SREENIVASA INSTITUTE of TECHNOLOGY and MANAGEMENT STUDIES
(Autonomous)

DEPARTMENT OF MANAGEMENT STUDIES

22MBA242A : FINANCIAL DERIVATIVES

LECTURE NOTES

II MBA / IV - SEMESTER   REGULATION: R22

BY

FACULTY INCHARGE   :   DR.K.SUDARSAN, PROFESSOR

II MBA – Semester - IV			L	T	P	C
Course Code	**FINANCIAL DERIVATIVES**		3	1	0	4
22MBA242A			3	1	0	4

Course Educational Objectives:

CEO1: To provide knowledge about financial derivatives and the role of derivatives in financial markets.

CEO2: To create awareness about types, trading mechanism, hedging strategies and pricing of forwards.

CEO3: To understand the trading mechanism, hedging strategies and pricing of futures.

CEO4: To explain the mechanics of the options market, various trading strategies and option pricing models.

CEO5: To give an elaborate view on pricing and valuing swaps and management of risk using Swaps.

UNIT - I	**Introduction to Derivatives Market**	Lecture Hrs: 10

Definition and features of derivatives - Development and growth of derivatives market - Types of derivatives – Uses and misuses of derivatives –Structure and functions of derivatives – Participants in derivatives market.

UNIT - II	**Forward Market**	Lecture Hrs: 12

Meaning, features, functions, types of forward contracts - Mechanism of forward trading – Hedging strategies using forwards – Forward pricing – Currency and interest rate forwards.

UNIT - III	**Future Market**	Lecture Hrs:12

Meaning, Features, Functions, Types of Futures Contract — Futures Market Vs. Forward Market - Mechanics of Future Markets - Hedging Strategies using Futures - Futures pricing – Currency and Interest rate futures.

UNIT - IV	**Options**	Lecture Hrs:12

Meaning of Options - Distinguish between Options and Futures - Structure of Options Market - Principles of Option Pricing. Option Pricing Models: The Binomial Model, The Black-Scholes Merton Model - Currency Options.

UNIT - V	**Swaps**	Lecture Hrs:12

Concept, Nature, Evolution, and Features - Interest Rate Swaps - Currency Swaps - Equity Index Swaps **-** Pricing and Valuing Swaps.

Course Outcomes:

	On successful completion of the course the student will be able to,	POs related to COs
CO1	**Understand** the concept of financial derivatives and the role of derivatives in financial markets.	PO1, PO8
CO2	**Acquire** analytical skills on trading mechanism, hedging strategies and pricing of forwards.	PO2, PO4, PO8
CO3	**Demonstrate** the trading mechanism, hedging strategies and pricing of futures.	PO2,PO4, PO8
CO4	**Knowledge** the various option trading strategies and pricing of options using Binomial Model, and Black-Scholes Merton Model.	PO2, PO4, PO8
CO5	**Understand** the pricing and valuing swaps and management of risk using swaps.	PO2, PO4, PO8

Text Books:
1. Derivatives and Risk Management, 1/e, Jayanth Rama Varma, TMH.   2. Financial Derivatives, Gupta, PHI. 2008
Reference Books:
1. Fundamentals of Financial Derivatives, Prafulla Kumar Swain, Himalaya Publishing House Pvt. Ltd., India, 2011.   2. Foreign Exchange Markets, Surendra S.Yadav, P.K.Jain, Max Peyrard, Macmillan Publishers India Ltd., 2011.   3. Financial Derivatives, Mishra, Excel, 2009.   4. Risk Management & Derivatives, Stulz, Cengage, 2009.   5. Options, Futures and Other Derivatives, 7/e, John C Hull, Pearson Education, 2009.   6. Derivatives Valuation and Risk Management, David A. Dubofsky, Thomas W Muller, TR, Oxford, 2008.   7. Fundamentals of Futures and Options Market, John C Hull, Pearson Education, 2008.   8. Financial Derivatives: Theory Concepts And Problems, 2/e, S.L. GUPTA, PHI, 2017.   9. Risk Management Insurance and Derivatives G. Koteshwar, Himalaya, 2008.
Online Learning Resources:
https://nptel.ac.in/courses/110107128   https://onlinecourses.nptel.ac.in/noc19_mg39/preview   https://nptel.ac.in/courses/110105071   https://learnawesome.org/topics/fb281c2e-51af-4d30-a7f3-2919902458e0-derivatives?item_type=course

UNIT – I

FINANCIAL DERIVATIVES

Definition of Financial Derivatives

The term "Derivative" indicates that it has no independent value, i.e., its value is entirely derived from the value of the underlying asset. The underlying asset can be securities, commodities, bullion, currency, livestock or anything else.

The Securities Contracts (Regulation) Act 1956 defines "derivative" as under:

"Derivative" includes

1. Security derived from a debt instrument, share, loan whether secured or unsecured, risk instrument or contract for differences or any other form of security.

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

The above definition conveys that

1. The derivatives are financial products.

2. Derivative is derived from another financial instrument/contract called the underlying. In the case of Nifty futures, Nifty index is the underlying. A derivative derives its value from the underlying assets. Accounting Standard SFAS133 defines a derivative as, 'a derivative instrument is a financial derivative or other contract with all three of the following characteristics:

(i) It has (1) one or more underlings, and (2) one or more notional amount or payments provisions or both. Those terms determine the amount of the settlement or settlements.

(ii) It requires no initial net investment or an initial net investment that is smaller than would be required for other types of contract that would be expected to have a similar response to changes in market factors.

(iii) Its terms require or permit net settlement. It can be readily settled net by a means outside the contract or it provides for delivery of an asset that puts the recipients in a position not substantially different from net settlement

Features of a Financial Derivatives

A derivative instrument relates to the future contract between two parties. It means there must be a contract-binding on the underlying parties and the same to be fulfilled in future. The future period may be short or long depending upon the nature of contract, for example, short term interest rate futures and long term interest rate futures contract.

2. Normally, the derivative instruments have the value which derived from the values of other underlying assets, such as agricultural commodities, metals, financial assets,

intangible assets, etc. Value of derivatives depends upon the value of underlying instrument and which changes as per the changes in the underlying assets, and sometimes, it may be nil or zero. Hence, they are closely related.

3.   In general, the counter parties have specified obligation under the derivative contract. Obviously, the nature of the obligation would be different as per the type of the instrument of a derivative. For example, the obligation of the counter parties, under the different derivatives, such as forward contract, future contract, option contract and swap contract would be different.

4.   The derivatives contracts can be undertaken directly between the two parties or through the particular exchange like financial futures contracts. The exchange- traded derivatives are quite liquid and have low transaction costs in comparison to tailor-made contracts. Example of exchange traded derivatives are Dow Jones, S&P 500, Nikki 225, NIFTY option, S&P Junior that are traded on New York Stock Exchange, Tokyo Stock Exchange, National Stock Exchange, Bombay Stock Exchange and so on.

5.   In general, the financial derivatives are carried off-balance sheet. The size of the derivative contract depends upon its notional amount. The notional amount is the amount used to calculate the pay off. For instance, in the option contract, the potential loss and potential payoff, both may be different from the value of underlying shares, because the payoff of derivative products differs from the payoff that their notional amount might suggest.

6. Usually, in derivatives trading, the taking or making of delivery of underlying assets is not involved; rather underlying transactions are mostly settled by taking offsetting positions in the derivatives themselves. There is, therefore, no effective limit on the quantity of claims, which can be traded in respect of underlying assets.

7.   Derivatives are also known as deferred delivery or deferred payment instrument. It means that it is easier to take short or long position in derivatives in comparison to other assets or securities. Further, it is possible to combine them to match specific, i.e., they are more easily amenable to financial engineering.
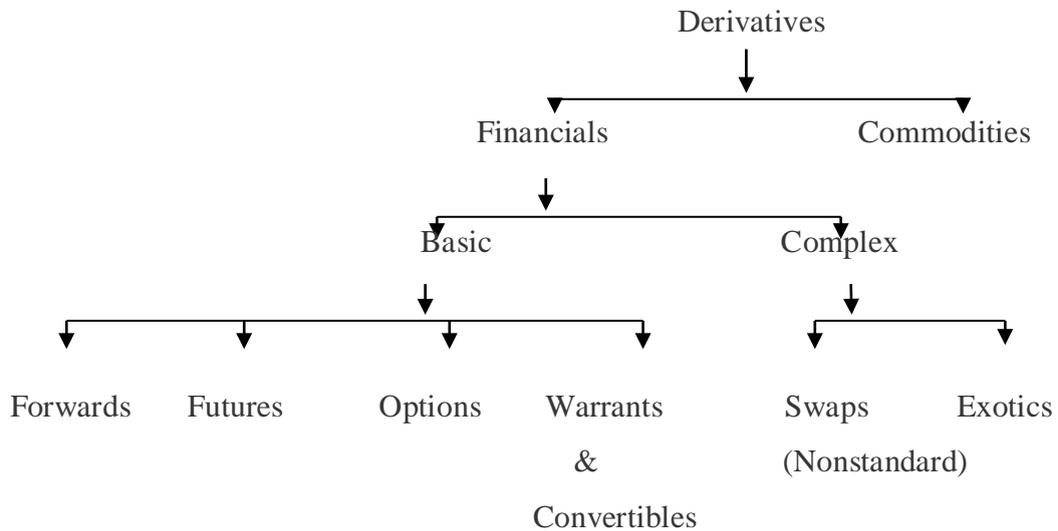
8.   Derivatives are mostly secondary market instruments and have little usefulness in mobilizing fresh capital by the corporate world; however, warrants and convertibles are exception in this respect.

9.   Although in the market, the standardized, general and exchange-traded derivatives are being increasingly evolved, however, still there are so many privately negotiated customized, over-the-counter (OTC) traded derivatives are in existence. They expose the trading parties to operational risk, counter-party risk and legal risk. Further, there may also be uncertainty about the regulatory status of such derivatives.

10. Finally, the derivative instruments, sometimes, because of their off-balance sheet nature, can be used to clear up the balance sheet. For example, a fund manager who is restricted from taking particular currency can buy a structured note whose coupon is tied to the performance of a particular currency pair.

Types of Financial Derivatives

The derivatives can be classified into different categories which are shown in the Fig.

```
                          Derivatives
                              │
                              ▼
              ┌───────────────┴───────────────┐
              ▼                                ▼
          Financials                      Commodities
              │
              ▼
      ┌───────┴───────┐
      ▼               ▼
    Basic           Complex
      │               │
      ▼               ▼
┌─────┼─────┬─────┐  ┌─┴───────┐
▼     ▼     ▼     ▼  ▼         ▼
Forwards Futures Options Warrants  Swaps   Exotics
                        &      (Nonstandard)
                     Convertibles
```

Basic Financial Derivatives

Forward Contracts

A forward contract is a simple customized contract between two parties to buy or sell an asset at a certain time in the future for a certain price. Unlike future contracts, they are not traded on an exchange, rather traded in the over-the-counter market, usually between two financial institutions or between a financial institution and its client.

Futures Contracts

Like a forward contract, a futures contract is an agreement between two parties to buy or sell a specified quantity of an asset at a specified price and at a specified time and place. Futures contracts are normally traded on an exchange which sets the certain standardized norms for trading in the futures contracts.

Options Contracts

Options are the most important group of derivative securities. Option may be defined as a contract, between two parties whereby one party obtains the right, but not the obligation, to buy or sell a particular asset, at a specified price, on or before a specified date. The person who acquires the right is known as the option buyer or option holder, while the other person (who confers the right) is known as option seller or option writer. The seller of the option for giving such option to the buyer charges an amount which is known as the option premium.

Warrants and Convertibles

Warrants and convertibles are other important categories of financial derivatives, which are frequently traded in the market. Warrant is just like an option contract where the holder has the right to buy shares of a specified company at a certain price during the given time period. In other words, the holder of a warrant instrument has the right to purchase a specific number of shares at a fixed price in a fixed period from an issuing company. If the holder exercised the right, it increases the number of shares of the issuing company, and thus, dilutes the equities of its shareholders. Warrants are usually issued as sweeteners attached to senior securities like bonds and debentures so that they are successful in their equity issues in terms of volume and price. Warrants can be detached and traded separately. Warrants are highly speculative and leverage instruments, so trading in them must be done cautiously.

Convertibles are hybrid securities which combine the basic attributes of fixed interest and variable return securities. Most popular among these are convertible bonds, convertible debentures and convertible preference shares. These are also called equity derivative securities. They can be fully or partially converted into the equity shares of he issuing company at the predetermined specified terms with regards to the conversion period, conversion ratio and conversion price. These terms may be different from company to company, as per nature of the instrument and particular equity issue of the company.

SWAP Contracts

Swaps have become popular derivative instruments in recent years all over the world. A swap is an agreement between two counter parties to exchange cash flows in the future.

Under the swap agreement, various terms like the dates when the cash flows are to be paid, the currency in which to be paid and the mode of payment are determined and finalized by the parties. Usually the calculation of cash flows involves the future values of one or more market variables.

Other Derivatives

As discussed earlier, forwards, futures, options, swaps, etc. are described usually as standard or 'plain vanilla' derivatives. In the early 1980s, some banks and other financial institutions have been very imaginative and designed some new derivatives to meet the specific needs of their clients. These derivatives have been described as 'non-standard' derivatives. The basis of the structure of these derivatives was not unique, for example, some non-standard derivatives were formed by combining two or more 'plain vanilla' call and put options whereas some others were far more complex.

Warrants

Warrants are the options which have a maturity period of more than one year and hence, are called long-dated options. These are mostly OTC derivatives.

Convertible Bonds

Convertible bonds are the type of contingent claims that gives the bondholder an option to participate in the capital gains caused by the upward movement in the stock price of the company, without any obligation to share the losses.

Callable Bonds

Callable bonds provide an option to the issuer to completely pay off the bonds before their maturity.

Advantages of Derivatives

Unsurprisingly, derivatives exert a significant impact on modern finance, because they provide numerous advantages to the financial markets:

1. **Hedging risk exposure**

Since the value of the derivatives is linked to the value of the underlying asset, the contracts are primarily used for hedging risks. For example, an investor may purchase a derivative contract whose value moves in the opposite direction to the value of an asset the investor owns. In this way, profits in the derivative contract may offset losses in the underlying asset.

2. **Underlying asset price determination**

Derivates are frequently used to determine the price of the underlying asset. For example, the spot prices of the futures can serve as an approximation of a commodity price.

3. **Market efficiency**

It is considered that derivatives increase the efficiency of financial markets. By using derivative contracts, one can replicate the payoff of the assets. Therefore, the prices of the underlying asset and the associated derivative tend to be in equilibrium to avoid arbitrage opportunities.

4. **Access to unavailable assets or markets**

Derivatives can help organizations get access to otherwise unavailable assets or markets. By employing interest rate swaps, a company may obtain a more favorable interest rate relative to interest rates available from direct borrowing.

Disadvantages of Derivatives

Despite the benefits that derivatives bring to the financial markets, the financial instruments come with some significant drawbacks. The drawbacks resulted in disastrous consequences during the financial crisis of 2007-2008. The rapid devaluation of mortgage-backed securities and credit-default swaps led to the collapse of financial institutions and securities around the world.

1. **High risk**

The high volatility of the derivatives exposes them to potentially huge losses. The sophisticated design of the contracts makes the valuation extremely complicated or even impossible. Thus, they bear a high inherent risk.

2. **Speculative features**

Derivatives are widely regarded as a tool of speculation. Due to the extremely risky nature of derivatives and their unpredictable behavior, unreasonable speculation may lead to huge losses.

3. **Counter-party risk**

Although derivatives traded on the exchanges generally go through a thorough due diligence process, some of the contracts traded over-the-counter do not include a benchmark for due diligence. Thus, there is a possibility of counter-party default.

Participants in Derivative Markets

The participants in the derivative markets can be broadly classified in three depending upon their motives. These are:

1. Hedgers
2. Speculators
3. Arbitrageurs

Hedgers

Hedgers are those who enter into a derivative contract with the objective of covering risk. A forward contract would eliminate price risk for both the parties. A forward contract is entered into with the objective of hedging against the price risk being faced by the farmer as well as the flour mill. Such participants in the derivatives markets are called hedgers. The hedgers would like to conclude the contract with the delivery of the underlying asset.

Speculators

Speculators are those who enter into a derivative contract to make profit by r assuming risk. They have an independent view of future price behaviour of the underlying asset and take appropriate position in derivatives with the intention of making profit later. For example, the forward price in US dollar for a contract maturing in three months is ` 48.00. If one believes that three months later the price of US dollar would be ` 50, one would buy forward today and sell later. On the contrary, if one believes US dollar would depreciate to ` 46.00 in 1 month one would sell now and buy later. Note that the intention is not to take delivery of underlying, but instead gain from the differential in price.

Arbitrageurs

Aarbitrageurs, performs the function of making the prices in different markets converge and be in tandem with each other. While hedgers and speculators want to eliminate and assume risk respectively, the arbitrageurs take riskless position and yet earn profit. They are constantly monitoring the prices of different assets in different markets and identify opportunities to make profit that emanate from mispricing of products.

Functions of Derivative Markets

Derivatives were invented to fulfill the need of hedging against the price risk. It enables transfer of risk from those wanting to avoid it to those who are willing to assume it. Besides hedging, derivatives perform many other important functions which are discussed below.

Enable Price Discovery

First, the derivatives and their market increase the competitiveness of the market as it encourages more number of participants with varying objectives of hedging, speculation, and arbitraging. With broadening of the market the changes in the price of the product are watched by many who trade on the slightest of reasons. Even a minor variation in price prompts action on the part of speculators. Active participation by large number of buyers and sellers ensures fair price. The derivative markets, therefore, facilitate price discovery of assets due to increased participants, increased volumes, and increased sensitivity of Participants To react to smallest of price changes.

Facilitate Transfer of Risk

Hedgers amongst themselves could eliminate risk if two parties face risk from opposite movement of price. As seen earlier, the wheat farmer needing to sell his produce faced a risk from the fall in price, while the flour mill needing to buy wheat was worried about the rise in price. Since risk was emanating from opposing directions of price movement, the convergence of the two was possible. If both the farmer and the flour mill wanted to hedge against price rise the two would not meet. When speculators enter the market they discharge an important function and help transfer of risk from those wanting to eliminate to those wanting to assume risk.

Provide Leveraging

Taking position in derivatives involves only fractional outlay of capital when compared with the position in the underlying asset in the spot market. Assume a speculator is convinced that price of wheat will be Rs.16 per kg in six months and a farmer agrees to sell at ` Rs. 15.50 per kg. To take advantage the speculator will have to pay the full price of Rs. 15.50 now and realize Rs.16.00 six months later. Instead, if a mechanism is available by which he can absolve himself of making the full payment, he will be too glad to enter into a contract.

Derivatives, as products, and their markets provide such exit route by letting him first enter into a contract and then permitting him to neutralize position by booking an opposite contract at a later date. This magnifies the profit manifolds with the same resource base. This also helps build volumes of trade, further helping the price discovery process.

Other Benefits

The function of leveraging and risk transfer helps in efficient portfolio management. With a smaller fund at disposal, better diversification can be achieved with part of the fund allocation to derivatives assets. Derivatives provide a much wider menu to portfolio managers who constantly seek better risk return trade off. The range of choices would be far more restricted in the absence of derivatives.

Since very large number of participants become active in the market (due to leveraging), the transaction costs are likely to be lower and lower with derivative markets.

Misuses, Criticism of Derivatives

Derivatives act like a double-edged sword. When used properly and conservatively they are highly effective but when used with indiscretion they are capable of causing miseries. Unfortunately there is no pragmatic way to demarcate the discretion with indiscretion. There is a very fine line that separates calculated risk taking and gambling. The following are often cited as demerits of derivatives.

Increased Volatility

Since derivatives offer extremely leveraged position, a large number of participants are attracted towards the market with nominal capital available with them. Giving rise to speculative tendencies derivative markets are often blamed for causing extreme volatilities in the prices, which are also seen in the spot markets. However, it remains to be seen that such volatility in price would be absent in the spot markets if derivatives were not to exist.

Increased Bankruptcies

Inherent leverage in derivatives may very easily cause bankruptcies when one assumes a position in derivatives that is totally out of sync with the financial position. Since positions in the financial markets are taken in sequentially one default may trigger a chain and can cause market failure.

Burden of Increased Regulation

With increasing derivative activity it is opined that there in an increasing need for regulation. Since derivatives allow accumulation of large positions with little capital, the disclosure of identities and positions taken is imperative. Also there is increasing need to discourage overly speculative positions to prevent bankruptcies and letting the chain of defaults to set in. Disclosure requirements and need to control has placed onerous

responsibilities on the monitoring and regulating agencies. Such requirements and control mechanisms are often disliked by some of the participants in the market because they are seen as impediments in the development of free markets.

Derivatives Market in India

The most notable development concerning the secondary segment of the Indian capital market is the introduction of derivatives trading in June 2000. SEBI approved derivatives trading based on Futures Contracts at both BSE and NSE in accordance with the rules/byelaws and regulations of the Stock Exchanges. A beginning with equity derivatives has been made with the introduction of stock index futures by BSE and NSE. Stock Index Futures contract allows for the buying and selling of the particular stock index for a specified price at a specified future date.

Stock Index Futures, inter alia, help in overcoming the problem of asymmetries in information. Information asymmetry is mainly a problem in individual stocks as it is unlikely that a trader has market-wide private information. As such, the asymmetric information component is not likely to be present in a basket of stocks. This provides another rationale for trading in Stock Index Futures.

Also, trading in index derivatives involves low transaction cost in comparison with trading in underlying individual stocks comparing the index. While the BSI' introduced Stock Index Futures for S&P CNX Nifty comprising 50 scripts. Stock Index Futures in India are available with one month, two month and three month maturities While derivatives trading based on the Sensitive Index (Sensex) commenced at the BSI on June 9, 2000,.,derivatives trading based on S&P CNX Nifty commenced at the NSE on June 12, 2000. SIT is the first attempt in the development of derivatives trading.

The product base has been increased to include trading in futures arid options on S&P CNX Nifty Index, futures and options on CNX IT index, Bank Nifty Index and single securities (118 stocks as stipulated by SEBI) and futures on interest rate.

The index futures and index options contracts traded on NSE are based on S&P CNX Nifty Index, CNX IT Index and the CNX Bank Index, while stock futures and options are based on individual securities. Stock Futures and Options are available on 118 securities. Interest rate future contracts are available on Notional 91 day t-bill and Notional 10 year bonds (6% coupon bearing and zero coupon bond). While the index options are European style, stock options arc American style.

At any point of time there are only three contract months available for trading, with 1 month, 2 months and 3 months to expiry. These contracts expire on last Thursday of the month and have a maximum of 3-month expiration cycle. A new contract is introduced on the next trading day following the expiry of the near month contract. All the derivatives contracts are presently cash settled. The turnover in the derivatives segment has witnessed considerable growth since inception.

In the global market, NSE ranks first (1st) in terms of number of contracts traded in the Single Stock Futures, second (2nd) in Asia in terms of number of contracts traded in equity derivatives instrument. Since inception, NSE established itself as the sole market leader in this segment in the country with more than 99.5% market share.

Evolution of Derivatives in India

Commodities futures' trading in India was initiated long back in 1950s; however, the 1960s marked a period of great decline in futures trading. Market after market was closed usually because different commodities' prices increases were attributed to speculation on these markets. Accordingly, the Central Government imposed the ban on trading in derivatives in 1969 under a notification issue. The late 1990s shows this signs of opposite trends—a large scale revival of futures markets in India, and hence, the Central Government revoked the ban on futures trading in October, 1995, The Civil Supplies Ministry agreed in principle for starting of futures trading in Basmati rice, further, in 1996 the Government granted permission to the Indian Pepper and Spice Trade Association to convert its Pepper Futures Exchange into an International Pepper Exchange. As such, on November 17, 1997, India's first international futures exchange at Kochi, known as the India Pepper and Spice Trade Association—International Commodity Exchange (IPSTA-ICE) was established.

Similarly, the Cochin Oil Millers Association, in June 1996, demanded the introduction of futures trading in coconut oils. The Central Minister for Agriculture announced in June 1996 that he was in favour of introduction of futures trading both domestic and international. Further, a new coffee futures exchange (The Coffee Futures Exchange of India) is being started at Bangalore. In August, 1997, the Central Government proposed that Indian companies with commodity price exposures should be allowed to use foreign futures and option markets. The trend is not confined to the commodity markets alone, it has initiated in financial futures too.

The Reserve Bank of India set up the Sodhani Expert Group which recommended major liberalization of the forward exchange market and had urged the setting up of rupee-based derivatives in financial instruments. The RBI accepted several of its recommendations in August, 1996. A landmark step taken in this regard when the Securities and Exchange Board

of India (SEBI) appointed a Committee named the Dr. L.C. Gupta Committee (LCGC) by its resolution, dated November 18, 1996 in order to develop appropriate regulatory framework for derivatives trading in India. While the Committee's focus was on equity derivatives but it had maintained a broad perspective of derivatives in general.

The Board of SEBI, on May 11, 1998, accepted the recommendations of the Dr. L.C. Gupta Committee and approved introduction of derivatives trading in India in the phased manner. The recommendation sequence is stock index futures, index options and options on stocks. The Board also approved the 'Suggestive Bye-Laws' recommended by the Committee for regulation and control of trading and settlement of derivatives contracts in India. Subsequently, the SEBI appointed J. R. Verma Committee to look into the operational aspects of derivatives markets. To remove the road-block of non-recognition of derivatives as securities under Securities Contract Regulation Act, the Securities Law (Amendment) Bill, 1999 was introduced to bring about the much needed changes. Accordingly, in December, 1999, the new framework has been approved and 'Derivatives' have been accorded the status of 'Securities'. However, due to certain completion of formalities, the launch of the Index

Futures were delayed by more than two years. In June, 2000, the National Stock Exchange and the Bombay Stock Exchange started stock index based futures trading in India. Further, the growth of this market did not take off as anticipated. This is mainly attributed to the low awareness about the product and mechanism among the market players and investors.

The volumes, however, are gradually picking up due to active interest of the institutional investors.

Major Recommendations of Dr. L.C. Gupta Committee

Before discussing the emerging structure of derivatives markets in India, let us have a brief view of the important recommendations made by the Dr. L.C. Gupta Committee on the introduction of derivatives markets in India. These are as under:

1. The Committee is strongly of the view that there is urgent need of introducing of financial derivatives to facilitate market development and hedging in a most cost- efficient way against market risk by the participants such as mutual funds and other investment institutions.

2. There is need for equity derivatives, interest rate derivatives and currency derivatives.

3. Futures trading through derivatives should be introduced in phased manner starting with stock index futures, which will be followed by options on index and later options on stocks. It will enhance the efficiency and liquidity of cash markets in equities through arbitrage process.

4.   There should be two-level regulation (regulatory framework for derivatives trading), i.e., exchange level and SEBI level. Further, there must be considerable emphasis on self regulatory competence of derivative exchanges under the overall supervision and guidance of SEBI.

5. The derivative trading should be initiated on a separate segment of existing stock exchanges having an independent governing council. The number of the trading members will be limited to 40 percent of the total number. The Chairman of the governing council will not be permitted to trade on any of the stock exchanges.

6. The settlement of derivatives will be through an independent clearing Corporation/ Clearing house, which will become counter-party for all trades or alternatively guarantees the settlement of all trades. The clearing corporation will have adequate risk containment measures and will collect margins through EFT.

7. The derivatives exchange will have on-line-trading and adequate surveillance systems. It will disseminate trade and price information on real time basis through two information vending networks. It should inspect 100 percent of members every year.

8. There will be complete segregation of client money at the level of trading/clearing member and even at the level of clearing corporation.

9. The trading and clearing member will have stringent eligibility conditions. At least two persons should have passed the certification programme approved by the SEBI.

10. The clearing members should deposit minimum ` 50 lakh with clearing corporation and should have a net worth of ` 3 crore.

11. Removal of the regulatory prohibition on the use of derivatives by mutual funds while making the trustees responsible to restrict the use of derivatives by mutual funds only to hedging and portfolio balancing and not for specification.

12. The operations of the cash market on which the derivatives market will be based, needed improvement in many respects.

13. Creation of a Derivation Cell, a Derivative Advisory Committee, and Economic Research Wing by SEBI.

14. Declaration of derivatives as 'securities' under Section 2 (h) of the SCRA and suitable amendments in the notification issued by the Central Government in June, 1969 under Section 16 of the SCRA.

The SEBI Board approved the suggested Bye-Laws recommended by the L.C. Gupta Committee for regulation and control of trading and settlement of derivatives contracts.

Structure of derivatives markets in India
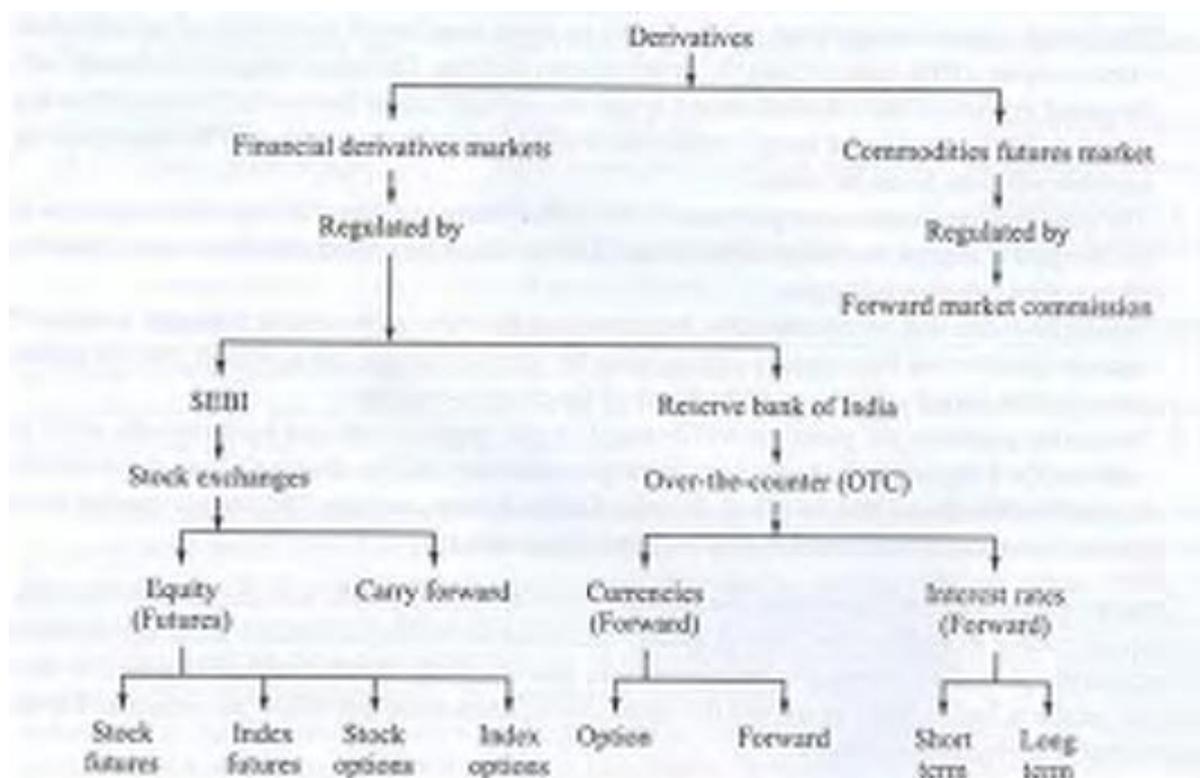
Financial Derivatives in India: A Chronology

Date	Progress
14 December, 1995	NSE asked SEBI for permission to trade futures
18 November, 1996	SEBI setup L.C. Gupta Committee to draft a policy framework for index futures
11 May, 1998	L.C. Gupta Committee submitted report
7 July, 1999	RBI gave permission for OTC forward rate agreement (FRAs) and interest rate swaps
24 May, 2000	SIMES chose NIFTY for trading futures and options on an Indian index
25 May, 2000	SEBI gave permission to NSE and BSE to do index futures trading
9 June, 2000	Trading of BSE sensex futures commenced at BSE
12 June, 2000	Trading of NIFTY futures commenced at NSE
31 August, 2000	Trading of futures and options on NIFTY to commence at SIMES
July, 2001	Trading on equity futures commenced at NSE on 31 securities
June, 2003	Trading on interest rate futures commenced at NSE
July, 2003	Trading on FC-rupee options started

UNIT – II

FORWARD MARKET

Forward Contract

A **forward contract** is a contract whose terms are tailor-made i.e. negotiated between buyer and seller. It is a contract in which two parties trade in the underlying asset at an agreed price at a certain time in future. It is not exactly same as a futures contract, which is a standardized form of the forward contract.

Features of Forward Contract

1. It is an agreement between the two counter parties in which one is buyer and other is seller. All the terms are mutually agreed upon by the counterparties at the time of the formation of the forward contract.

2. It specifies a quantity and type of the asset (commodity or security) to be sold and purchased.

3. It specifies the future date at which the delivery and payment are to be made.

4. It specifies a price at which the payment is to be made by the seller to the buyer. The price is determined presently to be paid in future.

5. It obligates the seller to deliver the asset and also obligates the buyer to buy the asset.

6. No money changes hands until the delivery date reaches, except for a small service fee, if there is.

Classification of Forward Contracts

The forward contracts can be classified into different categories. Under the Forward Contracts (Regulation) Act. 1952, forward contracts can be classified in the following categories:

Hedge Contracts

The basic features of such forward contracts are that they are freely transferable and do not specify any particular lot, consignment or variety of delivery of the underlying goods or assets. Delivery in such contracts is necessary except in a residual or optional sense. These contracts are governed under the provisions of the Forward Contracts (Regulation) Act, 1952.

Transferable Specific Delivery (TSD) Contracts

These forward contracts are freely transferable from one party to other party. These are concerned with a specific and predetermined consignment or variety of the commodity.

There must be delivery of the underlying asset at the expiration time. It is mandatory. Such contracts are subject to the regulatory provisions of the Forward Contracts (Regulation) Act, 1952, but the Central Government has the power to exempt (in specified cases) such forward contracts.

Non-Transferable Specific Delivery (NTSD) Contracts

These contracts are of such nature which cannot be transferred at all. These may concern with specific variety or consignment of goods or their terms may be highly specific. The delivery in these contracts is mandatory at the time of expiration. Normally, these contracts have been exempted from the regulatory provisions of Forward Act, but the Central Government, whenever feels necessary, may bring them under the regulation of the Act.

It is evident from the above that the definition of hedge contracts corresponds to the definition of futures contracts while the latter two are not futures contracts, and hence, termed as forward contracts. Since in both hedge contracts and futures contracts, no specification about the underlying asset/commodity is mentioned because such limits are set by the rules of the exchange on which types can or cannot he delivered. If the variety is superior or inferior to the basis variety for delivery, in that case the prices are adjusted by means of premium or discount as the case may be. Such adjustments are popularly known as tendering differences. Thus, on this basis, it may be generalized that every futures contract is a forward contract but every forward contract may not be futures contract.

Other Forward Contracts

Forward Rate Agreements (FRA)

Forward contracts are commonly arranged on domestic interest-rate bearing instruments as well as on foreign currencies. A forward rate agreement is a contract between the two parties, (usually one being the banker and other a banker's customer or independent party), in which one party (the banker) has given the other party (customer) a guaranteed future rate of interest to cover a specified sum of money over a specified period of time in the future.

Example

Suppose three month forward rupee is at ` 45 per US dollar. A quotation is given in terms of range. The forward rupee would be quoted at "` 48 to ` 50". If the spot rate rises above the maximum, i.e., ` 50 then the maximum level is used. If the spot rate falls below the minimum rate, i.e., ` 48 then the minimum level will be used.

Range Forwards

These instruments are very much popular in foreign exchange markets. Under this instrument, instead of quoting a single forward rate, a quotation is given in terms of a range, i.e., a range may be quoted for Indian rupee against US dollar at ` 47 to ` 49. It means there is no single forward rate rather a series of rate ranging from ` 47 1049 has been quoted. This is also known as flexible forward contracts. At the maturity, if the spot exchange rate is between these two levels, then the

actual spot rate is used. On the other hand, if the spot rate rises above the maximum of the range, i.e., ` 49 in the present case then the maximum

level is used.

Forward Trading Mechanism

Forward contracts are very much popular in foreign exchange markets to hedge the foreign currency risks. Most of the large and international banks have a separate 'Forward Desk' within their foreign exchange trading room which is devoted to the trading of forward contracts. Let us take an example to explain the forward contract.

Forward Trading Mechanism

Before discussing the forward trading mechanism, let us see some important terminology frequently used in the forward trading.

Long Position

The party who agrees to buy in the future is said to hold long position. For example, in the earlier case, the bank has taken a long position agreeing to buy 3-month dollar in futures.

Short Position

The party who agrees to sell in the future holds a short position in the contract. In the previous example, UK MNC has taken a short position by selling the dollar to the bank for a 3-month future.

The Underlying Asset

It means any asset in the form of commodity, security or currency that will be bought and sold when the contract expires, e.g., in the earlier example US dollar is-the underlying asset which is sold and purchased in future.

Spot-Price

This refers to the purchase of the underlying asset for immediate delivery. In other words, it is the quoted price for buying and selling of an asset at the spot or immediate delivery.

Future Spot Price

The spot price of the underlying asset when the contract expires is called the future spot price, since it is market price that will prevail at some futures date.

Delivery Price

The specified price in a forward contract will be referred to as the delivery price. This is decided or chosen at the time of entering into forward contract so that the value of the contract to both parties is zero. It means that it costs nothing to take a long or a short position. In other words, at the day on writing of a forward contract, the price which is determined to be paid or received at the maturity or delivery period of the forward contract is called delivery price. On the first day of the forward contract, the forward price may be same as to delivery price. This is

determined by considering each aspect of forward trading including demand and supply position of the underlying asset.

The Forward Price

It refers to the agreed upon price at which both the counter parties will transact when the contract expires. In other words, the forward price for a particular forward contract at a particular time is the delivery price that would apply if the contract were entered into at that time. In the example discussed earlier, on April 10, 2002, 0.6250 is the forward price for a forward contract that involves the delivery of US dollar on July 10, 2002.

FUTURES MARKET

Introduction

In the last two decades, the futures markets have experienced a remarkable growth all over the world in size, trading volume and acceptance by the business community. New contracts with new products along with entirely new possibilities in the futures markets have become the reality now. Futures trading were started in the mid-western part of the USA during 1970s, but today it is traded throughout the world, and 24 hours a day. Most common underlying assets used in futures markets today are commodities, agricultural products, metals, energy products, weather, electricity, interest rates, foreign exchange, equities, stock index, and so on. In fact, today the futures markets have become an integral part of the financial markets all over the world.

Futures

A futures contract, or simply called futures, is a contract to buy or sell a stated quantity of a commodity or a financial claim at a specified price at a future specified date. The parties to the futures have to buy or sell the asset regardless of what happens to its value during the intervening period or what happens to be the price on the date when the contract is implemented.

Futures Contract

A **futures contract** is an agreement between parties to buy or sell the underlying financial asset at a specified rate and time in future. While a futures contract is traded in an exchange, the forward contract is traded in OTC, i.e. over the counter between two financial institutions or between a financial institution or client.

Types of Financial Futures Contracts

There are different types of contracts in financial futures which are traded in the various futures financial markets of the world. These contracts can be classified into various categories which are as under:

Interest Rate Futures

It is one of the important financial futures instruments in the world. Futures trading on interest bearing securities started only in 1975, but the growth in this market have been tremendous. Important interest- bearing securities are like treasury bills, notes, bonds, debentures, euro-dollar deposits and municipal bonds. In this market, almost entire range of maturities bearing securities is traded. For example, three- month maturity instruments like treasury bills and euro-dollar time deposits, including foreign debt instruments at Chicago Mercantile Exchange (CME), British Government Bonds at London International Financial Futures Exchange (LIFFE), Japanese Government Bonds at CBOT, etc. are traded.

This market is also further categorized into short-term and long-term interest bearing instruments. A few important interest rate futures traded on various exchanges are: notional gilt-contracts, short-term deposit futures, treasury bill futures, euro-dollar futures, treasury bond futures and treasury notes futures.

Foreign Currencies Futures

These financial futures, as the name indicates, trade in the foreign currencies, thus, also known as exchange rate futures. Active futures trading in certain foreign currencies started in the early 1970s. Important currencies in which these futures contracts are made such as US-dollar, Pound Sterling, Yen, French Francs, Marks, Canadian dollar, etc. These contracts have a directly corresponding to spot market, known as interbank foreign exchange market, and also have a parallel interbank forward market. Normally futures currency contracts are used for hedging purposes by the exporters, importers, bankers, financial institutions and large companies.

Stock Index Futures

These are another major group of futures contracts all over the world. These contracts are based on stock market indices. For example, in the US markets, there exist various such futures contracts based on different indices like Dow Jones Industrial Average, Standard and Poor's 500, New York Stock Exchange Index, Value Line Index, etc. Other important futures contracts in different countries are like in London market, based on the Financial Times—Stock Exchange 100 share Index, Japanese Nikkei Index on the Tokyo Futures Exchange and on the Singapore International Monetary Exchange (SIMEX) as well. Similarly, in September, 1990, Chicago Mercantile Exchange began trading based on Nikkei 225 Stock Index and Chicago Board of Trade launched futures contracts based on the TOPIX index of major firms traded on the Tokyo Stock Exchange.

Bond Index Futures

Like stock index futures, these futures contracts are also based on particular bond indices, i.e., indices of bond prices. As we know that prices of debt instruments are inverselyrelated to interest

rates, so the bond index is also related inversely to them. The important example of such futures contracts based on bond index is the Municipal Bond Index futures based on US Municipal Bonds which is traded on Chicago Board of Trade (CBOT).

Cost of Living Index Futures

This is also known as inflation futures. These futures contracts are based on a specified cost of living index, for example, consumer price index, wholesale price index, etc. At International Monetary Market (1MM) in Chicago, such futures contracts based on American Consumer Price Index are traded. Since in USA, the inflation rates in 1980s and 1990s were very low, hence, such contracts could not be popular in the futures market. Cost of living index futures can be used to hedge against unanticipated inflation which cannot be avoided. Hence, such futures contracts can be very useful to certain investors like provident funds, pension funds, mutual funds, large companies and governments.

Evolution of Futures Market in India

➢ Organized futures market evolved in India by the setting up of "Bombay Cotton Trade Association Ltd." in 1875. In 1883, a separate association called "The Bombay Cotton Exchange Ltd." was constituted.

➢ Futures trading in oilseeds were started with the setting up of Gujarati Vyapari Mandali in 1900. A second exchange, the Seeds Traders' Association Ltd., trading oilseeds such as castor and groundnuts, was setup in 1926 in Mumbai. Then, many other exchanges trading in jute, pepper, turmeric, potatoes, sugar, and silver, followed.

➢ Futures market in bullion began at Mumbai, in 1920.

➢ In 1940s, trading in forwards and futures was made difficult through price controls till 1952 when the government passed the Forward Contract Regulation Act, which controls all transferable forward contracts and futures.

➢ During the 1960s and 70s, the Central Government suspended trading in several commodities like cotton, jute, edible oilseeds, etc. as it felt that these markets helped increase prices for commodities

➢ Two committees that were appointed—Datwala Committee in 1966, and Khusro Committee in 1980, recommended the reintroduction of futures trading in major commodities, but without much result.

One more committee on Forwards market, the Kabra Committee was appointed in 1993, which recommended futures trading in wide range of commodities and also up gradation of futures

market. Accepting partially the recommendations, Government permitted futures trading in many of the commodities.

Operators/Traders in Futures Market

Futures contracts are bought and sold by a large number of individuals, business organizations, governments and others for a variety of purposes. The traders in the futures market can be categorized on the basis of the purposes for which they deal in this market. Usually financial derivatives attract following types of traders which are discussed here as under:

Hedgers

In simple term, a hedge is a position taken in futures or other markets for the purpose of reducing exposure to one or more types of risk. A person who undertakes such position is called as 'hedger'. In other words, a hedger uses futures markets to reduce risk caused by the movements in prices of securities, commodities, exchange rates, interest rates, indices, etc. As such, a hedger will take a position in futures market that is opposite a risk to which he or she is exposed.

Speculators

A speculator may be defined as an investor who is willing to take a risk by taking futures position with the expectation to earn profits. The speculator forecasts the future economic conditions and decides which position (long or short) to he taken that will yield a profit if the forecast is realized.

Arbitrageurs

Arbitrageurs are another important group of participants in futures markets. An arbitrageur is a trader who attempts to make profits by locking in a risk less trading by simultaneously entering into transactions in two or more markets. In other words, an arbitrageur tries to earn riskless profits from discrepancies between futures and spot prices and among different futures prices.

Spreaders

Spreading is a specific trading activity in which offsetting futures position is involved by creating almost net position. So the spreaders believe in lower expected return but at the less risk. For a successful trading in spreading, the spreaders must forecast the relevant factors which affect the changes in the spreads. Interest rate behaviour is an important factor which causes changes in the spreads. In a profitable spread position, normally, there is large gain on one side of the spread in comparison to the loss on the other side of the spread. In this way, a spread reduces the risk even if the forecast is incorrect. On the other hand, the pure speculators would make money by taking only the profitable side of the market but at very high risk.

Functions of Futures Market

Hedging

The primary function of the futures market is the hedging function which is also known as price insurance, risk shifting or risk transference function. Futures markets provide a vehicle through which the traders or participants can hedge their risks or protect themselves from the adverse price movements in the underlying assets in which they deal.

Price Discovery

Another important use of futures market is the price discovery which is the revealing of information about futures cash market prices through the futures market.

Financing Function

Another important function of a futures market is to raise finance against the stock of assets or commodities. Since futures contracts are standardized contracts, so, they make it easier for the lenders about the assurance of quantity, quality and liquidity of the underlying asset.

Liquidity Function

As we see that the main function of the futures market deals with such transactions which are matured in the future period. They are operated on the basis of margins which are determined on the basis of rides involved in the contract. Under this the buyer and the seller have to deposit only a fraction of the contract value, say 5 percent or 10 percent, known as margins. It means that the traders in the futures market can do the business a much larger volume of contracts than in a spot market, and thus, makes market more liquid. That is why the volume of the futures markets is much larger in comparison to the spot markets. This is also known as gearing or leverage factor.

Price Stabilization Function

Another important function of a futures market is to keep a stabilizing influence on spot prices by reducing the amplitude of short term of fluctuations. In other words, futures market reduces both the heights of the peaks and the depth of the troughs.

Disseminating Information

Apart from the aforementioned functions of the futures markets like risk-transference (hedging), price discovery, price stabilization, liquidity, and financing, this market is very much useful to the economy too. Futures markets disseminate information quickly, effectively and inexpensively, and, as a result, reducing the monopolistic tendency in the market.

Mechanism of a Futures Contract

A futures contract calls for the delivery of the specified quantity at the specified rate on specified date. Or, before the maturity date it can be squarred off. In India, the financial derivatives (futures) are compulsorily squarred off on the maturity date. However, in case of commodities futures, delivery is made, if required, by the transfer of warehouse receipt. An investor can buy (a long position) or sell (a short position) a futures contract.

The profit or payoff position of a futures contract depends on the differences between the specified price (of the futures contract) and the actual market price prevailing on the maturity date. For example, if an investor has purchased a futures contract in HLL at the rate of ` 300 and one contract in for 500 shares. The value of the contract is ` 1,50,000 (` 300 x 500). Now, on the maturity date the rate is ` 310. The value of the contract is ` 1,55,000 and his profit is ` 5,000. Similarly, if the rate is ` 296, then his loss is ` 2,000. Further, that if the investor has sold initially, then his loss and profit position would be ` 5,000 and ` 2,000 respectively. This can be summarized as follows
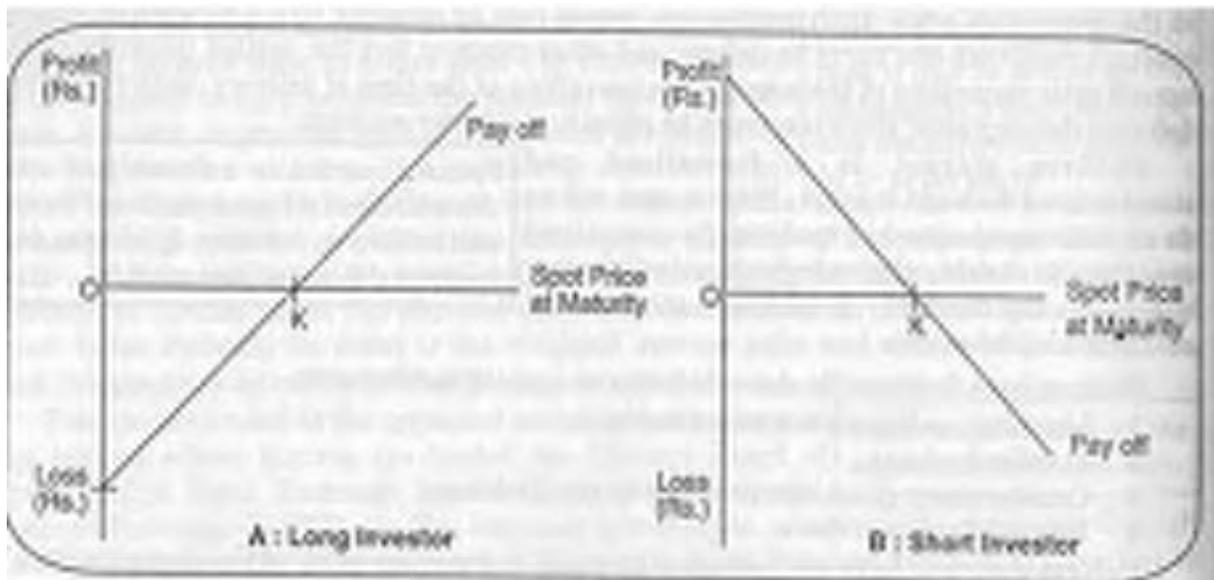
For Long investor: Profit = Spot price at Maturity – Futures Price

Loss = Futures Price – Spot Price at Maturity

For Short investor: Profit = Futures price – Spot Price at Maturity

Loss = Spot Price at Maturity – Futures Price

A futures contact is zero sum game. Profit to one party is the loss of the other party. Simple reason being that every long position is represented by a short position in the market. The pay off positions of the long investor and short investor in futures are shown in Figure

In Figure (A), K is the strike price. The figure shows that as the spot price at maturity increases, the profit of the long investor also increases. This break-even level is one when spot price is equal to strike price. Similarly, Figure (B) shows that maximum profit to short investor appears if the spot price is 0.

Thus profit decreases and Loss increases as the spot price increases. The breakeven appears when the spot price is equal to the strike price. The diagrams for buyer and seller are mirror image of each other.

Financial futures can be classified into Shares and Shares Indices Futures, Bond Futures, Currency Futures and Interest Rate Futures. Discussion on Shares and Shares Indices Futures is taken up first, followed up by currency futures and interest rate futures.

The Determination of Forward Prices

Forward contracts are generally easier to analyze than futures contracts because in forward contracts there is no daily settlement and only a single payment is made at maturity. Though both futures prices and forward prices are closely related, this will be described in the latter part of this chapter.

It is essential to know about certain terms before going to determine the forward prices such as distinction between investment assets and consumption assets, compounding, short selling, repo rate and so on because these will be frequently used in such computation. We are not discussing these here in detail but the traders must be aware about them thoroughly. A brief view of these terms is explained here as under:

An investment asset is an asset that is held for investment purposes, such as stocks, shares, bonds, treasury, securities, etc. Consumption assets are those assets which are held primarily for consumption, and not usually for investment purposes. There are commodities like copper, oil, food grains and live hogs.

Compounding is a quantitative tool which is used to know the lump-sum value of the proceeds received in a particular period. Consider an amount A invested for n years at an interest rate of R per annum. If the rate is compounded once per annum, the terminal value of that investment will be

Terminal value $= A (1 + R)n$

and if it is compounded m times per annum then the terminal value will be

Terminal value $= A (1 + R/m)mn$

where A is amount for investment, R is rate of return, n is period for return and m is period of compounding.

Short selling refers to selling securities which are not owned by the investor at the time of sale. It is also called 'shorting', with the intention of buying later. Short selling may not be possible

for all investment assets. It yields a profit to the investor when the price of the asset goes down and loss when it goes up.

For example, an investor might contract his broker to short 500 State Bank of India shares then the broker will borrow the shares from another client and sell them in the open market. So the investor can maintain the short position provided there are shares available for the broker to borrow. However, if the contract is open, the broker has no shares to borrow, then the investor has to close his position immediate, this is known as short- squeezed.

The repo rate refers to the risk free rate of interest for many arbitrageurs operating in future markets. Further, the 'repo' or repurchase agreement refers to that agreement where the owner of the securities agrees to sell them to a financial institution, and buy the same back later (after a particular period). The repurchase price is slightly higher than the price at which they are sold. This difference is usually called interest earned on the loan. Repo rate is usually slightly higher than the Treasury bill rate.

Assumptions and Notations

Certain assumptions considered here for determination of forward or futures prices are:

➢ There are no transaction costs.

➢ Same tax rate for all the trading profits.

➢ Borrowing and lending of money at the risk free interest rate.

➢ Traders are ready to take advantage of arbitrage opportunities as and when arise.

These assumptions are equally available for all the market participants; large or small.

Further, some Notations which have been used here are:

T = Time remained upto delivery date in the contract

S = Price of the underlying asset at present, also called as spot or cash or current

K = Delivery price in the contract at time T

F = Forward or future price today

f = Value of a long forward contract today

r = Risk free rate of interest per annum today

t = Current or today or present period of entering the contract

Now, we will discuss the mechanism of determination of forward prices of different types of assets.

The Forward Price for Investment Asset (Securities)

Here we will consider three situations in case of investment assets:

1. Investment assets providing no income
2. Investment assets providing a known income
3. Investment assets providing a known dividend income

Forward Price for An Asset that Provides no Income

This is the easiest forward contract to value because such assets do not give any income to the holder. These are usually nondividend paying equity shares and discount bonds. Let us consider the relationship between the forward price and spot price with an example.

Example

Consider a long forward contract to purchase a share (Non-dividend paying) in three-months. Assume that the current stock price is ` 100 and the three-month risk free rate of interest is 6% per annum. Further assume that the three months forward price is ` 105.

$F = Se^{rT}$

where F is forward price of the stock, S is spot price of the stock, T is maturity period (remained), r is risk-free interest rate.

If $F > Se^{rT}$ then the arbitrageur can buy the asset and will go for short forward contract on the asset.

If $F < Se^{rT}$ then he can short the asset and go for long forward contract on it.

Forward Prices for Security that Provides a Known Cash Income

We will consider forward contracts on such assets which provides a known cash income, for example, coupon bearing bonds, treasury securities, known dividend, etc. Let us explain with an example:

Example

Consider a long forward contract to purchase a coupon bond whose current price is ` 900 maturing 5 years. We assume that the forward contract matures in one year, so that the forward contract is a contract to purchase a four-year bond in one year. Further assume that the coupon payment of ` 40 are expected after six months and 12 months, and six-month and one-year risk free interest rate are 9 percent and 10 percent respectively.

In first situation, we assume that the forward price is high at ` 930. In this case, can arbitrageur can borrow ` 900 to buy the bond and short a forward contract. Then the first coupon payment has a present value of 40e -09 x = ` 38.24. So the balance amount ` 861.76

0.5

(900-38.24) is borrowed @ 10% for year. The amount owing at the end of the year is 86l.76℮

x = ` 952.39. The second coupon provides ` 40 toward this amount, and ` 930 is received

for the bond under the terms of the forward contract. The arbitrageur will earn

$$= (` 40 + ` 930) — ` 952.39 = ` 17.61$$

$F = (S – I)erT$

In the earlier example, S = ` 900, I = 40, r = 0.09 and 0.1 and T= 1.

I is calculated as:

$I = 40e_{-0.09} \quad = ` 74.433$
$\qquad +40$
$\qquad\quad e0.10$

$\qquad\qquad x1$

Then F = (900— 74.333)0.10x1 = ` 912.39

Forward Price where the Income is a Known Dividend Yield

A known dividend yield means that when income expressed as a percentage of the asset life is known. Let us assume that the dividend yield is paid continuously as a constant annual rate at q then the forward price for a asset would be $F = Se(r-q)T$

Example

Let us consider a six-month forward contract on a security where 4 percent per annum continuous dividend is expected. The risk free rate of interest is 10 percent per annum. The asset's current price is ₹ 25. Then we can calculate the forward price as:

$F = S_e{}^{(r-q)T}$

$F = 25_e{}^{(0.10-0.04)x0.5} = ₹ 25.76$

If $F > S_e{}^{(r-q)T}$ then an investor can buy the asset and enter into a short forward contract to lock in a riskless profit. If $F < S_e{}^{(r-q)T}$ then an investor can enter into a long forward contract and short the stock to earn riskless profit. Further, if dividend yield varies during the life of a forward contract the q should be set equal to the average dividend yield during the life of the contract.

and short the stock to earn riskless profit. Further, if dividend yield varies during the life of a forward contract the q should be set equal to the average dividend yield during the life of the contract.

Valuing Forward Contracts

On the basis of generalization in different situations, we can find out the value of a forward contract. As we know that the value of a forward contract at the time it is first written (entered) into is zero. However, at later stage, it may prove to have a positive or negative value. In general, the value of a forward contract can be determined as follows:

$$f = (F - K)_e^{-rT}$$

where f is value of a forward contract, F is forward price (current) of the asset, K is delivery price of the asset in the contract, T is time to maturity of contract and *r* is risk free rate of interest.

Let us examine the equation

We compare a long forward contract that has a delivery price of F with an otherwise identical long forward contract with a delivery price of K. As we know that the forward price is changing with the passage time, and that is why later on, F and K may not be equal which were otherwise equal at the time of entrance of the contract. The difference between the two is only in the amount that will be paid for the security at time T. Under the first contract, this amount is F, and under the second contract, it is K. A cash outflow difference of F- K at time T translates to a difference of $(F - K)_e^{-rT}$ today. Therefore, the contract with a delivery price F is less valuable than the contract with a delivery price K by an amount $(F - K)_e^{-rT}$. The value of contract that has a delivery price of F is by definition, zero.

Similarly, the value of a short forward contract with the delivery price K is $f= (F - K)_e^{-rT}$

Example

Consider a six-month long forward contract of a non-income-paying security. The risk free rate of interest is 6 percent per annum. The stock price is ₹ 30 and the delivery price is ₹ 28. Compute the value of forward contract.

Forward price $\qquad$ $F = 30_e^{0.06x05} = ₹ 30.90$

Value of forward contract $\quad f= (F - K)_e^{-rT}$

$= (30.90 - 28)_e^{-0.06x0.5}$

$= ₹ 2.90\text{-}0.09 = 2.8^*$ (app.)

Alternatively, using the other equation:

$$f = 30 - 28^{-0.06 \times 0.5}$$
$$f = 30 - 27.16 = 2.84 \text{ (app.)}$$

*The above difference is due to annual compounding.

Using the earlier equation of value of forward contract, we can show the value of long forward contract in all the three situations, which are as under:

(a) Asset with no income: $f = S - K_e^{-rT}$

(b) Asset with known income (l): $f = S - I - K_e^{-rT}$

(c) Asset with known dividend yield at the rate q: $f = S_e^{-qT} - K_e^{-rT}$

Note that in each case the forward price F is the value of K which makes f equal to zero.

Forward Prices Versus Futures Prices

Whether the forward prices are equal to futures prices, this is very important and debatable issue. It is argued that if risk free interest rate is constant and the same for all maturities, in such market situations, lie forward price will be same as the futures price for the contract.

However, in actual practice, the interest rates do not remain constant and usually vary unpredictably, then forward prices and futures prices no longer remain the same. We can get sense of the nature of the relationship by considering the situation where the price of the underlying asset is strongly positively correlated with interest rates.

Since in futures contracts, there is daily settlement, so if current price(s) increases, an investor who holds a long future position, makes an immediate profit, which will be reinvested at a higher than average rate of interest.

Similarly when current price(s) decreases, the investor will incur immediate loss, and this loss will be financed at a lower than average rate of interest. However, this position does not arise in the forward contract because there is no daily settlement and interest rate movements will not have any affect till maturity.

It is further argued that when spot (current) prices are strongly positively correlated with the interest rates, futures prices will tend to higher than the forward prices, similarly,

if spot prices are strongly negatively correlated with the interest rates then forward prices will tend to higher than the futures prices. It is further observed that though there may be theoretical difference between forward prices and futures prices due to various factors like taxes, transaction costs, treatment of margin and default risk, but this difference is very small which may be ignored. Thus, in our further discussion in various chapters, both forward contracts and futures contracts are assumed to be the same and the symbol F will be used to represent both futures price and forward price same at time zero.

UNIT – III
FUTURE MARKET

Futures Contract

A **futures contract** is an agreement between parties to buy or sell the underlying financial asset at a specified rate and time in future. While a futures contract is traded in an exchange, the forward contract is traded in OTC, i.e. over the counter between two financial institutions or between a financial institution or client.

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These are another major group of futures contracts all over the world. These contracts are based on stock market indices. For example, in the US markets, there exist various such futures contracts based on different indices like Dow Jones Industrial Average, Standard and Poor's 500, New York Stock Exchange Index, Value Line Index, etc. Other important futures contracts in different countries are like in London market, based on the Financial Times—Stock Exchange 100 share Index, Japanese Nikkei Index on the Tokyo Futures Exchange and on the Singapore International Monetary Exchange (SIMEX) as well. Similarly, in September, 1990, Chicago Mercantile Exchange began trading based on Nikkei 225 Stock Index and Chicago Board of Trade launched futures contracts based on the TOPIX index of major firms traded on the Tokyo Stock Exchange.

Bond Index Futures

Like stock index futures, these futures contracts are also based on particular bond indices, i.e., indices of bond prices. As we know that prices of debt instruments are inverselyrelated to interest rates, so the bond index is also related inversely to them. The important example of such futures contracts based on bond index is the Municipal Bond Index futures based on US Municipal Bonds which is traded on Chicago Board of Trade (CBOT).

Cost of Living Index Futures

This is also known as inflation futures. These futures contracts are based on a specified cost of living index, for example, consumer price index, wholesale price index, etc. At International Monetary Market (1MM) in Chicago, such futures contracts based on American Consumer Price Index are traded. Since in USA, the inflation rates in 1980s and 1990s were very low, hence, such contracts could not be popular in the futures market. Cost of living index futures can be used to hedge against unanticipated inflation which cannot be avoided. Hence, such futures contracts can be very useful to certain investors like provident funds, pension funds, mutual funds, large companies and governments.

Evolution of Futures Market in India

➢ Organized futures market evolved in India by the setting up of "Bombay Cotton Trade Association Ltd." in 1875. In 1883, a separate association called "The Bombay Cotton Exchange Ltd." was constituted.

➢ Futures trading in oilseeds were started with the setting up of Gujarati Vyapari Mandali in 1900. A second exchange, the Seeds Traders' Association Ltd., trading oilseeds such as castor and groundnuts, was setup in 1926 in Mumbai. Then, many other exchanges trading in jute, pepper, turmeric, potatoes, sugar, and silver, followed.

➢ Futures market in bullion began at Mumbai, in 1920.

➢ In 1940s, trading in forwards and futures was made difficult through price controls till 1952 when the government passed the Forward Contract Regulation Act, which controls all transferable forward contracts and futures.

➢ During the 1960s and 70s, the Central Government suspended trading in several commodities like cotton, jute, edible oilseeds, etc. as it felt that these markets helped increase prices for commodities

➢ Two committees that were appointed—Datwala Committee in 1966, and Khusro Committee in 1980, recommended the reintroduction of futures trading in major commodities, but without much result.

One more committee on Forwards market, the Kabra Committee was appointed in 1993, which recommended futures trading in wide range of commodities and also up gradation of futures market. Accepting partially the recommendations, Government permitted futures trading in many of the commodities.

Operators/Traders in Futures Market

Futures contracts are bought and sold by a large number of individuals, business organizations, governments and others for a variety of purposes. The traders in the futures market can be categorized on the basis of the purposes for which they deal in this market. Usually financial derivatives attract following types of traders which are discussed here as under:

Hedgers

In simple term, a hedge is a position taken in futures or other markets for the purpose of reducing exposure to one or more types of risk. A person who undertakes such position is called as 'hedger'. In other words, a hedger uses futures markets to reduce risk caused by the movements in prices of securities, commodities, exchange rates, interest rates, indices, etc. As such, a hedger will take a position in futures market that is opposite a risk to which he or she is exposed.

Speculators

A speculator may be defined as an investor who is willing to take a risk by taking futures position with the expectation to earn profits. The speculator forecasts the future economic conditions and decides which position (long or short) to he taken that will yield a profit if the forecast is realized.

Arbitrageurs

Arbitrageurs are another important group of participants in futures markets. An arbitrageur is a trader who attempts to make profits by locking in a risk less trading by simultaneously entering into transactions in two or more markets. In other words, an arbitrageur tries to earn riskless profits from discrepancies between futures and spot prices and among different futures prices.

Spreaders

Spreading is a specific trading activity in which offsetting futures position is involved by creating almost net position. So the spreaders believe in lower expected return but at the less risk. For a successful trading in spreading, the spreaders must forecast the relevant factors which affect the changes in the spreads. Interest rate behaviour is an important factor which causes changes in the spreads. In a profitable spread position, normally, there is large gain on one side of the spread in comparison to the loss on the other side of the spread. In this way, a spread reduces the risk even if the forecast is incorrect. On the other hand, the pure speculators would make money by taking only the profitable side of the market but at very high risk.

Funtions of Futures Market

Hedging

The primary function of the futures market is the hedging function which is also known as price insurance, risk shifting or risk transference function. Futures markets provide a vehicle through which the traders or participants can hedge their risks or protect themselves from the adverse price movements in the underlying assets in which they deal.

Price Discovery

Another important use of futures market is the price discovery which is the revealing of information about futures cash market prices through the futures market.

Financing Function

Another important function of a futures market is to raise finance against the stock of assets or commodities. Since futures contracts are standardized contracts, so, they make it easier for the lenders about the assurance of quantity, quality and liquidity of the underlying asset.

Liquidity Function

As we see that the main function of the futures market deals with such transactions which are matured in the future period. They are operated on the basis of margins which are determined on the basis of rides involved in the contract. Under this the buyer and the seller have to deposit only a fraction of the contract value, say 5 percent or 10 percent, known as margins. It means that the traders in the futures market can do the business a much larger

volume of contracts than in a spot market, and thus, makes market more liquid. That is why the volume of the futures markets is much larger in comparison to the spot markets. This is also known as gearing or leverage factor.

Price Stabilization Function

Another important function of a futures market is to keep a stabilizing influence on spot prices by reducing the amplitude of short term of fluctuations. In other words, futures market reduces both the heights of the peaks and the depth of the troughs.

Disseminating Information

Apart from the aforementioned functions of the futures markets like risk-transference (hedging), price discovery, price stabilization, liquidity, and financing, this market is very much useful to the economy too. Futures markets disseminate information quickly, effectively and inexpensively, and, as a result, reducing the monopolistic tendency in the market.

S. No.	Basis for Comparison	Forward Contract	Futures Contract
1	Meaning	Forward Contract is an agreement between parties to buy and sell the underlying asset at a specified date and agreed rate in future.	A contract in which the parties agree to exchange the asset for cash at a fixed price and at a future specified date, is known as future contract.
2	What is it?	It is a tailor made contract.	It is a standardized contract.
3	Traded on	Over the counter, i.e. there is no secondary market.	Organized stock exchange.
4	Settlement	On maturity date.	On a daily basis.
5	Risk	High	Low
6	Default	As they are private agreement, the chances of default are relatively high.	No such probability.
7	Size of contract	Depends on the contract terms.	Fixed
8	Collateral	Not required	Initial margin required.
9	Maturity	As per the terms of contract.	Predetermined date
10	Regulation	Self regulated	By stock exchange
11	Liquidity	Low	High

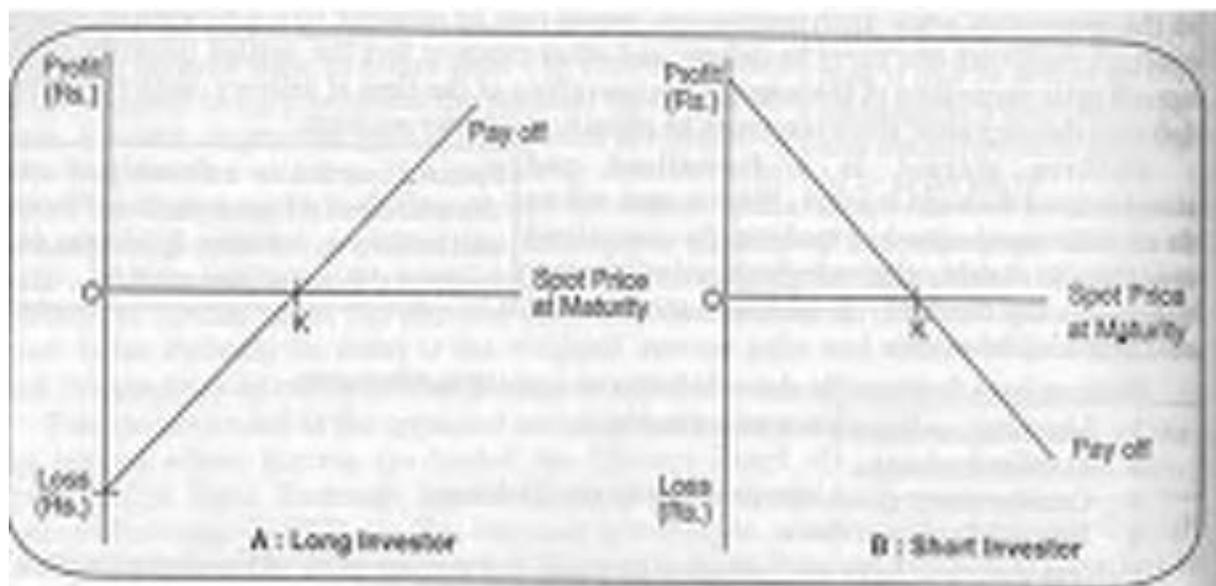**Mechanism of a Futures Contract**

A futures contract calls for the delivery of the specified quantity at the specified rate on specified date. Or, before the maturity date it can be squarred off. In India, the financial derivatives (futures) are compulsorily squarred off on the maturity date. However, in case of commodities futures, delivery is made, if required, by the transfer of warehouse receipt. An investor can buy (a long position) or sell (a short position) a futures contract.

The profit or payoff position of a futures contract depends on the differences between the specified price (of the futures contract) and the actual market price prevailing on the maturity date. For example, if an investor has purchased a futures contract in HLL at the rate of ` 300 and one contract in for 500 shares. The value of the contract is ` 1,50,000 (` 300 x 500). Now, on the maturity date the rate is ` 310. The value of the contract is ` 1,55,000 and his profit is ` 5,000. Similarly, if the rate is ` 296, then his loss is ` 2,000. Further, that if the investor has sold initially, then his loss and profit position would be ` 5,000 and ` 2,000 respectively. This can be summarized as follows

For Long investor: Profit = Spot price at Maturity – Futures Price

Loss = Futures Price – Spot Price at Maturity

For Short investor: Profit = Futures price – Spot Price at Maturity

Loss = Spot Price at Maturity – Futures Price

A futures contact is zero sum game. Profit to one party is the loss of the other party. Simple reason being that every long position is represented by a short position in the market. The pay off positions of the long investor and short investor in futures are shown in Figure

In Figure (A), K is the strike price. The figure shows that as the spot price at maturity increases, the profit of the long investor also increases. This break-even level is one when spot price is equal to strike price. Similarly, Figure (B) shows that maximum profit to short investor appears if the spot price is 0.

Thus profit decreases and Loss increases as the spot price increases. The breakeven appears when the spot price is equal to the strike price. The diagrams for buyer and seller are mirror image of each other.

Financial futures can be classified into Shares and Shares Indices Futures, Bond Futures, Currency Futures and Interest Rate Futures. Discussion on Shares and Shares Indices Futures is taken up first, followed up by currency futures and interest rate futures.

S. No.	Basis for Comparison	Forward Contract	Futures Contract
1	Meaning	Forward Contract is an agreement between parties to buy and sell the underlying asset at a specified date and agreed rate in future.	A contract in which the parties agree to exchange the asset for cash at a fixed price and at a future specified date, is known as future contract.
2	What is it?	It is a tailor made contract.	It is a standardized contract.
3	Traded on	Over the counter, i.e. there is no secondary market.	Organized stock exchange.
4	Settlement	On maturity date.	On a daily basis.
5	Risk	High	Low
6	Default	As they are private agreement, the chances of default are relatively high.	No such probability.
7	Size of contract	Depends on the contract terms.	Fixed
8	Collateral	Not required	Initial margin required.
9	Maturity	As per the terms of contract.	Predetermined date
10	Regulation	Self regulated	By stock exchange
11	Liquidity	Low	High

Pricing of Futures

If an investor wants to acquire shares in a particular company, he can acquire these shares today itself at the current price or he can take a long position in futures. In either case, he will be having the asset on some date in future. No doubt, the market determined cost of acquiring the asset in either of these strategies must be equal. So, there is some relationship between the current price of the asset, cost of holding it in future and the futures prices today. This relationship can be explained by taking cash flow positions at time O and time 't' in both strategies. Say, S in the spot rate, F is the futures price and r is the risk-free rate of interest, the position can be shown as follows:

		Initial Cash Flow	Cash Flow at Time 'T'
Strategy I:	Buy Asset now :	$-S_0$	S_T
Strategy II:	1 Long Futures :	—	$S_T - F_0$
	Invest $F_0/(1+r)^t$:	$-F_0/(1+r)^t$	F_0
	Net Position :	$-F_0/(1+r)^t$	S_T

Table shows that the cash flow position at time 't' is same in both strategies. However, the initial cash flow positions are -S0 and -F0(1 + r)t. In order to eliminate the arbitrate opportunities; these two values should also be same, S.

$$S = F /(1 + r)t$$

$$F_0 = S \times (1+r)t$$

This gives the relationship between the current spot price and the futures price. This is known as Spot-Futures Parity or Cost of Carry Relationship. The expected dividend (income) from the asset during the futures period can also be incorporated in the analysis. So, pricing of futures contract depends on the following variables:

(i) Price of the underlying asset in the cash market,

(ii) Rate of return expected from investment in the asset, and

(iii) Risk-free rate of interest.

The mechanism of pricing of futures can be explained as follows: Suppose,

(i) In cash market, the underlying asset X is selling at ` 100. (ii)

The expected return from the asset is 3% per quarter.

(iii) The risk free rate of borrowing or lending is 8% p.a. or 2% per quarter. (iv)

The futures contract period is also a quarter.

What should be the price of futures?

say,   S = Current spot price of the asset

       F Futures price

       r = % Financing cost per futures period

       y = % Yield on investment per futures period

Now,   F =S+S(r-y)

Suppose, the investor borrows funds to purchase one unit of asset 'X' resulting in no initial cash outlay for his strategy. At the end of 3 month's period, ` 3 will be received from holding the asset 'X and would be required to pay interest (financing cost) of ` 2.

In the example given above,

F = 100 + 100 (.02 -.03)

= ` 99

So, the futures price should be ` 99. What happens if the futures price is ` 92 or `107?

The position can be explained as follows:

In case, the futures contracts are available at ` 92 (i.e., less than the theoretical price of ` 99), the investor should buy one future contract for ` 92 and should sell one unit of asset X for ` 100 and invest the money @ 8% p.a. for 3 months. After 3 months, he will receive the proceeds of ` 102 (` 100 + ` 2). He will spend ` 92 to purchase an asset (out of futures contract). Besides, he will not receive the yield of ` 3 from the asset. So, his cost is `95 (92 + 3). His gain would be ` 7 (` 102 - 95).

Similarly, if the futures contract price is ` 107, he should sell the futures contract at ` 107 and should borrow ` 100 now to buy one unit of asset 'X in the spot market. After 3 months, his proceeds would be ` 110 (107 + 3) and payment would be ` 102 (100 + 2). He would be able to make a profit of ` 8.

So, if the futures price is other than the theoretical price of ` 99, it would give rise to arbitrage opportunities. In case of price of ` 92 or ` 107, investors can look for a riskless arbitrage profit of ` 7 or ` 8. The demand and supply forces would react to this arbitrage opportunity and the futures price would settle around the equilibrium level of ` 99.

In the above analysis, the cost of carry (i.e., the interest amount) has been considered in an over simplified way. In the pricing of futures, the interest effect is taken up on the basis of continuous compounding. The procedure for pricing the futures can be standardized in 3 different situations as follows:

(a) When the asset provides no income:

$F = S \times e^{rt}$ ... (13.1)

(b) Where the asset provides known dividend:

$F = (S - I) \times e^{rt}$ ... (13.2)

(c) Where the asset provides a known dividend yield:

$F = S \times e^{(r - q)t}$ ... (13.3) Where,

F = Futures Price

S = Spot price of the underlying asset.

e = 2.71828 (base of natural logarithm)

r = Rate of interest on borrowing/lending

t = Time duration of futures

I = Present value of expected dividend @'r'

q = Dividend yield.

Theories of Futures Prices

There are several theories which have made efforts to explain the relationship between spot and futures prices. A few important there are as follows:

The Cost-of-Carry Approach

Some top economists like Keynes and Hicks, have argued that futures prices essentially reflect the carrying cost of the underlying assets. In other words, the inter-relationship between spot and futures prices reflects the carrying costs, i.e., the amount to be paid to store the asset from the present time to the futures maturity time (date). For example, food grains on hand in June can be carried forward to, or stored until, December.

Carrying costs are of several types, important among these are:

1. Storage costs

2. Insurance costs

3. Transportation costs

4. Financing costs

Storage Costs refer to those expenses which are done on storing and maintaining the asset in safe custody. It includes rent of the warehouse and others expenses associated with like deterioration, pilferage, normal wastage, etc. In case of financial instruments, the costs incurred on keeping the securities in a bank vault or with custodians.

Insurance Costs refer to amount incurred on safety of the assets against fire, accidents and others. For example, stored wheat be protected against fire, water damage, weather, natural disaster, etc. So insurance is necessary for protection against such hazards. Thus, premium and other costs incurred on insurance is called insurance costs.

In some cases, carrying costs also include the transportation costs. When the futures contract matures the delivery of the assets is given at a particular place which may be far away from the warehouse of stored goods. Obviously, transportation costs will be different from location to location and also to the nature of the commodities.

Another important carrying cost is cost of financing the underlying asset. For example, if gold costs ` 5000 per 10 grams and the financing rate are one percent per month then the financing charge for carrying the gold forward is ` 50 per month (1% of 5000).

Apart from the carrying cost on an underlying asset, there can be possibility of earning a yield on storing the asset. Such yield is known as 'convenience yield' from holding stocks. For example, in case of wheat, there could arise extra yield due to low production of wheat due to bad weather in futures.

Thus, up to a certain level, stock holding has a yield in the event of stock out and unanticipated demand. This may be termed as a negative carrying cost. Hence, the net marginal carrying cost for any given asset may be expressed as:

$C_t = C_{gt} - Y_t$

Where, CT is net carrying cost of that quantity, Cgt, is gross carrying cost of that quantity, Yt, is convenience yield of that quantity and t is time period of storage.

The Cost-of-Carry Model in Perfect Market

The following formula describes a general cost-of-carry price relationship between the cash (spot) price and futures price of any asset:

Futures price = Cash (spot) price + Carrying cost

In addition, the formula assumes the conditions of perfect competition which are as under:

1. There are no information or transaction costs associated with the buying and selling the asset.

2. There is unlimited capacity to borrow and lend.

3. Borrowing and lending rates are the same.

4. There is no credit risk. No margin is required on buying and selling the asset.

5. Goods can be stored indefinitely without loss to the quality of the goods.

6. There are no taxes.

Before discussing the various rules of carrying cost, let us see cash-and-carry arbitrage. In this, the trader buys the goods at the cash price and carries it to the expiration of the futures contract. Let us take an example as given in Table.

The Cost-of-Carry Model In Imperfect Market

We have seen the relationship between the spot price and futures price in the conditions of perfect market which is rare in actual practice. There are various imperfections in real markets which disturb the relationship of Rule III and Rule VI. Among the various imperfections, five are important which have been discussed here in after:

Direct Transaction Cost

In actual practice, when a trader makes the spot or futures transactions he has to pay a fee; known as brokerage fee or commission. In other words, transaction costs refer to all such costs which have to be borne by the trader to buy or sell a particular asset for spot or futures. These costs are transaction fees, exchanges charges and fee, fee for arranging funds, etc. It is also called as the round- trip fee.

Unequal or Differential Borrowing and Lending Rates

It refers to that market situation where the rates of interest on borrowing and lending are different and they are not equal. Normally, in real market, borrowing rates are higher than the lending rate. These differentials of borrowing and lending rates serve to widen the no-arbitrage boundaries.

Restriction on Short- Selling

This is another market imperfection. Earlier, we have assumed that traders can sell assets short and use the proceeds from the short sale without any restrictions. Due to inherent risks in short sales, there are restrictions on short selling virtually in all markets.

Bid-Ask Spread

It is another market imperfection because we see in actual practice that the trader tries to sell the asset at higher price than to purchase the same. The difference between bid price and ask price is called bid-ask spread.

Storage Problem

It is another market imperfection because except gold, most of the commodities cannot be stored very well at all. The storability of a commodity is very important in futures market trading. If a commodity cannot be stored then full arbitrage opportunity will not be available in the market.

Futures Prices and the Capital Asset Pricing Model (Systematic Risk Explanation)

The Capital Asset Pricing Model (CAPM) has been widely applied to all kinds of financial instruments including futures contracts. In general, the higher the risk of an investment, the higher the expected return demanded by an investor. The expected return demanded by the holders of futures positions is reflected in the difference between futures prices and expected future spot prices. This risk return model can be used for other assets like stocks and bonds. The CAPM leads to the conclusion that there are two types of risk in the economy; systematic and unsystematic.

Unsystematic risk is not so important since it can be almost completely eliminated by holding a well-diversified portfolio. Systematic risk or market risk cannot be diversified away. So as per this model, the investors should be compensated only for systematic risk. In general, an investor requires a higher expected return than the risk-free interest rate for being the systematic risk.

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UNIT – VI

OPTIONS

</div>

Introduction

An option is a unique instrument that confers a right without an obligation to buy or sell another asset, called the underlying asset. Like forwards and futures it is a derivative instrument because the value of the right so conferred would depend on the price of the underlying asset. As such options derive their values inter alia from the price of the underlying asset.

Terminology of Options

Before we discuss how an option contract works it would be useful to familiarize with the basic terms that are often used in describing and using options. These basic terms are described below.

Call Option

A right to BUY the underlying asset at predetermined price within specified interval of time is called a CALL option.

Put Option

A right to SELL the underlying asset at predetermined price within a specified interval of time is called a PUT option.

Buyer or Holder

The person who obtains the right to buy or sell but has no obligation to perform is called the owner/holder of the option. One who buys an option has to pay a premium to obtain the right.

Writer or Seller

One who confers the right and undertakes the obligation to the holder is called seller/writer of an option.

Premium

While conferring a right to the holder, who is under no obligation to perform, the writer is entitled to charge a fee upfront. This upfront amount is called the premium. This is paid by the holder to the writer and is also called the price of the option.

Strike Price

The predetermined price at the time of buying/writing of an option at which it can be exercised is called the strike price. It is the price at which the holder of an option buys/ sells the asset.

Strike Date/Maturity Date

The right to exercise the option is valid for a limited period of time. The latest time when the option can be exercised is called the time to maturity. It is also referred to as

expiry/maturity date.

These terms would become clearer when the two basic options, call and put are described In detail.

Types of Options

Nature of Exercise: American Versus European

Based on the timing of exercise the options can be either American or European. American options can be exercised at any point of time before the expiry date of the option, while European options are exercisable only upon maturity.

Nature of Markets: OTC Versus Exchange Traded

Options can also be categorized as OTC or exchange traded depending upon where and how they are created, traded, and settled. Options may be like it forward contracts, which are specific and negotiated by two contracting parties mutually with direct negotiations, known as OTC, or they can be like futures which may be bought and sold on the specific exchanges where the two contracting parties may not be known to each other but instead enter into a contract on the floor/screen of an exchange. In the exchange-traded options the contracts need to be standardized, while an OTC product is tailor-made to the requirements of the parties concerned.

The standardization of option contract would be in at the discretion of the exchange and is done in terms of Quantity of Underlying Asset Only specific quantity of the underlying asset could be traded on the exchange and need to be predetermined.

Strike Prices

Only specific strike prices can be handled in a standardized product traded on the exchanges. OTC products can have any strike price as agreed by the two contracting parties.

Expiration Dates

Like strike price the expiration dates too must be known before trading can take place in options at the exchanges.

Nature of Exercise of Option Whether the options are American or European in nature too must be known to traders in options.

Ways of Settlement

Options can be settled either by delivery of underlying asset or by cash settlement, which is closing out by exchanging the differential of price at initiation and closing out. Cash settlement at the expiry is done by exchanging difference between the exercise price and price of the underlying asset. It can also be settled by the cancellation of the contract by entering into an equal and opposite contract to the original one.

Nature of Underlying Assets

Like forwards and futures, options too can have any asset as underlying. Options on

stocks, indices, commodities, currencies, and interest rates are available either OTC or on exchanges. Though not available in India as of now, options on commodities are traded internationally on agricultural products, live stock, food products, energy, and metals.

Naked (Uncovered) and Covered Option

Naked or uncovered options are those which do not have offsetting positions, and therefore, are more risky. On the other hand, where the writer has corresponding offsetting position in the asset underlying (he option is called covered option. Writing a simple uncovered (or naked) call option indicates toward exposure of the option writer to unlimited potential losses. The basic aim is to earn the premium. In period of stable or declining prices, call option writing may result in attractive profits by capturing the time value of an option. The strategy of writing uncovered calls reflects an investor's expectations and tolerance for risk.

A covered option position involves the purchase or sale of an option in combination with an offsetting (or opposite) position in the asset which underlies the option. As observed earlier, the writer of the call option incurs losses when stock prices rise, and put writers incur losses when prices fall. In such situation, the writer can cover the short put with a short position and short call with a long position in the underlying asset. This can be stated as:

Covered call sale = Short call + Long futures

Covered put sale = Short put + Short futures

Stock Options

Options on individual shares of common stock have been traded for many years. Trading on standardized call options on equity shares started in 1973 on CBOE whereas on put options began in 1977. Stock options on a number of over-the-counter stocks are also available. While strike prices are not because of cash dividends paid to common stock holders, the strike price is adjusted for stock splits, stock dividends, reorganization, recapitalizations, etc. which affect the value of the underlying stock.

Foreign Currency Options

Foreign currency is another important asset, which is traded on various exchanges. One among these is the Philadelphia Stock Exchange. It offers both European as well as American option contracts. Major currencies which are traded in the option markets are US dollar, Australian dollar, British pound, Canadian dollar, German mark, French franc, Japanese yen, Swiss franc, etc. The size of the contract differs currency to currency. This has been explained in more detail in the chapter on currency option.

Index Options

Many different index options are currently traded on different exchanges in different countries. For example, the S&P 100 index at CBOE and Major Market Index at AMEX are traded in the US options markets. Similarly, in India, such index options have been started on National Stock Exchange and Bombay Stock Exchange. Like stock option, index option's strike price is the index value at which the buyer of the option can buy or sell the underlying stock index. The strike index is converted into dollar (rupee) value by multiplying the strike index by the multiple for the contract. If the buyer of the stock index option intends to exercise the option then the stock must be delivered. It would be complicated to settle a stock index option by delivering all the stocks that make up that particular index. Hence, instead, stock index options are cash settlement contracts. In other words, if the option is exercised, the exchange assigned option writer pays cash to the option buyer, and there will be no delivery of any share.

Futures Options

In a futures option (or options on futures), the underlying asset is a futures contract. An option contract on futures contract gives the buyer the rights to buy from or sell to the writer a specified future contract at a designated price at a time during the life of the options. If the futures option is a call option, the buyer has the right to acquire a long futures position.

Similarly, a put option on a futures contract grants the buyer the right to sell one particular future contracts to the writer at the exercise price. It is observed that the futures contract normally matures shortly after the expiration of the option. Futures options are now available for most of the assets on which futures contracts are on the Euro dollar at CME and the Treasury bond at the CBOT.

Interest Rate Options

They are another important options contract, which are popular in the international financial markets. Interest rate options can be written on cash instruments or futures. There are various debt instruments, which are used as underlying instruments for interest rate options on different exchanges. These contracts are referred to as options on physicals. Recently, these interest rate options have also gained popularity on the over-the-counter markets like on treasury bonds, agency debentures and mortgagebacked-securities. There are governments, large banking firms and mortgage-backed-securities dealers who make a market in such options on specific securities.

Leaps Options

These options contracts are created for a longer period. The longest time before expiration for a standard exchange traded option is six-months. However, Long Term

Equity Anticipated Securities (LEAPS) are option contracts designed to offer with longer period maturities even up to 39 months. These LEAPS options are available on individual stocks and some indexes. Usually, they are designed for a particular purpose.

Flex Options

It is a specific type of option contract where some terms of the option have been customized. The basic objective of customization of some terms is to meet the wide range of portfolio strategy needs of the institutional investors that cannot be satisfied through the standard exchange-traded options. FLEX options can be created for individual stocks, stock indexes, treasury securities, etc. They are traded on an option exchange and cleared and guaranteed by the clearing house of that exchange. The value of FLEX option depends upon the ability to customize the terms on four dimensions, such as underlying asset, strike price, expiration date and settlement style (i.e., American vs European). Moreover, the exchange also provides a secondary market to offset or alter positions and an independent daily marking of prices.

Exotic Options

The option contracts through the OTC market can be customized in any manner desired by an institutional investor. For example, if a dealer can reasonably hedge the risk associated with opposite side of the option sought, it will design an option as desired by the customer. OTC options are not limited to only European or American type of options, rather a particular option can be created with different exercise dates as well as the expiration date of the option. Such options are also referred to as limited exercise options, Bermuda options, Atlantic options, etc. Thus, more complex options created as per the needs of the customers are called exotic options which ma' be with different expiration dates, exercise prices, underlying assets, expiration date and so on.

Factor affecting option prices

Factor	Call option's	Put option's
Increase in underlying asset's	Increase	Decreases
Increase in strike price	Decrease	Increases
Increases in variance of underlying	Increases	Increases
Increase in time to expiration	Increases	Increases
Increases in interest rates	Increases	Decreases
Increase in dividends paid	Decreases	Increases

Option Pricing Methods

**Binomial Option Pricing Model**

The binomial model of stock price movements is a discrete time model, i.e., time is divided into discrete bits and only at these time points are stock prices modeled. The binomial approach assumes that the security price obeys a binomial generating process, i.e., at every point of time there are exactly two possible states - stock can move up or down. A priori it is not known which of the two states will occur but the amount by which it can go up or down is assumed as known. Figure shows a binomial tree.
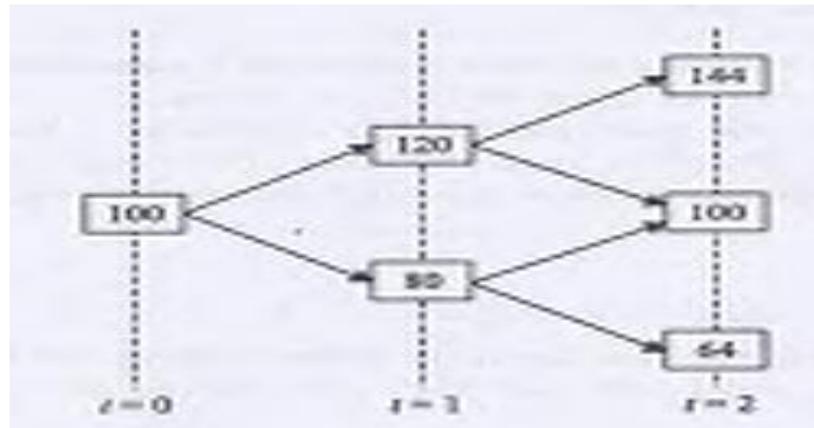
Two – period binomial tree.

Let us understand the binomial tree's terminology. The tree depicted in Figure is a two-period binomial tree and the stock price changes two times. Each point where two lines meet is termed as a node, which represents a possible future price of the stock. The tree is called as binomial because the spot price at every node can either move up or down. If we denote the stock price at the beginning as S0 and Su as the stock price in an up state and Sd as the stock price in a down state, then we can define the up factor as Su/S0 and down factor as Sd/S0. The probability that the stock price will move from one node to another is called as transition probability. The binomial trees as given by Cox, Ross and Rubinstein,CRR here after have some important characteristics, which are given below:

1. Length of the time interval remains constant throughout the tree, i.e., if the interval between the nodes is in months, it will be months everywhere and if it is in terms of years, it will years everywhere.

2. Volatility remains constant throughout the tree.

3. Transition probability remains the same in the entire tree.

4. The trees are recombining, i.e., an up move followed by a down move will take the stock to the same value as a down move followed by an up move.
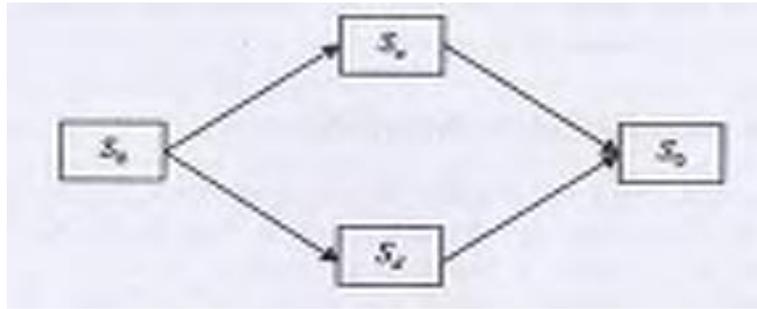
A Recombining Tree

Single Period Binomial Model

Assume that a stock price follows a binomial model and we are interested in finding the price of a European option that expires at the end of one period.

As explained earlier in the numerical example, formulate a hedge portfolio that exactly imitates the payoff of the call option in all the states. This hedge portfolio at to comprises Δ number of shares and a risk-less zero-coupon bond maturing to the par value B by the time t1. Therefore, at time t0.

$$\text{Value of Portfolio } \Delta. S_0 + e^{-rT}. B \text{ (2.4)}$$

Since this is a replicating portfolio, the value of the portfolio will be equal to C1, the option's value in case it moves up and Cd in case stock price moves down.

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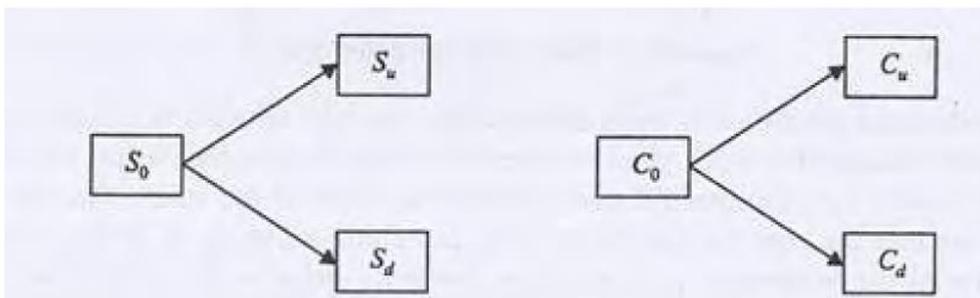
At time T we can note that if the stock price moves up:

$$\Delta. S_u + B = C_u \quad (2.5)$$

and if the stock price moves down:

$$\Delta. S_d + B = C_d \quad (2.6)$$

By solving the above equations we can obtain B and A. From equation (2.5) we can find that $B = C_{u-\Delta.s}u$ and now substitute this in equation (2.6) for B and solve we get

$$\Delta = \frac{C_u - C_d}{S_u - S_d} \quad \text{and } B = \frac{S_u - S_d}{S_u - S_d}$$

Now if we substitute the values of Δ and B in equation (2.4) we obtain

$$C_0 = \frac{C_u - C_d}{S_u - S_d} \cdot S_0 + e^{-rT} \cdot \frac{S_u C_d - C_u S_d}{S_u - S_d}$$

Rearranging the terms, we get:

$$C_0 = \frac{S_0 - e^{-rT} \cdot S^d}{S_u - S_d} \cdot C_u + \frac{e^{-rT} \cdot S_u - S_d}{S_u - S_d} \cdot C_d$$

Black—Scholes Option Pricing Model (BSOPM)

Chronologically speaking, BSOPM was introduced much earlier than binomial option pricing, but for ease of understanding we first considered the binomial model. Infact, Black—Scholes provided the first ever closed form of solution for pricing the European calls in 1973 and published the path-breaking paper titled "The pricing of options and corporate liabilities" in Journal of Political Economy. Prof. Scholes and Prof. Merton were awarded the Nobel Prize for their contributions in option pricing.

The data inputs to this model are current stock price, exercise price, expected volatility, interest rate and time to expiry. The pricing intuition remains the same - construct a replicating hedge portfolio comprising a long position in stock and a short position in a zero-coupon bond.

The hedge portfolio will be constituted in such a way that at any given point of time its value will always be equal to the option's price at that time. If the option's price differs from the hedge portfolio's value, then arbitrageurs' actions will bring back the equilibrium relationship. The proportion of stocks and bonds will be determined by the Black—Scholes formula.

As the formula depends on constantly changing factors like volatility, current market price of the stock, etc., the portfolio mix has to be constantly adjusted so that it will reflect the current outputs of Black—Scholes. Hence this portfolio is called as dynamic portfolio and the act of maintaining the portfolio in balance is called as hedge rebalancing.

The mathematical derivation of the Black—Scholes model is quite complicated and requires understanding of a sophisticated branch of mathematics called as stochastic calculus, the details of which are out of the scope of this book. So the detailed mathematical derivation of BSOPM is provided as an appendix to this chapter. The famous Black—Scholes formula for option pricing is given below:

$$C = S \cdot N(d_1) - X \cdot e^{-rt} \cdot N(d_2) \qquad (2.7)$$

$$d_1 = \frac{\ln\left(\frac{S}{x}\right) + (r + \sigma^2/2 \times t}{\sigma \cdot \sqrt{t}} \qquad (2.8)$$

$$d_2 = rd_1 - \sigma \cdot \sqrt{t} \qquad (2.9)$$

Where N (.) = Cumulative normal distribution function

In = Natural logarithm,

S = Spot price of the stock,

X = Exercise price of the option,

r = Annual risk-free rate of return,

t = Time to expiry of the option, and

σ = Annual volatility of the stock.

If t is in years, then o and r should also be expressed in annual terms.

If t is in years, then o and r should also be expressed in annual terms.

Since the calculation of option price through the Black—Scholes formula involves many intermediary computations, a systematic procedure may be useful:

1. It is better to start with equation (2.8). So,
   a. Work out In (S/X)
   b. Calculate (r + a2/2)
   c. Find $\sigma \cdot \sqrt{t}$
   d. Compute d1
2. Calculate d2 from equation (2.9).
3. Find cumulative normal distribution values either using N(d) tables given at the end of this book or using the numerical formulae
4. Now calculate the price of the option by substituting the respective values in equation

Example 2.4

The current price of a stock is ₹ 90 per share. The risk-free interest rate is 8% (annualized, continuous compounding). If the volatility of the stock is 23% p.a., what is the price of the ₹ 80 call option expiring in 6 months?

Solution

Performing the above mentioned steps:

1. (a) In (90/80) = 0.1178

    (b) $¢r = \dfrac{\sigma^2}{2} \le = (0.08 + (0.23 \times 0.23/2)) = 0.1064$

    (c) $\sigma . \sqrt{t} = 0.1626$

    (d) Find the vlaue of the numerator in d1L II 1

$$In (S/X) + ¢r = \dfrac{\sigma^2}{2} \le . t = 0.1178 + 0.1064 \times 0.5 = 0.171$$

    Now, divide this with 0.1626, which gives $d_1 = 0.171/0.1626 = 1.0517$

2. $d_2 = d_1 - \sigma . \sqrt{t} = 1.0517 – 0.1626 = 0.8891$

3. N(1.0517) = 0.8535 and N(0.8891) = 0.8130

4. $C = S. N(d_1) – X. e^{-rt}. N(d_2) = 90 \times 0.8535 \times 80 \times e^{-0.08 \times 0.5} \times 0.8130$

    = ₹ 14.3253 = 14.33

European Put Option Pricing

B-S initially provided the formula for pricing European style call options on assets without any intermediate income. Simultaneously, in an article in Bell Journal of Economics and Management Science, Robert Merton (1973) provided an elegant analysis in which he provided explicit formulas for pricing put options and suggested adjustments to take care of dividend payments.

The price of the European put option can be computed using the formula given in equation

$$P = X\ e^{rt}.\ N(-d_2) - S.\ N(-d_1) \qquad (2.10)$$

All the terms that appear in this formula are as explained in the above section. It can be noted that $N(-d_2)$ is the same as $1 - N(d_2)$ and $N(-d_1)$ is the same as $1 - N(d_1)$.

Example 2.5

Using the information provided in the previous example, find the price of a put option.

Solution

We can start with the computation of d_1 and d_2 but if we make use of the fact that $N(-d_2)$ is the same as $1 - N(d_2)$ and $N(-d_1)$ is the same as $1 - N(d_1)$, then the put option's value is given as:

$$P = 80\ x\ e^{-0.08x0.5}\ x\ (1 - 0.8130) - 90\ c\ (1 - 0.8535)$$
$$= 1.1884 = 1.19$$

B-S Model Assumptions and Limitations

Just as with most other models in finance, BSOPM is also based on some assumptions, which are as follows:

(a) Frictionless markets. More precisely it means there are no transaction costs, short-selling is permitted, existence of similar borrowing and lending rates and infinitely divisible assets. This is not a severely restrictive assumption since the intention is to

separate the effect of market forces on option prices.

(b) The asset pays zero dividends. This is also not an implausible assumption at least in the short run. But subsequent models in the literature proposed some adjustments to the basic BSOPM to incorporate dividend/intermediate income.

(c) The option is European style.

(d) Asset prices follow a geometric Brownian motion. In other words, asset returns are normal and stationary. Many critics called this assumption as the biggest hole in the B-S formula, including its inventor Prof. Fisher Black in an influential article in the Journal of Applied Corporate Finance in 1989.

But this way of making simplifying assumptions to describe the complex real world more well-mannered is followed in many disciplines of Sciences and also in economics and finance from ages, and in that spirit this model is not an exception. More importantly, despite these seemingly deficient assumptions, the model does a reasonable job in pricing a variety of derivative instruments.But the real utility of BSOPM is that it provides us a mechanism to hedge an option and the cost of hedging gives us insights into the likely price of the option. In the B-S model, all the data inputs are directly observable except volatility. In the next section, we will see some important ways of estimating volatility.

<div align="center">

UNIT – V

SWAPS

</div>

Different Types of Swaps

1. Currency Swaps

Currency swaps are agreements between counter-parties to exchange interest and principal payments in different currencies. Like a forward, a cross currency swap consists of the exchange of principal amounts (based on today's spot rate) and interest payments between counter-parties. It is considered to be a foreign exchange transaction and is not required by law to be shown on the balance sheet.

In a currency swap, these streams of cash flows consist of a stream of interest and principal payments in one currency exchanged for a stream, of interest and principal payments of the same maturity in another currency. Because of the exchange and re-exchange of notional principal amounts, the currency swap generates a larger credit exposure than the interest rate swap.

2. Credit Default Swap

Credit Default Swap is a financial instrument for swapping the risk of debt default. Credit default swaps may be used for emerging market bonds, mortgage backed securities, corporate bonds and local government bond.

The buyer of a credit default swap pays a premium for effectively insuring against a debt default. He receives a lump sum payment if the debt instrument is defaulted.

The seller of a credit default swap receives monthly payments from the buyer. If the debt instrument defaults they have to pay the agreed amount to the buyer of the credit default swap.

Example of Credit Default Swap;

An investment trust owns £1 million corporation bond issued by a private housing firm.

If there is a risk the private housing firm may default on repayments, the investment trust may buy a CDS from a hedge fund. The CDS is worth £1 million.

The investment trust will pay an interest on this credit default swap of say 3%. This could involve payments of £30,000 a year for the duration of the contract.

If the private housing firm doesn't default. The hedge fund gains the interest from the investment bank and pays nothing out. It is simple profit.

If the private housing firm does default, then the hedge fund has to pay compensation to the investment bank of £1 million – the value of the credit default swap.

Therefore the hedge fund takes on a larger risk and could end up paying £1million

3. Commodity Swap

A commodity swap is an agreement whereby a floating (or market or spot) price is exchanged for a fixed price over a specified period. The vast majority of commodity swaps involve oil. A swap where exchanged cash flows are dependent on the price of an underlying commodity. This swap is usually used to hedge against the price of a commodity. Commodities are physical assets such as precious metals, base metals, energy stores (such as natural gas or crude oil) and food (including wheat, pork bellies, cattle, etc.).

4. Equity Swap

An equity swap is a special type of total return swap, where the underlying asset is a stock, a basket of stocks, or a stock index. An exchange of the potential appreciation of equity's value and dividends for a guaranteed return plus any decrease in the value of the equity. An equity swap permits an equity holder a guaranteed return but demands the holder give up all rights to

appreciation and dividend income. Compared to actually owning the stock, in this case you do not have to pay anything up front, but you do not have any voting or other rights that stock holders do have.
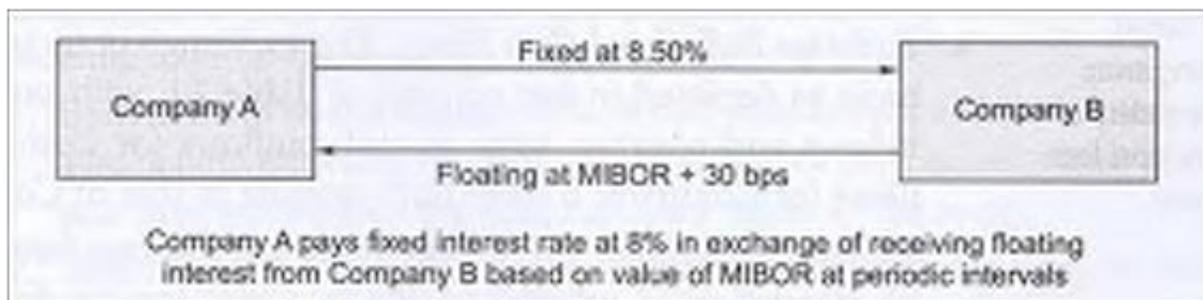
5. Interest Rate Swap

An interest rate swap, or simply a rate swap, is an agreement between two parties to exchange a sequence of interest payments without exchanging the underlying debt. In a typical fixed/floating rate swap, the first party promises to pay to the second at designated intervals a stipulated amount of interest calculated at a fixed rate on the "notional principal"; the second party promises to pay to the first at the same intervals a floating amount of interest on the notional principle calculated according to a floating-rate index.

Interest Rate Swaps

Features of SWAP

Usually, interest rate swaps involve payment/receipt of fixed rate of interest for receiving/paying a floating rate of interest. The basis of exchange of cash flows under interest rate swap is the interest rate. This fixed-to-floating swap, commonly known as 'plain vanilla swap', is depicted in-Figure, where Company A agrees to pay Company B fixed interest rate of 8.5011/o in exchange of receiving from it the interest at 30 bps (100 bps = 111/6) above the floating interest rate, Mumbai Inter Bank Offer Rate (MIBOR), at predetermined intervals of time.

Fixed at 8.50%

Company A

Company B

Floating at MIBOR + 30 bps

Company A pays fixed interest rate at 8% in exchange of receiving floating interest from Company B based on value of MIBOR at periodic intervals

'Plain Vanilla' Interest Rate Swap

Assuming that the swap between Company A and Company B is (a) for a period of three years, (b) with semi-annual exchange of interest, (c) on notional principal of ` 50 crores the cash flows for Company A for 6 semi-annual periods for an assumed MIBOR would be as per Table. What is received/paid by Company A is paid/received by Company B.

Interest Rate Swap to Reduce Funding

Two Indian firms IndoPas and IndoCar are contemplating to raise finance of ` 100 crore each. They have been offered following loans by a bank

	Fixed Rate	Floating Rate
IndoPlas	12.00%	MIBOR + 70 bps
IndoCar	11.00%	MIBOR + 30 bps

Another bank acting as swap intermediary is willing to work out a swap arrangementfor a fee of 5 bps from each firm. IndoCar believes that interest rate would fall and hence, wants to raise funds in the floating rate basis. IndoPlas feels otherwise and likes to raise funds on fixed interest rate basis. What swap can be arranged between the two parties? What would be the saving in financing cost of each firm?

Solution

The absolute advantage for IndoCar is 100 bps in fixed rate market while it is 40 bps in the floating rate market. Though IndoCar wants to raise finance at floating rate, the firm must access the fixed rate market and then enter into a swap deal with IndoPlas to convert the fixed rate liability into floating rate. The total benefit to be availed is 60 bps the differential of absolute advantage of IndoCar in the two markets. Of this benefit 10 bps would be taken away by the bank, while the remaining 50 bps may be shared equally by both the parties through a swap. One such structure is presented below (see Figure E).
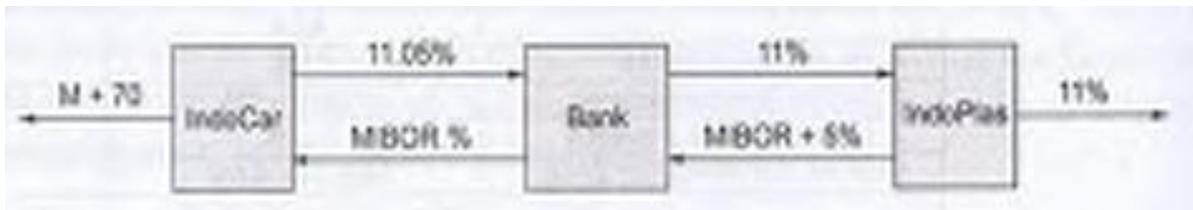
	IndoCar	IndoPlas
Payment to investors	11%	MIBOR + 0.7%
Payment to Bank	MIBOR + 0.05%	11.05%
Receipt from Bank	11%	MIBOR%
	MIBOR%	MIBOR+5% I
Cost of borrowing (1 + 2 - 3)	MIBOR + 0.05%	11.75%

Interest Rate Swap: A Schematic View with Intermediary

The aggregate cost of funds for IndoCar would be NIB OR + 5 bps a saving of 25 bps if it had accessed the floating rate market at MIBOR + 30 bps. Similarly, IndoPlas obtains funds at 11.75% against 12% otherwise, without the swap deal resulting in an advantage of 25 bps.

Types of Interest Rate SWAPS

With the bank as intermediary and each party deals with the bank rather than each other. Interest rate swaps (IRS) can be categorized as follows.

Fixed-to-Floating

In the fixed-to-floating rate swaps the party pays fixed rate of interest to the bank or swap dealer and in exchange receives a floating rate interest determined on the basis of a reference/benchmark rate at predetermined intervals of time.

Such a swap is used by a firm which has floating rate liability and it anticipates a rise in the interest rates. Through the swap the firm will cancel out the receipts and payments of floating rate and have cash outflow based on the fixed rate of interest.

Floating-to-Fixed

In this kind of swap the party pays floating rate of interest to the bank or swap dealer and in exchange receives a fixed rate interest at predetermined intervals of time.

Such a swap is used by a firm who has fixed rate liability and it anticipates a fall in the interest rates. Through the swap the firm will cancel out the receipts and payments of fixed rate liability and have cash outflow based on the floating rate of interest.

Currency Swaps

In a currency swap the exchange of cash flows between counterparties take place in two different currencies. Since two currencies are involved, currency swaps become different from interest rate swaps in its uses functionality, and administration. The first recorded currency swap was initiated in 1981 between IBM and World Bank.

Swaps to Hedge Against Exchange Rate Risk

Assume that an Indian software firm Inso Ltd wants to acquire a US firm with a cost of $2.00 crore. For the purpose it raises the required capital of ` 90 crore (current exchange rate of ` 45/$) at 12%. The US acquisition is expected to yield 150/0 return. At the same time a US engineering firm USENG Inc. is negotiating a joint venture to contribute US $ 2.00 crore which promises to yield 15% return in India. USENG Inc. raises the required dollar at a cost of 8°/s. Assume that all

liabilities need annual payments.

1. Examine the risk faced by Inso Ltd and USENG Inc. if the Rupee appreciates to 44,42, 40, 38, and 36 per $ for next five years. Rupee depreciates to 46, 48, 50, 52, and 54 per $ for next five years

2. Show how a swap arrangement between the two can help eliminate the risk of exchange rate fluctuations.

Solution

Inso Ltd is targeting annual profit of ` 270 Iakh as shown below.

Income in US dollar	= 15% of $ 200 lakh	= $ 30 lakh p.a.
Equivalent rupee		= ` 1,350 lakh p.a.
Interest payment	= 12°/s of ` 9,000 lakh	= ` 1,080 lakh p.a.
Anticipated profit	= 1350 - 1,080	= ` 270 lakh p.a.

If Indian rupee appreciates, Inso Ltd would receive lesser income than expected and hence, carries risk of reduction in profit due to appreciation of rupee, liability being fixed in rupee.

Similarly, USENG Inc. is targeting annual profit of $ 14 lakh as shown below.

Income in rupee	= 15°/s of ` 9,000 lakh	= ` 1,350 lakh p.a.
Equivalent dollar		= $ 30 lakh p.a.
Interest payment	= 8% of $ 200 lakh	= $ 16 lakh p.a.
Anticipated profit	= 30 - 16	= $ 16 lakh p.a.

Distinguishing Features of Currency SWAP

It may be seen that currency swap is similar to parallel loan. However, swaps are better because they may be entered with the financial intermediary saving the trouble of finding the counterparty with matching needs as also reducing the counterparty risk.

Though working on the same principle of comparative advantage, operationally currency swaps become different than interest rate swaps. Under currency swap the cash flows are as follows:

1. Exchange of principal at the time of setting the swap deal at the current spot rate

2. Exchange of periodic interest payments

3. Exchange of the principal back upon maturity

Under interest rate swap there is no exchange of principal at the begin-fling of swap or at its conclusion.

Currency swaps may be classified as following

In a fixed-to-fixed currency swap the interest rates in the two currencies involved are fixed. For example, a British firm may raise loan in pound and exchange it for dollar to an US firm. Interest payment may be made by the British firm in dollar while receiving pound interest from the US firm. The US firm would do the reverse, making interest payment in pound and receiving dollar interest. The interest rate in US dollar and pound both are fixed.

(a) Fixed-to-Floating

In a fixed-to-floating currency swap the interest rate in one of the currencies is fixed while other is floating. In the earlier example if the British firm made interest payment in dollar at a fixed rate while receiving pound interest based on London Inter Bank Offer Rate (LIBOR) from the US firm, such a swap would be fixed to floating. Such swaps not only transform the nature of asset/ liability from one currency to another but also change it from fixed rate to floating rate. It becomes a complex tool for hedging against currency risk as well as interest rate risk.

(b) Floating-to-Floating

In a floating-to-floating currency swap both the interest rates are floating but in different currencies. In the earlier example if the British firm made interest payment in dollar based at prime rate in the USA while receiving pound interest based on LIBOR from the US firm, such a swap would be floating-to floating.

Valuation of Swaps

Pricing of the swap is an important issue for two reasons. First, as stated earlier banks function as warehouse of swaps and are ready to offer swap to the desired customers. For this they are required to quote the swap rates for paying and receiving a fixed rate of interest for receiving/paying the benchmark variable rate. The other reason for valuing the swap is for the purpose of cancellation of an existing swap. For reasons of economy a firm may like to cancel the obligations or part thereof by paying or receiving the value of the swap at that point of time.

Valuing Interest Rate Swap

As stated earlier, an interest rate swap consists of fixed rate cash flow and floating rate cash flow in the opposite direction. At the time of inception of the swap the present value of these payments must be equal in the opinions of both the parties to the swap else they would not agree to it.

Therefore, at inception the value of swap is zero implying that the present values of cash inflows and outflows are equal and its aggregate flow is zero.

However, the circumstances would change after the swap is initiated. The value of an interest rate swap at any time is the net difference between the present value of the payments to be received' and the present value of the payments to be made. It becomes positive to one party and is equivalently negative to the other party. This tells how much cash the two parties must exchange to nullify the remaining obligations in the swap.

From the valuation perspective a swap transaction may be interpreted in at least two ways. It can be thought of either as a pair of bonds or a series of forward agreements. Any of the interpretation of the swap helps in its initial pricing as well as its valuation, if and when one wants a premature closure. We take the pricing of swap by both methods by treating the swap as pair of bonds or as a series of forward agreements.

Value of Interest Rate Swap

A firm had entered into a swap arrangement for a notional principal of ` 1 crore with a bank where the bank paid 9% fixed and received MIB0R semi annually. It has 3 more years to go and has just exchanged the cash flow. The 6-month MIBOR for the next payment of interest was reset at 8%. Next day the markets exhibited a fall and the 6-month MIBOR fell to 7%s, leading the firm to believe that it is overpaying. It wants to cancel the swap arrangement. How much should the firm ask the bank to pay to cancel the swap deal?

Solution

The value of the swap for the firm is determined on the basis of discounted cash flows. Since the rates have changed the discount rate used would be 7%; the prevalent market rate. The value of the cash outflows on the fixed basis discounted at 7% is ` 115.63 as shown below (see Table E).

Fixed leg payment - Cash outflow	9.00%
Present 12-month MIBOR	7.00%
Next Interest payment on floating rate	8.00%

Present Value of Cash Flow of the Fixed Leg

Months	Years	Cash Flow	DCF at 7.00%
6	0.50	4.50	4.42
12	1.00	4.50	4.35
18	1.50	4.50	4.27
24	2.00	4.50	4.20
30	2.50	450	4.13
36	3.00	104.50	94.25
Present Value of Fixed Leg			115.63

The present value of the inflow at floating rate would be next interest, payment known decided a period in advance plus face value of ` 100 discounted at 7/a. This amount works out to ` 100.48 (see Table E):

Value of Floating Leg

Interest to be received after 6-rn	4.00
Principal to be received after 6-m	100.00
	104.00
Present Value at 7.00%	100.48

The present value of the cash outflow is more by ` 15.15 for a principal of ` 100. If the bank pays ` 15.15 lakh for the principal amount of ` 1 crore, the firm may exit the swap.

Valuing Currency Swap

We can price currency swap on the same lines and principle as that of interest rate swap, i.e. equating the value of cash inflows with the value of cash outflows. These cash flows are in different currencies, domestic and foreign and need to be converted to the domestic currency. If the present values of cash flows of domestic currency and foreign currency are Vd and Vf respectively, and the spot rate is S then the value of the swap, which pays domestic and receives foreign currency, is given by

$$Vs = S \times Vf - Vd \quad (3.7)$$

Value of Currency Swap

A swap was entered by an Indian firm with a bank converting its rupee liability into British pound, where the firm received 10% on Indian rupee and paid 5% on British pound. The amount of principals involved are ` 120 million and £ 1.5 million fixed at the then exchange rate of `

80/£. The swap has 4 semi-annual payments to follow. Assume the next payment is due after 6 months from now and term structure in Indian rupee and British pound is flat at 9.00% and 5.50% respectively, for the next 2 years. If the current exchange rate is ` 82.00/£, what is the value of the swap for the Indian firm and the bank?

Commodity Swaps

Prices of commodities change continuously. If the prices of output were fixed the profit would be variable. By entering into futures contract traders can render stability to profits.

However, futures as a hedging tool remains a short- term measure, as the hedging period is limited to the maximum maturity of futures contracts available at any point of time. Swaps, being OTC product can ensure a level of profit for the longer period.

Equity SWAPS

Under equity swap one party pays a fixed rate of return, while it receives a return based on the stock market index of the preceding period. The stock market returns are variable. For example, consider a mutual fund owning a portfolio of stocks. It is concerned about providing some minimum returns to the members of the fund. In order to achieve this objective it can enter into a swap for the part value of the portfolio where it pays to swap dealer returns based on an index say Nifty (the index of National Stock Exchange) determined at specified periodicity as agreed in the swap, while receiving a fixed rate of return, say 10%. This is shown in Figure.

Mutual fund pays returns equal to % gains/losses on the index in exchange of receiving fixed 10% locking in 10% return.