubai Gold & Commodities Exchange, Dubai

The contribution of individual investors to the total turnover in the equity derivative segment remained in the range of 26 per cent to 33 per cent. The proprietary trades, i.e., trading by stock brokers on their proprietary account dominate trading in Index options. Non-Institutional Non-Proprietary category which includes individual investors and proprietary category together contributed around 85 per cent of the total trading volume in index options. One possible reason for the active trading by proprietary trades in derivatives especially options could be upfront income in the form of option premium on writing of options. Foreign investors contribute between 15 per cent–20 per cent in the total volume across all product categories available in equity derivatives segment.

SEBI has taken steps to develop the cash market by initiating measures, such as, introduction of new products, redesigning existing products, conducting investor awareness initiative, etc. SEBI has revised the margin trading facility by rationalising initial margin requirements in cash market, permitting stocks as collateral for availing funding from stock brokers, etc.

Conclusion

The derivatives market has grown tremendously world over. This market, just like other markets, is not immune to disasters and breakdowns. Excessive speculation in the futures markets led to the collapse of 200 year-old bank, Barings, as well as of Germany's big industrial group, Metallgesellschaft. Similarly, the Long Term Capital Management (LTCM), an institution created by two professors who won the Nobel Prize, had USD 120 billion in balance-sheet exposure and USD 1.2 trillion of notional derivatives exposure. This institution was closed down by the US government within one year of its operations.

In India, the derivatives market is new but is just catching up. Proper checks and controls are necessary for a smooth functioning of this market to prevent excessive speculation and scams.

KEY TERMS

Arbitrageur
At-the-money Option
Bear Spread
Bull spread
Cost of Carry
Derivatives
Exchange-Traded Derivative
Forwards
Forward Contracts
Futures
Futures Contracts
Hedger
In-the-money Option
Intrinsic Value of Options
Options
OTC Derivatives
Out-of-the-money Option
Speculator
Spot Price
Spreads
Straddle
Strangle and Covered Call
Swaps
Swaptions
Time Value of Options
Volatility
Warrants

SUMMARY

1. A derivative is a contract whose value is derived from the value of another asset, known as the underlying, which could be a share, a stock market index, an interest rate, a commodity, or a currency.
2. The explosive growth of derivatives in developed centuries is fuelled by the increased volatility in global financial markets, the technological changes, breakthrough in modern financial theory, political developments, and increased integration of domestic financial markets with international markets.
3. Derivatives reduce risk, enhance liquidity, lower transaction costs, enhance the efficiency price discovery process, help investors to adjust the risk and return characteristics of their stock portfolio and provide information on the magnitude and the direction in which various market indices are expected to move.
4. The Securities Contracts (Regulation) Act [SC(R)A], 1956, defines derivatives in the following manner. Derivatives include: (i) 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. (ii) a contract which derives its value from the prices or index of prices of underlying securities.
5. The different types of financial derivatives are forwards, futures, options, warrants, swaps, and swaptions.
6. The different traders in derivatives market are hedger, speculators, and arbitrageurs.
7. Derivatives trading in India formally commenced in June 2000 on the two major stock exchanges—the BSE and the NSE. Futures trading based on the Sensex commenced at the BSE on June 9, 2000, while futures trading based on the S&P CNX Nifty commenced at the NSE on June 12, 2000.
8. A forward contract is a customized contract between two parties where settlement takes place on a specific date in the future at a price agreed today. They are over-the-counter traded contracts.
9. Futures are exchange-traded contracts, or agreements, to buy or sell a specified quantity of financial instrument/commodity in a designated future month at a price agreed upon by the seller and buyer.
10. Futures allow hedging against adverse price changes, help in price-discovery, make transactions across time easier, speedier, and less costly and help in optimal allocation of resources.
11. There are four views that an investor can take on market movements: bullish, bearish, volatile, and neutral. Different strategies are available for different views on market movements. These strategies can be classified into three groups: hedging strategies, speculative trading strategies and arbitrage strategies.
12. The price of the contract defined under cost of carry model of futures prices is:
$$F = S + C$$
Futures price = Spot price + Carry costs
The above equation can also be expressed as:
$$F = S\,(1+r)^T$$
13. Cost of carry model for stock index futures = Financing cost − Dividends.
Price of Index futures when given the expected dividend yield.
$$F = S\,[1+(r-d)^T]$$
14. There are four hedging strategies in case of index futures: Long stock, short index futures; short stock, long index futures; hedging a portfolio with short index futures; and hedging with long index futures.
15. There are two strategies for speculation in case of index futures: long index futures, short index futures and basis trading.
16. Options are contracts that give the holder the option to buy/sell specified quantity of the underlying assets at a particular (strike) price on or before a specified time period. The word 'option' implies that the holder of the options has the right but not the obligation to buy or sell underlying assets.
17. Options are of two basic types—'call' option and 'put' option. A call option is a right to buy an underlying asset at a specified price on or before a particular day by paying a premium. A 'put' option is a right to sell an underlying asset at a specified price on or before a particular day by paying a premium.
18. An option may be in the money, out of the money, or at the money. When the underlying asset price (S) is greater than the strike price (X) of the call option, that is, S > X is in-the-money option. When the underlying asset price (S) is less than the strike price (*X* of the call option), that is, S < X is an out-of-the-money option. When the option's underlying asset price is equal to the option's strike price, that is, S = X is at-the-money option. It would lead to zero cash flow if exercised immediately.
19. The intrinsic value of an option is the greater of zero, or the amount that is in-the-money. Only in-the-money options have intrinsic value. It is defined as the amount by which an option is in the money, or the immediate exercise value of the option when the underlying position is marked-to-market.
For a call option: Intrinsic value = Spot price − Strike price.
For a put option: Intrinsic value = Strike price − Spot price.
20. The time value of an option is the difference between its premium and its intrinsic value. Time value is the amount option buyers are

willing to pay for the possibility that the option may become profitable prior to expiration due to favourable change in the price of the underlying.

21. The various option Greeks are: *Delta*, *Gamma*, *Theta*, *Rho*, and *Vega*. *Delta* measures the sensitivity of an option's premium/price to a change in the value of the underlying asset. *Gamma* measures the change in *delta* of an option for a change in the price of the underlying asset. *Theta* measures the rate at which an option's time premium diminishes as time passes. *Rho* measures the change in the option price for a change in the risk-free interest rates. *Vega* measures the sensitivity of an option's price to a change in its implied volatility.
22. Options are versatile derivative instruments as they are a means of insurance against adverse price movement, and provide high leverage.
23. The different types of options trading strategies are option spreads—vertical spreads, horizontal spreads, and diagonal spreads; volatility trading—Straddle, strangle, and butterfly spread; put–call parity; arbitrage beyond upper and lower bounds and covered writing.
24. Vertical spreads involve the simultaneous buying and selling of options on the same underlying instrument for the same expiration date but with different exercise prices. Bull spread is a spread that is created by buying a low strike price option and selling a high strike price option on the same stock. It is designed to profit if the price goes up. A spread that is designed to profit if the price goes down is called a bear spread. A horizontal or calendar spread is a spread where the options used have the same strike price but different expiration dates. A calendar spread trading strategy is used by an investor who thinks that the market will be weak in the short-term but rally in the long-term. Diagonal spread combines both vertical and horizontal features. In a diagonal spread, both the expiration date and the strike price of the calls are different. Straddle is a position of buying a put and call with the same price and expiration date. Like a straddle, a strangle is the buying/selling of a combination of one call option and one put option with same maturity. But unlike straddle, strangle has different exercise prices. A butterfly spread is a combination of a bull and bear spread. This strategy is used when the investors expect that the stock prices will not significantly rise or decline by expiration.
25. The Black–Scholes Option Pricing Model was originally developed for European-style options on non-dividend paying stocks by Fischer Black and Myron Scholes.

$$C = S.N(d_1) - Ke^{-rT}.N(d_2)$$

$$P = Ke^{-rT}N(-d_2) - SN(-d_1)$$

where $d_1 = \text{In } S/K + \left(r + \sigma^2/2\right)^T/\sigma\sqrt{T}$

$d_2 = d_1 - \sigma/\sqrt{T}$

26. Put–call parity relationship is expressed as

$$S + p = c + \frac{X}{\left(1 + r\right)^T}$$

where,

S = Spot price of the underlying
p = Price of European put option
c = Price of European call option
X = Exercise price of options
T = Time to expiration
r = Risk-free rate of interest

If $S + p \neq c\,\frac{X}{(1 + r)^T}$, then an arbitrage opportunity exists.

For a dividend paying stock, the put–call parity relationship is

$$c + \frac{X}{(1 + r)^T} + D = p + S.$$

27. A call option gives the holder the right to buy a stock or an index for a certain price. As the option can never be worth more than the stock/index, the stock price/index is an upper bound to the option price.

$C < S$, where
C = Price of call option
S = Current stock price/current index level

The lower bound for the price of a call option is $S - X\,(1+r)^{-T}$. If the price of a call is not worth at least this much, then it will be possible to make riskless profits.

28. A call option is a means of ensuring a maximum purchase price and a put option ensures a minimum selling price. The purchase of a put option, or alternatively, selling of a call option are a means of hedging against a price fall. The purchase of a call option or, alternatively, selling of a put option are a means of protection from a price rise. The strategy of writing options is preferable if the price change is not significant or is modest whereas buying options is a better strategy if the price movement is significant or substantial.
29. There are now four equity derivative products in the Indian market. Stock index options are options where the underlying asset is a stock index. Individual stock options are contracts where the underlying asset is an equity stock. Stock index futures are futures contracts where the underlying asset is the index. Stock futures are futures contracts on the shares of individual companies.

REVIEW QUESTIONS

1. What are derivatives? State the reasons for the explosive growth of derivatives.
2. Explain the difference between hedging, speculation, and arbitrage.
3. How do futures contracts differ from forward contracts?
4. How do futures differ from options?
5. Explain the cost of carry model of future prices.
6. What are options? Explain the different types of options.
7. When is a call option in the money, out of the money, and at the money?
8. Discuss options trading strategies.
9. What is volatility trading? Which are the different strategies for volatility trading?
10. Which issues still need to be resolved for the growth of the Indian derivatives market?
11. Fill in the blanks
    i. Spot value of Nifty is 1,120. An investor buys a one month Nifty 1,130 call option for a premium of ₹7. The option is _____.
       (a) in the money (c) at the money
       (b) out of the money (d) none of the above
    ii. A stock is currently selling at ₹90. The call option to buy the stock at ₹85 costs ₹10. What is the time value of the option?
       (a) ₹4 (d) ₹2
       (b) ₹5 (e) ₹6
       (c) ₹3
    iii. A bull spread is created by _____.
       (a) buying a call and a put
       (b) buying a call and a spread

(c) buying two calls
(d) selling two calls

iv. Nifty stands at 1,065, the risk-free rate of interest is 12 per cent per annum, the price of a three-month Nifty 1,060 calls is ₹90 and the price of three months Nifty put is ₹60. To exploit the arbitrage, an investor should _____.
(a) sell the index plus a put and buy a call
(b) sell the index plus a call and buy a put
(c) buy the index plus a put and sell a call
(d) none of the above

v. On January 1, call option on the Nifty with a strike of 1,160 is available for trading. Expiration date is January 20. The *T* that is used in the Black–Scholes formula should be:
(a) 0.091 (c) 20
(b) 0.055 (d) none of the above

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