KARNATAKA STATE OPEN UNIVERSITY
Mukthagangotri, Mysuru-570 006

MBA
(FOURTH SEMESTER)

ELECTIVE : A-FINANCE

DERIVATIVES

Department of Studies and Research in Management

Course : 24 A

Module : 1 to 5

KARNATAKA STATE OPEN UNIVERSITY

MUKTHAGANGOTHRI, MYSURU- 570 006.

DEPARTMENT OF STUDIES AND RESEARCH IN MANAGEMENT

M.B.A IV Semester

ELECTIVE: A-FINANCE

COURSE - 24 A

DERIVATIVES

Course Design and Editorial Committee

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Karanataka State Open University
Mukthagangothri, Mysuru - 570006

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Mukthagangothri, Mysuru - 570006

Editor

Dr. C. Mahadevamurthy
Chairman
Department of Management
Karanataka State Open University
Mukthagangothri, Mysuru - 570006

Co- Editor & Subject Co-ordinator

Dr. C. Mahadevamurthy
Chairman
Department of Management
Karanataka State Open University
Mukthagangothri, Mysuru - 570006

Course Writers

Dr. C. Mahadevamurthy — **Module - 1** **(Units 1 to 4)**
Chairman
Dept. of Management
Karanataka State Open University
Mukthagangothri, Mysuru

Prof. Kotreshwar — **Module - 2** **(Units 5 to 8)**
Professor
University of Mysore
Mysuru

Prof. Mallikarjunappa — **Module - 3** **(Units 9 to 12)**
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Dept.
mysor

Prof. Kotreshwar — **Module - 4** **(Units 13 to 16)**
Professor
University of Mysore
Mysuru.

Prof. Kotreshwar — **Module - 5** **(Units 17 to 20)**
Professor
University of Mysore
Mysuru.

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Dear Learner,

It gives me immense pleasure to welcome you to the Department of management to study MBA Second Year (Fourth Semester) in our esteemed university.

I am Extremely happy in placing this study material in your hand. The Department of Studies and Research in Management, Karnataka State Open University is providing you Self Learning Materials (SLM) for all the courses developed by the team of experts drawn from various conventional universities, Open Universities, B-Schools Management institutions and professionals.

This study material explains even the most complicated topics in a very simple and user-friendly manner, it starts with the Objectives, explanation of concepts followed by Case study, Notes, Summary, Key Words, Self Assessment Questions and References. It provides more value added information on contemporary issues.

Department has focussed on conceptual learning and on avoiding bulky and prolonged description. Every concept has been explained in the simplest manner. Some complicated concepts have been simplified in the study material, so that the learner can learn easily.

The Department of Management, Karnataka State Open University is offering three electives or specialization. You have already chosen the stream in which you wish to specialize i.e. Finance, Marketing and People Management. Hope you will gain expertise in you field.

The specialization in an MBA is due to business complexities and diversities. The MBA is over 100 years old now. Leading management institutes are trying to come up with new and innovative ways to educate the next generations of business leaders. In an MBA, an elective facilitates learners to plank extra focus on one particular area of interest and tailor their MBA in a different way depending on their background and future goals.

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b) Marketing – Marketing has become one of the most desired specialization both by students and employees in recent years. With the shift to digital and online marketing, most businesses now have their own, in-house marketing teams specialized in bringing customers to the company. Prospective students aspiring to demonstrate that they have the potential to become an excellent marketing manager require a broad skill set. Individuals with soft skills, such as communications, tend to grow well in marketing field. Other desired skills for marketing typically include analytical and leadership skills. The department has carefully chosen the papers to impart the above skills in you.

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In addition to the study material provided to you, I advise you to go through the books which are suggested in the reference of every unit. Further, I also suggest you to make yourself acquainted by reading newspapers and journals.

Apparently, the curriculum designed by the board of studies helps you to prepare for UGC NET, various state commission examinations and UPSC examinations. With these words I welcome you for the wonderful learning experience of business education.

I wish all the best and good luck in your education and successful management career.

Dr. C. Mahadevamurthy
Chairman
Department of Management
Karnataka State Open University
Mukthagangothri, Mysore 570006

INTRODUCTION

The last two and half decades have witnessed many fold increase in the volume of international trade and business due to the wave of globalization and liberalization sweeping across the world . This has led to rapid development in Industrialized countries apart from money market and capital market securities, a verity of other securities known as 'derivatives' have now became available for investment and trading. It is widely believed in financial world that the most significant milestone in financial innovation is achieved with the issuance and trading of derivatives. The derivatives markets have become and intergral part of modern financial system. India is one of the top producers of a large number of commodities ranging from agricultural to non – agricultural products, with long history in its trading market.

Derivatives provide and effective solution to the problem of risk caused by uncertainty and volatitaty in underlying asset. Derivatives are risk management tools that helps an organization to effectively transfer risk.

As a result derivatives are instruments which have no independent value, their value depends upon the underlying assets

Course -24A : Derivatives exhibits to fulfilling the needs of the learns to understand the overall views and concepts of derivatives, the subject grouped into 5 modules and it further divided into 20 units for better understanding.

Module 1: Introduction to derivatives consists of four units (1-4). First unit consists introduction, meaning, definition history and need of derivatives, features, type's, uses of financial derivatives. Unit 2 deals with introduction, evaluation, functions, benefits of derivatives and derivatives market in India. Unit 3 regulating authorities and derivatives exchanges in India explaining. Regulation of derivatives trading in India, objectives of derivatives market, derivatives exchange in India, categories of derivatives trading and regulatory authorities in India, OTC and ETD market in India. Unit 4 participants in derivatives markets exhibits derivatives market participants, risk faced by participants in future market, future market trading management and the facilitators of future trading.

Module 2: Forwards and futures comprises of four units (5-8) Fifth unit examines, introduction, features of forwards and introduction , features and socio-economic benefits of futures, futures v/s forwards and types of futures. Unit 6 tells about Trading in forwards and futures, Introduction, clearing house open, open interest, margin requirements, M2M, pricing of futures and forwards and continuous compounding. Unit 7 depicts hedging principles, short, long and cross hedge basis risk and the hedge ratio. Unit 8 explains stock index futures, major indices traded in the Indian capital market, contract specifications, pricing of index futures and portfolio hedging.

Module 3: Forwards and futures depicts four units(9-12) Ninth unit shows Introduction to option, options classification, positions and price, quotations, Intrinsic and Time value, option bounds meaning lower and upper bound of call prices. Unit 10 explains various concepts of American options. Unit 11 Informed that different aspects of put options bounds. Unit 12 tells about options combinations, options spreads strategies and, option combinations strategies.

Module 4: Valuation modules explain four units (13-16) unit 13 deals with factors affecting call prices and maximum and minimum option prices. Unit 14 explains option pricing put call pricing, assumptions and arbitrage opportunities. Unit15 deals with one step and two step binomial model and valuation of American options. Unit 16 shows Black Scholes option pricing model

Module -5: Other derivatives and risk management consists four units (17-20) 17 unit depicts different concepts of measures of risk. i.e., delta risk, Gamma risk, theta risk, Vega risk, and RHO risk. Unit 18 shows Euro dollar derivatives (Futures). Unit 19 explains accounting issues in derivatives and lastly Unit 20 depicts Energy derivatives, cat strophe bounds derivatives and carbon credit derivatives

Dr. C. Mahadevamurthy
Chairman
Department of Management
Karnataka State Open University
Mukthagangothri, Mysore 570006

MODULE –I
INTRODUCTION TO DERIVATIVES

UNIT- 1: DERIVATIVES: AN OVERVIEW

Structure :

1.1 Objectives

1.1 Introduction

1.2 Meaning and Definitions Of Derivatives

1.3 History of Derivatives

1.4 Need for Derivatives

1.5 Features of Financial Derivatives

1.6 Underlying Asset in A Derivatives Contract

1.7 Types of Financial Derivatives

1.8 Uses of Financial Derivatives

1.9 Summary

1.10 Self Assessment Questions

1.11 Case Study

1.12 Notes

1.13 References

1.0 OBJECTIVES

After studying this unit, you should be able to;

- Define the terms Financial Derivatives.
- Highlight the features of Derivatives.
- Give an account of types of Financial Derivatives.
- Describe the uses of Derivatives.

1.1 INTRODUCTION

A Derivatives trading has become an important economic activity all over the world. The derivatives originate in mathematics and refer to a variable which has been derived from another variable. A derivative is a financial product which has been derived from another financial product or commodity. The derivatives do not have independent existence without underlying product and market. Derivatives are contracts which are written between two parties for a easily marketable assets. Derivatives are also known as deferred delivery or deferred payment instruments. A derivative is a complicated financial contract that gets (derives) its value from an underlying asset. The buyer and seller agree on how much the asset price will change over a specific period. The underlying asset can be a commodity, such as oil, gasoline or gold. Many derivatives are based on stocks or bonds. Others use currencies, especially the U.S. dollar, as their underlying asset. Still others use interest rates, such as the yield on the 10-year Treasury note, as their base. These assets can be, but do not have to be, owned by either party to the agreement. This makes derivatives much easier to trade than the asset itself. Most derivatives require that the agreement is fulfilled. That's accomplished by either by an exchange of the asset, a cash payment, or another agreement that offsets the value of the first.

Today, the financial derivatives have become increasingly popular and most commonly used in the world of finance. This has grown with so phenomenal speed all over the world that now it is called as the derivatives revolution.

Financial derivatives like futures, forwards, options and swaps are important tools to manage assets, portfolios and financial risks. Thus, it is essential to know the terminology and conceptual framework of all these financial derivatives in order to analyze and manage the financial risks. The prices of these financial derivatives contracts depend upon the spot prices of the underlying assets, costs of carrying assets into the future and relationship with spot prices. For example, forward and futures contracts are similar in nature, but their prices in future may differ. Therefore, before using any financial derivative instruments for hedging, speculating, or arbitraging purpose, the trader or investor must carefully examine all the important aspects relating to them.

1.2 MEANING AND DEFINITIONS OF DERIVATIVES

Let us start by understanding what derivatives really are. In order to understand the nature of derivatives, we need to start from marketing of products or assets. In a market, certain types of assets are exchanged for money between buyers and sellers. For eg: in the stock market, shares of different corporates are being bought and sold. In the commodities market, different types of commodities are traded such as gold, cotton, rubber etc. in the foreign exchange market foreign currencies such as US Dollar, Euro, Yen etc. are traded. In other words, Derivatives are derived values. A Derivative is a financial instrument or contract whose value is delivered from some other asset or economic variable which is called an underlying assets. In normal trading an asset is acquired or sold. When we deal with derivatives the asset itself is not traded, but the right to buy or sell the asset is traded.

Definitions

According to Webster Dictionary, Derivatives is "A substance that can be derived from another substance."

John C. Hull defined the derivatives as "A financial instrument whose value depends on (or derived from) the value of other, more basic underlying variables."

D.G. Gardener defined the derivatives as "A derivative is a financial product which has been derived from market for another product."

The securities contracts (Regulation) Act 1956 defines "derivative" as under section 2(ac).As per this "Derivative" includes

(a) "A security derived from a debt instrument, share, loan whether secured or unsecured, risk instrument or contract for differences or any other form of security."

(b) "A contract which derived its value from the price, or index of prices at underlying securities."

The above definition conveys that the derivatives are financial products. Derivative is derived from another financial instrument/contract called the underlying. A derivative derives its value from underlying assets.

Points to Note that:

a. Derivatives may be commodity or financial derivatives.

b. Financial derivatives are financial instruments (or contracts).

c. The value of the derivative depends on the value of the original asset.

d. The original asset (security or commodity or economic variable) from which the value of derivative instrument is derived is knows as Underlying Asset.

e. Derivatives are securities under the Securities Contracts (Regulation) Act and hence trading the derivatives is governed by the regulatory framework under this Act.

1.3 HISTORY OF DERIVATIVES

The history of derivatives is surprisingly longer than what most people think. Some texts even find the existence of the characteristics of derivative contracts in incidents of Mahabharata. Traces of derivative contracts can even be found in incidents that date back to the ages before Jesus Christ. However, the advent of modern day derivative contracts is attributed to the need for farmers to protect themselves from any decline in the price of their crops due to delayed monsoon, or over production. The first 'futures' contracts can be traced to the Yodoya rice market in Osaka, Japan around1650. These were evidently standardized contracts, which made them much like today's futures. The Chicago Board of Trade (CBOT), the largest derivative exchange in the world, was established in 1848 where forward contracts on various commodities were standardized around 1865. From then on, futures contracts have remained more or less in the same form, as we know them today. Derivatives have had a long presence in India. The commodity derivative market has been functioning in India since the nineteenth century with organized trading in cotton through the establishment of Cotton Trade Association in 1875. Since then contracts on various other commodities have been introduced as well. Exchange traded financial derivatives were introduced in India in June 2000 at the two major stock exchanges, NSE and BSE. There are various contracts currently traded on these exchanges. The National Stock Exchange of India Limited (NSE) commenced trading in derivatives with the launch of index futures on June 12, 2000. The futures contracts are based on the popular benchmark S&P CNX Nifty Index. The Exchange introduced trading in Index Options (also based on Nifty) on June 4, 2001. NSE also became the first exchange to launch trading in options on individual securities from July 2, 2001. Futures on individual securities were introduced on November 9, 2001.

Futures and Options on individual securities are available on 227 securities stipulated by SEBI. The Exchange provides trading in other indices i.e. CNX-IT, BANK NIFTY, CNX NIFTYJUNIOR, CNX 100 and NIFTY MIDCAP 50 indices. The Exchange is now introducing mini derivative (futures and options) contracts on S&P CNX Nifty index. National Commodity & Derivatives Exchange Limited (NCDEX) started its operations in December 2003, to provide a platform for commodities trading. The derivatives market in India has grown exponentially, especially at NSE. Stock Futures are the most highly traded contracts. The size of the derivatives market has become important in the last 15 years or so. In 2007the total world derivatives market expanded to $516 trillion. With the opening of the economy to multinationals and the adoption of the liberalized economic policies, the economy is driven more towards the free market economy. The complex nature of financial structuring itself involves the utilization of multi-currency transactions. It exposes the clients, particularly corporate clients to various risks such as exchange rate risk, interest rate risk, economic risk and political risk.With the integration of the financial markets and free mobility of capital, risks alsomultiplied. For instance, when countries adopt floating exchange rates, they have to face risks due to fluctuations in the exchange rates. Deregulation of interest rate cause interest risks. Again, securitization has brought with it the risk of default or counter party risk. Apart from it, every asset, whether commodity or metal or share or currency - is subject to depreciation in its value. It may be due to certain inherent factors and external factors like the market condition, Government's policy, economic and political condition prevailing in the country and so on. In the present state of the economy, there is an imperative need of the corporate clients to protect their operating profits by shifting some of the uncontrollable financial risks to those who are able to bear and manage them. Thus, risk management becomes a must for survival since there is a high volatility in the present financial markets.

In this context, derivatives occupy an important place as risk reducing machinery. Derivatives are useful to reduce many of the risks discussed above. In fact, the financial service companies can play a very dynamic role in dealing with such risks. They can ensure that the above risks are hedged by using derivatives like forwards, future, options, swaps etc. Derivatives, thus, enable the clients to transfer their financial risks to the financial service companies. This really protects the clients from unforeseen risks and helps them to get there due operating profits or to keep the project well within the budget costs. To hedge the various risks that on faces in the financial market today, derivatives are absolutely essential

1.4 NEED FOR DERIVATIVES

Since 1991, due to liberalization of economic policy, the Indian economy has entered an era in which Indian companies cannot ignore global markets. Before the nineties, prices of many commodities, metals and other assets were controlled. Others, which were not controlled, were largely based on regulated prices of inputs. As such there was limited uncertainty, and hence, limited volatility of prices. But after 1991, starting the process of deregulation, prices of most commodities is decontrolled. It has also resulted in partly deregulating the exchange rates, removing the trade controls, reducing the interest rates, making major changes for the capital market entry of foreign institutional investors, introducing market based pricing of government securities, etc. All these measures have increased the volatility of prices of various goods and services in India to producers and consumers alike. Further, market determined exchange rates and interest rates also created volatility and instability in portfolio values and securities prices. Hence, hedging activities through various derivatives emerged to different risks.Futures' trading offers a risk-reduction mechanism to the farmers, producers, exporters, importers, investors, bankers, trader, etc. which are essential for any country.

In the words of Alan Greenspan, Chairman of the US Federal Reserve Board, "The array of derivative products that has been developed in recent years has enhanced economic efficiency. The economic function of these contracts is to allow risks that formerly had been combined to be unbundled and transferred to those most willing to assume and manage each risk components." Development of futures markets in many countries has contributed significantly in terms of invisible earnings in the balance of payments, through the fees and other charges paid by the foreigners for using the markets. Further, economic progress of any country, today, much depends upon the service sector as on agriculture or industry.

Services are now backbone of the economy of the future. India has already crossed the roads of revolution in industry and agriculture sector and has allowed the same now in services like financial futures. India has all the infrastructure facilities and potential exists for the whole spectrum of financial futures trading in various financial derivatives like stock market indices, treasury bills, gilt-edged securities, foreign currencies, cost of living index, stock market index, etc. For all these reasons, there is a major potential for the growth of financial derivatives markets in India.

1.5 FEATURES OF FINANCIAL DERIVATIVES

1. **It is a contract:**

Derivative is defined as 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. **Derives value from underlying asset:**

Normally, the derivative instruments have the value which is 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. **Specified obligation:**

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. **Direct or Exchange Traded:**

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 Jons, 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. **Related to Notional Amount:**

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 payoff. 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. **Delivery of underlying asset not involved:**

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.**May be used as deferred delivery:**

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. **Secondary Market Instruments:**

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. Exposure to risk: 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-thecounter (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.

9. **Off Balance Sheet Item:**

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.

1.6 UNDERLYING ASSET IN A DERIVATIVES CONTRACT

As defined above, 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. In other way the underlying asset may assume many forms:

(i) Commodities including grain, coffee beans, orange juice;

(ii) Precious metals like gold & silver;

(iii) Foreign exchange rates or currencies;

(iv) Bonds of different types, including medium to long term negotiable debt, securities issued by governments, companies etc;

(v) Shares and share warrants of companies traded on recognized stock exchanges and stock index;

(vi) Short term securities such as T-bills; and

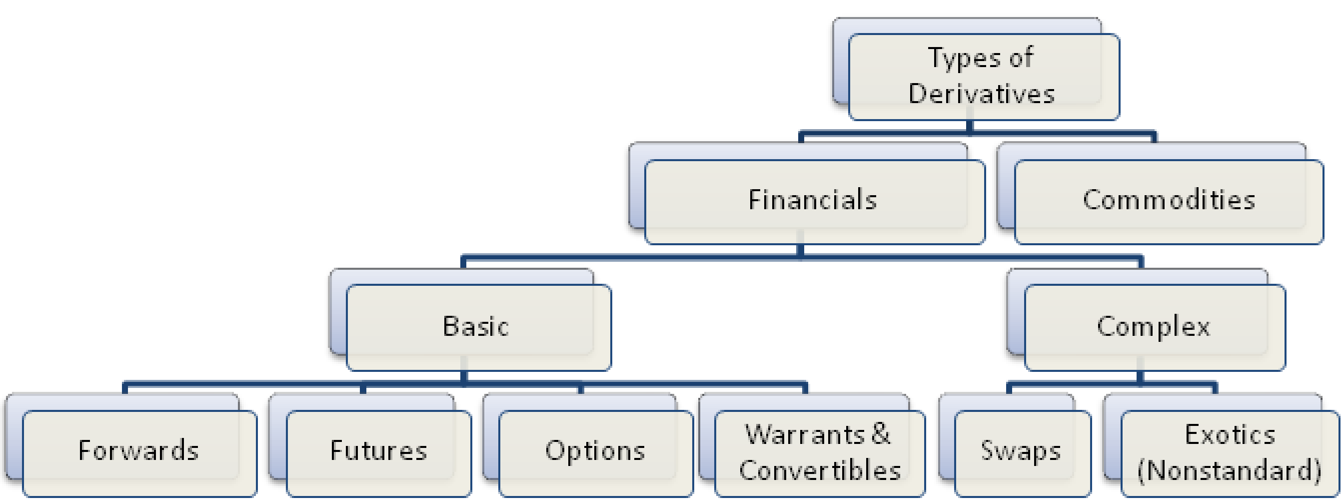
(vii) Over the counter (OTC) money market products such as loans or deposits.

1.7 TYPES OF FINANCIAL DERIVATIVES

The financial derivatives are those assets whose values are determined by the value of some other assets, called as the underlying. Presently, there are complex varieties of derivatives already in existence, and the markets are innovating newer and newer ones continuously. For example, various types of financial derivatives based on their different properties like, plain, simple or straightforward, composite, joint or hybrid, synthetic, leveraged, mildly leveraged, customized or OTC traded, standardized or organized exchange traded, etc. are available in the market.

Due to complexity in nature, it is very difficult to classify the financial derivatives, so in the present context, the basic financial derivatives which are popular in the market have been described in brief. In simple form, the derivatives can be classified into different categories which are shown in the below Fig. 1.1.

Types of Derivatives



One form of classification of derivative instruments is between commodity derivatives and financial derivatives. The basic difference between these is the nature of the underlying instrument or asset. In a commodity derivatives, the underlying instrument is a commodity which may be wheat, cotton, pepper, sugar, jute, turmeric, corn, soya beans, crude oil, natural gas, gold, silver, copper and so on. In a financial derivative, the underlying instrument may be treasury bills, stocks, bonds, foreign exchange, stock index, gilt-edged securities, cost of living index, etc. It is to be noted that financial derivative is fairly standard and there are no quality issues, whereas in commodity derivative, the quality may be the underlying matters. However, the distinction between these two from structure and functioning point of view, both are almost similar in nature.

Another way of classifying the financial derivatives is into basic and complex derivatives. In this, forward contracts, futures contracts and option contracts have been included in the basic derivatives whereas swaps and other complex derivatives are taken into complex category because they are built up from either forwards/futures or options contracts, or both. In fact, such derivatives are effectively derivatives of derivatives.

I Basic Financial Derivatives

1. 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.

Example

An Indian company buys Automobile parts from USA with payment of one milliondollar due in 90 days. The importer, thus, is short of dollar that is, it owes dollars for future delivery. Suppose present price of dollar is ¹ 68. Over the next 90 days, however, dollar might rise against ¹ 68. The importer can hedge this exchange risk by negotiating a 90 days forward contract with a bank at a price ¹ 70. According to forward contract in 90 days the bank will give importer one million dollar and importer will give the bank 50 million rupees hedging a future payment with forward contract. On the due date importer will make a payment of‘ 50 million to bank and the bank will pay one million dollar to importer, whatever rate of the dollar is after 90 days. So this is a typical example of forward contract on currency.

The basic features of a forward contract are given in brief here as under:

1. Forward contracts are bilateral contracts, and hence, they are exposed to counterparty risk. There is risk of non-performance of obligation either of the parties, so these are riskier than to futures contracts.

2. Each contract is custom designed, and hence, is unique in terms of contract size, expiration date, the asset type, quality, etc.

3. In forward contract, one of the parties takes a long position by agreeing to buy the asset at a certain specified future date. The other party assumes a short position by agreeing to sell the same asset at the same date for the same specified price. A party with no obligation offsetting the forward contract is said to have an open position. A party with a closed position is, sometimes, called a hedger.

4. The specified price in a forward contract is referred to as the delivery price. 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. It is important to differentiate between the forward price and the delivery price. Both are equal at the time the contract is entered into. However, as time passes, the forward price is likely to change whereas the delivery price remains the same.

5. In the forward contract, derivative assets can often be contracted from the combination of underlying assets, such assets are oftenly known as synthetic assets in the forward market.

6. In the forward market, the contract has to be settled by delivery of the asset onexpiration date. In case the party wishes to reverse the contract, it has to compulsory go to the same counter party, which may dominate and command the price it wants as being in a monopoly situation.

7. In the forward contract, covered parity or cost-of-carry relations are relation between the prices of forward and underlying assets. Such relations further assist in determining the arbitrage-based forward asset prices.

8. Forward contracts are very popular in foreign exchange market as well as interest rate bearing instruments. Most of the large and international banks quote the forward rate through their 'forward desk' lying within their foreign exchange trading room. Forward foreign exchange quotes by these banks are displayed with the spot rates.

9. As per the Indian Forward Contract Act- 1952, different kinds of forward contracts can be done like hedge contracts, transferable specific delivery (TSD) contracts

and non-transferable specify delivery (NTSD) contracts. Hedge contracts are freely transferable and do not specific, any particular lot, consignment or variety for delivery. Transferable specific delivery contracts are though freely transferable from one party to another, but are concerned with a specific and predetermined consignment. Delivery is mandatory. Non-transferable specific delivery contracts, as the name indicates, are not transferable at all, and as such, they are highly specific.

In brief, a forward contract is an agreement between the counter parties to buy or sell a specified quantity of an asset at a specified price, with delivery at a specified time (future) and place. These contracts are not standardized; each one is usually being customized to its owner's specifications.

2. *Future 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.

Example

A silver manufacturer is concerned about the price of silver, since he will not be able to plan for profitability. Given the current level of production, he expects to have about 20,000 ounces of silver ready in next two months. The current price of silver on May 10 is ₹ 1052.5 per ounce, and July futures price at FMC is ₹ 1068 per ounce, which he believes to be satisfied price. But he fears that prices in future may go down. So he will enter into a futures contract. He will sell four contracts at MCX where each contract is of 5000 ounces at ₹ 1068 for delivery in July.

Perfect Hedging Using Futures

Date	Spot Market	Futures Market
May 10	Anticipate the sale of 20,000 ounce in two months and expect to receive ₹ 1068 per ounce or a total ₹ 21.36,00.00	Sell four contracts, 5000 ounce each July futures contracts at ₹1068 per ounce.
July 5	The spot price of silver is ₹ 1071 per ounce; Miner sells 20,000 ounces and receives ₹21.42,0000.	Buy four contracts at ₹1071. Total cost of 20,000 ounce will be ₹ 21,42,0000.
Profit / Loss	Profit = ₹60,000	Future Loss= ₹60,000

The following are the features of futures contracts.

1. Standardization

One of the most important features of futures contract is that the contract has certain standardized specification, i.e., quantity of the asset, quality of the asset, the date and month of delivery, the units of price quotation, location of settlement, etc. For example, the largest exchanges on which futures contracts are traded are the Chicago Board of Trade (CBOT) and the Chicago Mercantile Exchange (CME). They specify about each term of the futures contract.

2. Clearing House

In the futures contract, the exchange clearing house is an adjunct of the exchange and acts as an intermediary or middleman in futures. It gives the guarantee for the performance of the parties to each transaction. The clearing house has a number of members all of which have offices near to the clearing house. Thus, the clearing house is the counter party to every contract.

3. Settlement Price

Since the futures contracts are performed through a particular exchange, so at the close of the day of trading, each contract is marked-to-market. For this the exchange establishes a settlement price. This settlement price is used to compute the profit or loss on each contract for that day. Accordingly, the member's accounts are credited or debited.

4. Daily Settlement and Margin

Another feature of a futures contract is that when a person enters into a contract, he is required to deposit funds with the broker, which is called as margin. The exchange usually sets the minimum margin required for different assets, but the broker can set higher margin limits for his clients which depend upon the credit-worthiness of the clients. The basic objective of the margin account is to act as collateral security in order to minimize the risk of failure by either party in the futures contract.

5. Tick Size

The futures prices are expressed in currency units, with a minimum price movement called a tick size. This means that the futures prices must be rounded to the nearest tick. The difference between a futures price and the cash price of that asset is known as the basis.

6. Cash Settlement

Most of the futures contracts are settled in cash by having the short or long to make cash payment on the difference between the futures price at which the contract was entered or impossible to deliver sometimes, the underlying asset. This type of settlement is very much popular in stock indices futures contracts.

7. Delivery

The futures contracts are executed on the expiry date. The counter parties with a short position are obligated to make delivery to the exchange, whereas the exchange is obligated to make delivery to the longs. The period during which the delivery will be made is set by the exchange which varies from contract to contract.

8. Regulation

The important difference between futures and forward markets is that the futures contracts are regulated through a exchange, but the forward contracts are self-regulated by the counter-parties themselves. The various countries have established Commissions in their country to regulate futures markets both in stocks and commodities. Any such new futures contracts and changes to existing contracts must by approved by their respective Commission.

3. 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.

Options can be divided into two types: calls and puts. A call option gives the holder the right to buy an asset at a specified date for a specified price, whereas in put option, the holder gets the right to sell an asset at the specified price and time. The specified price in such contract is known as the exercise price or the strike price and the date in the contract is known as the expiration date or the exercise date or the maturity date.

The asset or security instrument or commodity covered under the contract is called as the underlying asset. They include shares, stocks, stock indices, foreign currencies, bonds, commodities, futures contracts, etc. Further options can be American option or European option.A European option can be exercised on the expiration date only, whereas an American option can be exercised at any time before the maturity date.

Example

Suppose the current price of CIPLA share is ¹ 750 per share. X owns 1000 shares of CIPLA Ltd. and apprehends in the decline in price of share. The option (put) contract available at BSE is of ¹ 800, in next two-month delivery. Premium cost is ¹ 10 per share.X will buy a put option at 10 per share at a strike price of ¹ 800. In this way X has hedged his risk of price fall of stock. X will exercise the put option if the price of stock goes down below ¹ 790 and will not exercise the option if price is more than ¹ 800, on the exercise date.In case of options, buyer has a limited loss and unlimited profit potential unlike in case of forward and futures.

It should be emphasized that the option contract gives the holder the right to do something. The holder may exercise his option or may not. The holder can make a reassessment of the situation and seek either the execution of the contracts or its non-execution as be profitable to him. He is not under obligation to exercise the option. So, this fact distinguishes options from forward contracts and futures contracts, where the holder is under obligation to buy or sell the underlying asset. Recently in India, the banks are allowed to write cross-currency options after obtaining the permission from the Reserve Bank of India.

4. 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 donecautiously.

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 the 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.

II Complex

Swaps and other complex derivatives are taken into complex category because they are built up from either forwards / futures or options contracts, or both.

1. 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.

There are two most popular forms of swap contracts, i.e., interest rate swaps and currency swaps. In the interest rate swap one party agrees to pay the other party interest at a fixed rate on a notional principal amount, and in return, it receives interest at a floating rate on the same principal notional amount for a specified period. The currencies of the two sets of cash flows are the same. In case of currency swap, it involves in exchanging of interest flows, in one currency for interest flows in other currency. In other words, it requires the exchange of cash flows in two currencies. There are various forms of swaps based upon these two, but having different features in general.

2. Exotics 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.

In fact, there is no boundary for designing the non-standard financial derivatives, and hence, they are sometimes termed as 'exotic options' or just 'exotics'. There are various examples of such non-standard derivatives such as packages, forward start option, compound options, choose options, barrier options, binary options, look back options, shout options, Asian options, basket options, Standard Oil's Bond Issue, Index Currency Option Notes (ICON), range forward contracts or flexible forwards and so on.

1.8 USES OF FINANCIAL DERIVATIVES

Derivatives are supposed to provide some services and these services are used by investors. Some of the uses and applications of financial derivatives can be enumerated as following:

1. Management of risk:

One of the most important services provided by the derivatives is to control, avoid, shift and manage efficiently different types of risk through various strategies like hedging, arbitraging, spreading etc. Derivative assist the holders to shift or modify suitable the risk characteristics of the portfolios. These are specifically useful in highly volatile financial conditions like erratic trading, highly flexible interest rates, volatile exchange rates and monetary chaos.

2. Measurement of Market:

Derivatives serve as the barometers of the future trends in price which result in the discovery of new prices both on the spot and future markets. They help in disseminating different information regarding the future markets trading of various commodities and securities to the society which enable to discover or form suitable or correct or true equilibrium price in the markets.

3. Efficiency in trading:

Financial derivatives allow for free trading of risk components and that leads to improving market efficiency. Traders can use a position in one or more financial derivatives as a substitute for a position in underlying instruments. In many instances, traders find financial derivatives to be a more attractive instrument than the underlying security. This is mainly because of the greater amount of liquidity in the market offered by derivatives as well as the lower transaction costs associated with trading a financial derivative as compared to the costs of trading the underlying instruments in cash market.

4. Speculation and arbitrage:

Derivatives can be used to acquire risk, rather than to hedge against risk. Thus, some individuals and institutions will enter into a derivative contract to speculate on the value of the underlying asset, betting that the party seeking insurance will be wrong about the future value of the underlying asset. Speculators look to buy an asset in the future at a low price according to a derivative contract when the future market price is high, or to sell an asset in the future at a high price according to derivative contract when the future market price is low. Individual and institutions may also look for arbitrage opportunities, as when the current buying price of an asset falls below the price specified in a futures contract to sell the asset.

5. Price discovery:

The important application of financial derivatives is the price discovery which means revealing information about future cash market prices through the future market. Derivative markets provide a mechanism by which diverse and scattered opinions of future are collected into one readily discernible number which provides a consensus of knowledgeable thinking.

6. Hedging:

Hedge or mitigate risk in the underlying, by entering into a derivative contract whose value moves in the opposite direction to their underlying position and cancels part or all of it out. Hedging also occurs when an individual or institution buys an asset and sells it using a future contract. They have access to the asset for a specified amount of time, and can then sell it in the future at a specified price according to the futures contract of course, this allows them the benefit of holding the asset.

7. Price stabilization function:

Derivative market helps to keep a stabilizing influences on spot prices by reducing the short term fluctuations. In other words, derivatives reduces both peak and depths and lends to price stabilization effect in the cash market for underlying asset.

8. Gearing of value:

Special care and attention about financial derivatives provide leverage (or gearing), such that a small movement in the underlying value can cause a large difference in the value of the derivative.

9. Develop the complete markets :

It is observed that derivative trading develop the market towards "complete markets" complete market concept refers to that situation where no particular investors be better of than others, or patterns of returns of all additional securities are spanned by the already existing securities in it, or there is no further scope of additional security.

10. Encourage competition :

The derivatives trading encourage the competitive trading in the market, different risk taking preference at market operators like speculators, hedgers, traders, arbitrageurs etc. resulting in increase in trading volume in the country. They also attract young investors, professionals and other experts who will act as catalysts to the growth of financial market.

11. Liquidity and reduce transaction cost :

As we see that in derivatives trading no immediate full amount of the transaction is required since most of them are based on margin trading. As a result, large number of traders, speculators, arbitrageurs operates in such markets. So, derivatives trading enhance liquidity and reduce transaction cost in the markets of underlying assets.

12. Other uses :

The other uses of derivatives are observed from the derivatives trading in the market that the derivatives have smoothen out price fluctuations, squeeze the price spread, integrate price structure at different points of time and remove gluts and shortage in the markets. The derivatives also assist the investors, traders and managers of large pools of funds to device such strategies so that they may make proper asset allocation increase their yields and achieve other investment goals.

1.9 SUMMARY

This unit discussed about the features of derivatives, definition of derivatives, underlying asset in a derivatives contract are discussed in length. An account of types of derivatives and uses of derivatives is also given in this unit. Derivatives are risk management that help in effective management of risk by various stakeholders. Derivatives provide an opportunity to transfer risk, from the one who wish to avoid it, to one, who wishes to accept it.

1.10 SELF ASSESSMENT QUESTIONS

1. Define Financial Derivatives?

2. Describe the features of Financial Derivatives.

3. Briefly explain the types of Derivatives.

4. Mention the different uses of Financial Derivatives.

1.11 CASE STUDY

1. A farmer in Karnataka expects to harvest 25000 bushels of Rice in late July. On 10th June, the price of wheat is ¹ 170 per bushel. The farmer is worried as he suspects that price will fall below ¹ 160 before his July delivery date he can hedge is position by selling July Rice futures. The July Rice future price is ¹ 167 per bushel. The former sold the July Rice futures. When July end approached, the price had fallen to ¹ 160 per bushel.

Calculate

(a) What is the gain of the future contract?

(b) What is the revenue from the sale of Rice?

(c) What is the cash flow per bushel of Rice?

2. If more Tax concessions are offered to real investors that share market will move forward. Do you agree? Give reasons.

1.12 NOTES

1.13 REFERENCES

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UNIT -2 : FINANCIAL DERIVATIVES IN INDIA

Structure :

2.0 OBJECTIVES

After studying this unit, you should be able to;

- Understand the Evolution of Derivatives in India
- Know about the Evolution of Derivatives Market in India
- Be aware about the Functions of Derivatives Market
- Understand the Recommendation of L.C.Gupta Committee

2.1 INTRODUCTION

The individuals and the corporate sector units are freely using derivatives, also popularly known as future market instruments, in most of the developed countries of the world to manage different risks by the individuals and the corporate sector units, emerged in 1970s, the derivatives markets have seen exponential growth and trading volumes have nearly doubled in every three years, making it a multi- trillion dollar business market. The future markets in various segments have developed so much that now one cannot think of the existence of financial markets without the derivatives instruments. In other words, the derivatives markets whether belonging to commodities or financials have become, today, an integral part of the financial system of a country.

The Indian financial markets indeed waited for too long for derivatives trading to emerge. The phase of waiting is over. The statutory hurdles have been cleared. Regulatory issues have been sorted out. Stock exchanges are gearing up for derivatives. Mutual funds, foreign institutional investors, financial institutions, banks, insurance companies, investment companies, pension funds and other investors who are deprived of hedging opportunities now find the derivatives market to bank on. They would find very soon all other important derivatives instruments in the Indian financial markets to manage their portfolios and associated risks.

2.2 EVOLUTION OF DERIVATIVES IN INDIA

The origin of derivatives can be traced back to the need of farmers to protect themselves against fluctuations in the price of their crop. From the time it was sown to the time it was ready for harvest, farmers would face price uncertainty. Through the use of simple derivative products, it was possible for the farmer to partially or fully transfer price risks by locking-in asset prices. These were simple contracts developed to meet the needs of farmers and were basically a means of reducing risk.

2.3 EVOLUTION OF DERIVATIVES MARKET IN INDIA

Derivative markets in India were originated in the last part of 19^{th} century. In the area of commodities, the Bombay Cotton Trade Association started future trading way back in 1875. This was the first organized futures market. Then Bombay Cotton Exchange Ltd. in 1893, Gujarat Vyapari Mandall in 1900, Calcutta Hesstan Exchange Ltd. in 1919 had started future market. After the country attained independence, derivative market came through a full circle from prohibition of all sorts of derivative trades to their recent reintroduction. Commodities futures' trading in India was initiated long back in 1950s; however, the1960s 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 first steps towards introduction of Financial Derivatives trading in India, was the promulgation at the securities laws (Amendment) Ordinance 1995. It provides for withdrawal at prohibition on options in Securities.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 rupeebased 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 the Dr. L.C. Gupta Committee 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 was 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.The more detail about evolution of derivatives are shown in table No.1 with the help of the chronology of the events.

A Chronology of Events: Financial Derivatives of India

Sl. No.	Progress Date	Progress of Financial Derivatives
1.	1952.	Enactment of the forward contracts (Regulation) Act
2.	1953	Setting up of the forward market commission.
3.	1956	Enactment of Securities Contract Regulation Act 1956
4.	1969	Prohibition of all forms of forward trading under section 16 of SCRA
5.	1972	Informal carry forward trades between two settlement cycles began on BSE
6.	1980	Khuso Committee recommends reintroduction of futures in most commodities
7.	1983	Govt. amends bye-laws of exchange of Bombay, Calcutta and Ahmedabad and introduced carry forward trading in specified shares
8.	1992	Enactment of the SEBI Act
9.	1993	SEBI Prohibits carry forward transactions
10.	1994	Kabra Committee recommends futures trading in 9 commodities
11.	1995	G.S. Patel Committee recommends revised carry forward system
12.	14th Dec. 1995	NSE asked SEBI for permission to trade index futures
13.	1996	Revised system restarted on BSE
14.	18th Nov. 1996	SEBI setup LC Gupta committee to draft frame work for index futures
15.	11th May 1998	LC Gupta committee submitted report
16.	1st June 1999	Interest rate swaps/forward rate agreements allowed at BSE
17.	7th July 1999	RBI gave permission to OTC for interest rate swaps/forward rate agreements
18.	24th May 2000	SIMEX chose Nifty for trading futures and options on an Indian index
19.	25th May 2000	SEBI gave permission to NSE & BSE to do index futures trading
20.	9th June 2000	Equity derivatives introduced at BSE
21.	12th June 2000	Commencement of derivatives trading (index futures) at NSE
22.	31st Aug. 2000	Commencement of trading futures & options on Nifty at SIMEX
23.	1st June 2001	Index option launched at BSE
24.	June 2001	Trading on equity index options at NSE
25.	July 2001	Trading at stock options at NSE

26.	9th July 2001	Stock options launched at BSE
27.	July 2001	Commencement of trading in options on individual securities
28.	1st Nov. 2001	Stock futures launched at BSE
29.	Nov. 2001	Commencement of trading in futures on individual security
30.	9th Nov. 2001	Trading of Single stock futures at BSE
31.	June 2003	Trading of Interest rate futures at NSE
32.	Aug. 2003	Launch of futures & options in CNX IT index
33.	13th Sep. 2004	Weekly options of BSE
34.	June 2005	Launch of futures & options in Bank Nifty index
35.	Dec. 2006	'Derivative Exchange of the Year by Asia risk magazine
36.	June 2007	NSE launches derivatives on Nifty Junior & CNX 100
37.	Oct. 2007 1st	NSE launches derivatives on Nifty Midcap - 50
38.	Jan. 2008	Trading of Chhota (Mini) Sensex at BSE
39.	1st Jan. 2008	Trading of mini index futures & options at NSE
40.	3rd March 2009	Long term options contracts on S&P CNX Nifty index
41.	NA	Futures & options on sectoral indices (BSE TECK, BSE FMCG, BSE Metal, BSE Bankex & BSE oil & gas)
42.	29th Aug. 2008	Trading of currency futures at NSE
43.	Aug. 2008	Launch of interest rate futures
44.	1st Oct. 2008	Currency derivative introduced at BSE
45.	10th Dec. 2008	S&P CNX Defty futures & options at NSE
46.	Aug. 2009	Launch of interest rate futures at NSE
47.	7th Aug. 2009	BSE-USE form alliance to develop currency & interest rate derivative markets
48.	18th Dec. 2009	BSE's new derivatives rate to lower transaction costs for all
49.	Feb. 2010	Launch of currency future on additional currency pairs at NSE
50.	Apr. 2010	Financial derivatives exchange award of the year by Asian Banker to NSE
51.	July 2010	Commencement trading of S&P CNX Nifty futures on CME at NSE
52.	Oct. 2010	Introduction of European style stock option at NSE
53.	Oct. 2010	Introduction of Currency options on USD INR by NSE

54.	July 2011	Commencement of 91 day GOI trading Bill futures by NSE
55.	Aug. 2011	Launch of derivative on Global Indices at NSE
56.	Sep. 2011	Launch of derivative on CNX PSE & CNX infrastructure Indices at NSE
57.	30th March 2012	BSE launched trading in BRICSMART indices derivatives
58.	29th November 2013	BSE launched currency derivative segment
59.	28th January 2014	BSE launch of Interest Rate Futures

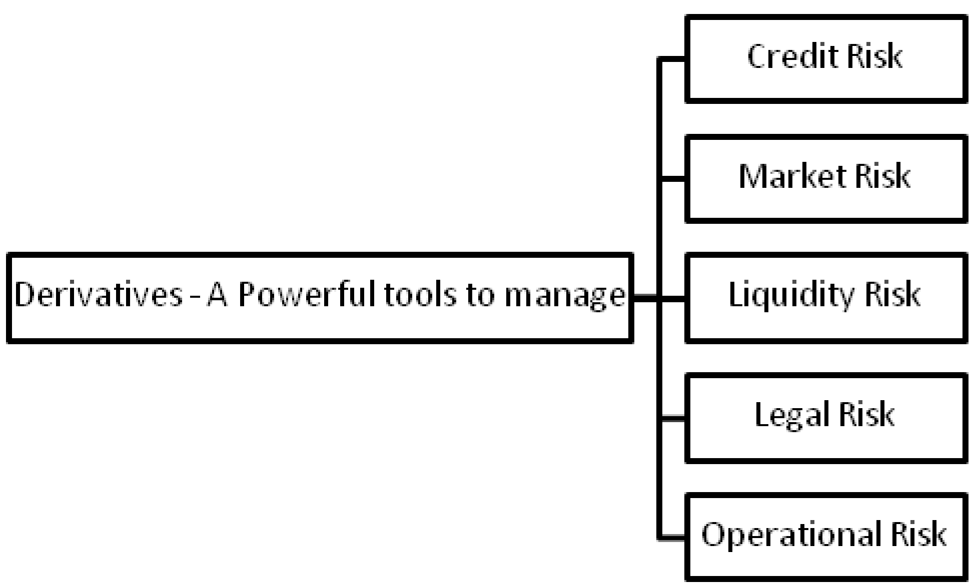
Source: Compiled from NSE and BSE website.

2.4 FUNCTIONS OF DERIVATIVES MARKET

With the increase in Internalization of economic activity, the derivative market performs a number of economic functions. Few important functions are as follows:

1. **Management of Risks:** This is the most important function of derivatives. Financial derivatives provide a powerful tool for limiting risks that individuals and organisations face in the ordinary conduct of their business. Different kinds of risks faced by participants are (a) credit risk; (b) market risk; (iii) liquid risk; (d) legal risk; and (e) operational risk. Thus,

Chart 2.1



Derivatives offer protection from possible adverse market movements and can be used to manage or offset exposures by hedging or shifting risks particularly during period of volatility thereby reducing costs.

2. Efficiency in Trading:

Derivatives bring efficiency in the market and make the market a full complete due to the following reasons:

a. Low transaction costs;

b. Minimization of risks;

c. Clear reflection of the market perception.

d. Protection to investors from financial risks;

e. Facilitating the trading activities under regulated form.

3. Price Discovery:

In an organized derivatives market price reflect the perception of market participants about the future. This leads the prices of underlying to the perceived future level. As a result, the prices of derivatives converge with the prices of the underlying at the expiration of derivative contract. Thus, derivatives help in discovery of future as well as current prices of underlyings.

4. Price Stabilization Function:

Derivatives provide a significant tool or mechanism through which all the investors or the participants can judge the movement of prices and protects themselves from financial risk. Indirectly derivatives stabilize the price movements through a participative controlled mechanism.

5. Catalyst for New Entrepreneurial Activity:

Derivatives offer new business and employment opportunities across the globe. At present, there are so many active people working in the stock markets as agents, traders, advisors and many more with distinctive responsibilities. The attractive gains through low investment instills a within educated people to earn more and start their own business.

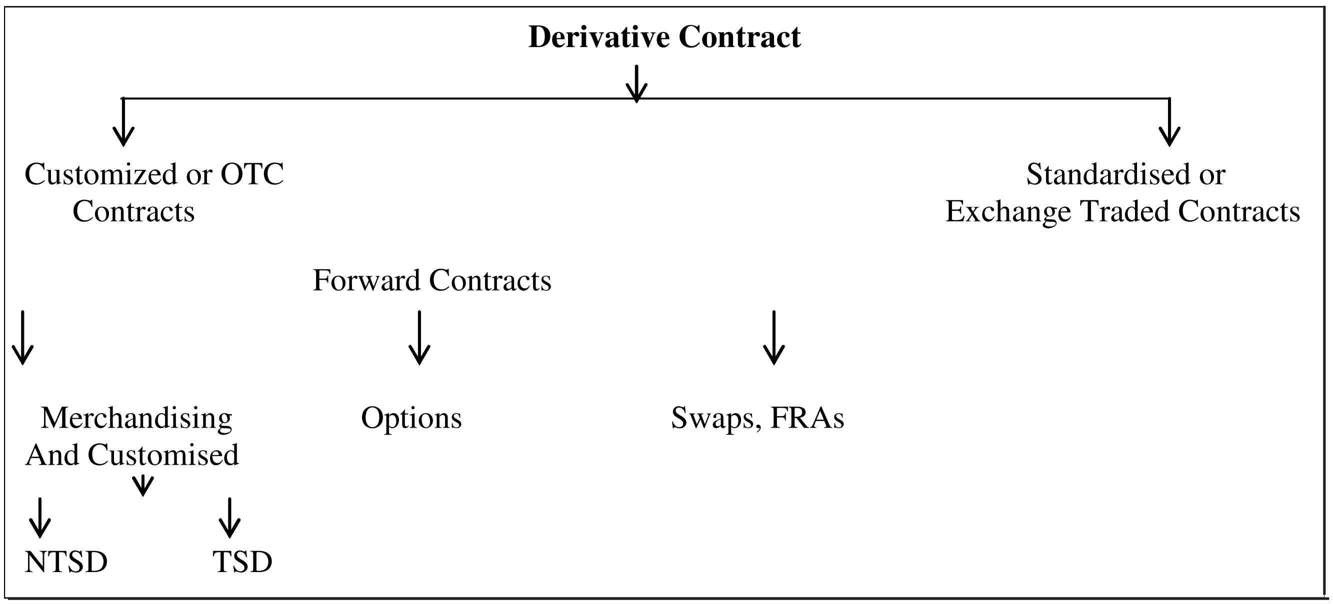
2.5 DERIVATIVE MARKETS IN INDIA – A STRUCTURAL LOOK

Derivatives markets are successful institutions because they make financial markets more efficient. This generally means that borrowing and lending can occur at lower cost than would otherwise be the case because derivatives reduce transaction. A derivative contract is an enforceable agreement. This agreement may be a standardized contract or a customized contact.

The following diagrams exhibit the structural look of the above concept:

Chart 2.2

Derivative Contract



The various derivative contracts as exhibited above are explained below:

1. **Customised Contracts:** All the OTC contracts are customized contracts. Forward contracts (other than futures) are customized.

2. **Standardised Contracts:** Future contracts are standardized. In other words, the parties to the contracts do not contracts do not decide the terms of future contracts, but they merely accept terms of contracts standardized by the Exchange.

3. **Forward Contract:** A forward contract is a legally enforceable agreement for delivery of the underlying assets on a specific date in future at a price agreed on the date of contract. Under Forward Contracts (Regulation) Act, 1952, all the contracts for delivery of goods, which are settled by payment of money difference

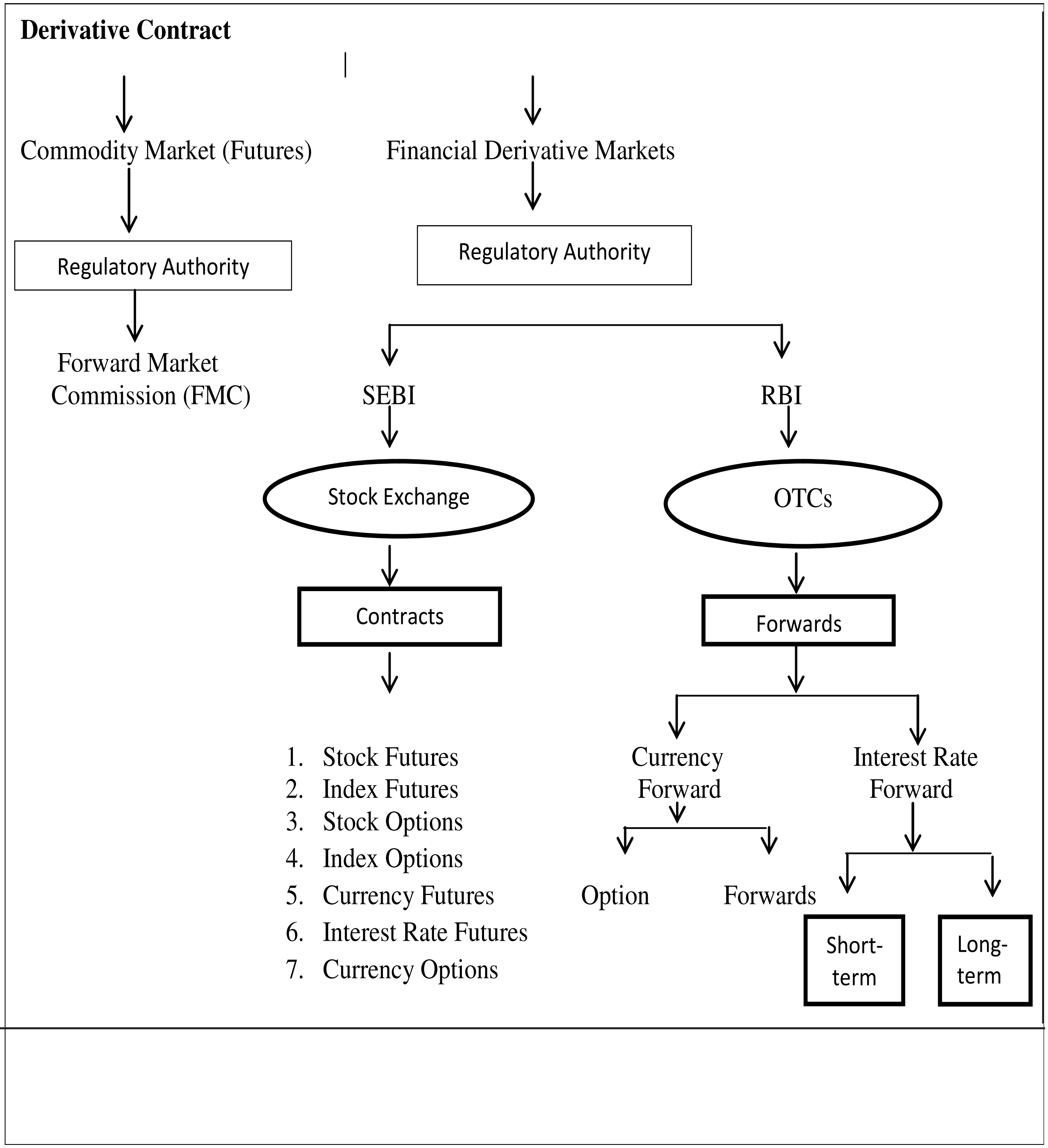
or where delivery and payment is made after a period of 11 days are forward contracts.

4. **Future Contract:** Futures contract is specific type of Forward contract. These are exchange traded contracts to sell or buy standardized financial instruments or physical commodities for delivery on a specified future date on agree price. As the terms of the contracts are standardized, these are generally not used for merchandising purposes. These contracts are generally for protecting against risk of adverse price fluctuations.

5. **Non-transferable Specific Delivery (NTSD) Contract:** It is an enforceable bilateral agreement under which the terms of contract are customized and the performance of the contract is by giving specific delivery of goods. Cannot be transferred by transferring delivery order, railway receipt, bill of lading, warehouse receipts or any other documents of titles or underlyings or goods.

6. **Transferable Specific Delivery (TSD) Contract:** It is an enforceable customized agreement where the rights and liabilities under the delivery order, railway receipt, bill of lading, warehouse receipts or any other documents of title to the goods are transferable. The contract is performed by delivery goods by first seller to the last buyer.

Chart 2.3


Derivative Contract
Commodity Market (Futures)
Financial Derivative Markets
Regulatory Authority
Regulatory Authority
Forward Market
Commission (FMC)
SEBI
RBI
Stock Exchange
OTCs
Contracts
Forwards
1. Stock Futures
2. Index Futures
3. Stock Options
4. Index Options
5. Currency Futures
6. Interest Rate Futures
7. Currency Options
Currency
Forward
Interest Rate
Forward
Option
Forwards
Short-
term
Long-
term

2.6 MAJOR RECOMMENDATIONS OF DR. L.C. GUPTA COMMITTEE

SEBI appointed the L.C.Gupta Committee on 18th November 1996. The 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 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 surveillancesystems. 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 crores.

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.

Explanation of Some Important Terms Used in the Committee's Recommendations

2.6.1 Derivatives Concept

A derivative product, or simply 'derivative', is to be sharply distinguished from the underlying cash asset. Cash asset is the asset which is bought or sold in the cash market on normal delivery terms. Thus, the term 'derivative' indicates that it has no independent value. It means that its value is entirely 'derived' from the value of the cash asset. The main point is that derivatives are forward or futures contracts, i.e., contracts for delivery and payment on a specified future date. They are essentially to facilitate hedging of price risk of the cash asset. In the market term, they are called as 'Risk Management Tools'.

2.6.2 Financial Derivatives – Types

Though the Committee was mainly concerned with equity based derivatives but it has tried to examine the need for derivatives in a broad perspective for creating a better understanding and showing inter-relationship.

Broadly, there are three kinds of price risk exposed to a financial transaction, viz.

1. Exchange rate risk, a position arisen in a foreign currency transaction like import, export, foreign loans, foreign investment, rendering foreign services, etc.

2. Interest rate risk, as in the case of fixed-income securities, like treasury bond holdings whose market price could fall heavily if interest rates shot up

3. Equities', 'market risk', also called 'systematic risk'—a risk which cannot be diversified away cause the stock market as a whole may go up or down from time to time The above said classification indicates towards the emergence of three types of financial derivatives namely currency futures, interest rate futures and equity futures. As both forward contracts and futures contracts can be used for hedging, but the Committee favours the introduction of futures wherever possible.

Forward contracts are presently being used in India to provide forward cover against exchange rate risk. Currency and interest rate futures lie in the sphere of Reserve Bank of India (RBI).

The Dr. L.C. Gupta Committee recognizes that the basic principles underlying the organization, control and regulation of markets of all kinds of financial futures are the more or less same and that the trading infrastructure may be common or separate, partially or wholly. The Committee is of further opinion that there must be a formal mechanism for coordination between SEBI and RBI in respect of financial derivatives markets so that all kinds of overlapping of jurisdiction in respect of trading mechanismare removed. Financial derivatives markets in India have been developed so far in three important instruments like equity, interest and currency. First one is regulated by the SEBI, whereas other two are controlled by the RBI. The markets of these instruments are in their preliminary stage.

2.6.3 Equity Derivatives

Dr. L.C. Gupta Committee considered in its study both types of equity like stock index derivatives and individual stocks derivatives. At the international level, stock index derivative is more popular than the individual stock. The Committee found in its survey that index futures are more preferable than individual stock from the respondents. The orderof over-all preference in India as per the survey of the Committee was as follows: (i) Stock index futures, (ii) Stock index options, (iii) Individual stock options and (iv) Individual stock futures.

2.6.4 Basic Reasons for the Preference of Stock Index Futures

Not only in India, in other countries too, is stock index futures most popular financial derivatives due to the following reasons:

1. Institutional investors and other large equity holders prefer the most this instrument in terms of portfolio hedging purpose.
2. Stock index futures are the most cost-efficient hedging device whereas hedging through individual stock futures is costlier as observed in other countries.
3. Stock index futures cannot be easily manipulated whereas individual stock price can be exploited more easily in India it is rather easier to play this game as witnessed in the past scams.
4. This is in fact that due to a limited supply of an individual stock, supply can easily be cornered even in large companies in India like Reliance Industries, State Bank of India, etc. The Management of these companies has complained many times about their share prices being manipulated by some interested parties. On the other hand, the supply of stock index futures is unlimited, and hence, the possibility of cornering is ruled out. In fact, the manipulation of stock index futures can be possible only of the cash prices of each component securities in the index be influenced, which is rare and not so high.
5. It is observed from the experiences of other countries that stock index futures are more liquid, more popular and favorable than individual stock futures. The same is also witnessed by the L.C. Gupta Committee in its survey from the responses of the respondents.
6. Since, stock index futures consists of many securities, so being an average stock, is much less volatile than individual stock price. Further, it implies much lower capital adequacy and margin requirements in comparison of individual stock futures.
7. In case of stock index futures trading, there is always clearing house guarantee, so the chances of the clearing house going to be bankrupt is very rare, and hence, it is less risky.
8. Another important reason is that in case of individual stocks, the outstanding positions are settled normally against physical delivery of the shares. Hence, it is necessary that futures and cash prices remained firmly tied to each other. However, in case of stock index futures, the physical delivery is almost impractical, and they are settled in cash all over the world on the premise that index value, as

independentlyderived from the cash market, is safely accepted as the settlement price.

9. Lastly, it is also seen that regulatory complexity is much less in the case of stock index futures in comparison to other kinds of equity derivatives.

In brief, it is observed that the stock index futures are more safer, popular and attractive derivative instrument than the individuals stock. Even in the US market, the regulatory framework does not allow use of futures on the individual stocks. Further only very few countries of world, say one or two, have futures trading on individual stock.

2.6.5 Strengthening of Cash Market

The Dr. L.C. Gupta Committee observed that for successful introduction of futures market in any country, there must be a strong cash market because derivatives extract their value from the cash asset. The constant feedback between these two markets through arbitrage will keep these markets in alignment with each other. The Committee noted certain weaknesses of the Indian equities markets which should be taken care for success of the futures trading in India. A few important weaknesses observed are as under:

2.6.6 Mixing of Cash and Forward Transactions

1. There is queer mixture of cash and future transactions in the Indian stock markets. For example, cash transactions (involving delivery), in most active scripts, deliveries are just around 5 per cent of the trading volume whereas in many others, it is just, 20-30 percent. In fact, the dominant cash transactions are the non-delivery which are the equivalent of futures/forward transactions.

2. It is further noted that the above said mixed system (cash-cum-carry forward) is not very sound for futures trading because (i) no transparency in the carry forward system, (ii) the influence of fundamental factors is not so strong due to dominance of short term speculation and (iii) creating a future market on such basis may have the effect of compounding the existing weaknesses.

3. The Committee is of the view that there must be separation between cash market and futures market. It will promote the markets economic efficiency. This has led to the adoption of the rolling settlement system because in this way, cash market will function as genuine cash markets but no carry forward. Even futures market does not permit carry forward from one settlement to another in the way practiced inIndia.

4. The trading in Indian stock market was shifted to rolling settlement recently where always empha sized for settlement by delivery. But in India, 'squaring up or closing' business (i.e. offsetting of buying and selling transactions within the settlement) is accounted for in bulk which is not appropriate for futures trading.

2.6.7 Differences in Trading Cycles among Stock Exchanges

1. Indian stock exchanges, now, most of them, have a weekly trading cycle but the cycles are not uniform. For example, NSE has from Wednesday to Tuesday and BSE has from Monday to Friday. Due to difference in trading cycles, the brokers who have membership in both the exchanges can easily go on circulating their trades from one exchange to the other without ever having to delivery. Such situation is a complete travesty of the cash market and an abuse to the stock market system.
2. It seems that in Indian stock markets, the different trading cycles have been kept with a vested interest in order to deliberately generate arbitrage opportunities, it is seen that due to this, the prices for the same securities on two (NSE and BSE) stock exchanges differ from 0.5 to 1.5 percent even it is larger on expiration days. The Committee feels that the different cycles serving the interest of only speculators and not of genuine investors. Even it is not good for market development and futures trading.
3. It is also noted, that the prices of various securities on both exchanges (NSE and BSE), sometimes are not the same. As a result, the value of the stock indices on both the exchanges will not be same, if computed separately from the NSE and BSE prices. This will create a problem in valuation of future market stock.
4. The Committee also noted that for a successful future trading, a coordinated but pro-competitive nationwide market system be achieved. So it is suggested that before implementing a uniform trading cycle system among all exchanges, till such time the rolling settlement system can be adopted. This system will provide 'a sound and reliable basis for futures trading in India.

2.6.8 Weakness of Stock Exchange Administrative Machinery

The Dr. L.C. Gupta Committee members were of the strong opinion that for successful derivatives trading on the stock exchanges, there must be stringent monitoringnorms and match higher standard of discipline, than in the present, be maintained. Though the SEBI has already made a good efforts but much more still is to be done specifically in the controlling of trading members.

2.6.9 Inadequate Depository System

The Committee is of the view that all such securities which are composing in stock index and used for stock index futures, should necessarily be in depository mode. As observed earlier, settlement problems of the cash market may weaken the arbitrage process by making it risky and costly. Since, index based derivatives trading does not itself involve deliveries, it will increase the arbitrage trading between cash and index derivatives markets.

The arbitrage process keeps the two markets in alignment. Thus, due to this reason, it is essential for successful futures trading that all the scripts of the particular stock index futures must be in the depository mode. Hence, depository scripts in India should be enhanced.

The Committee has no doubt that the creation of futures markets by introducing the financial derivatives, including equity futures, currency futures and interest rate futures would be a major step towards the further growth and development of the Indian financial markets provided that the trading must be cost-efficient and risk hedging facilities.

2.7 BENEFITS OF DERIVATIVES IN INDIA

Derivatives are innovative Financial Instrument that aims to increase return and reduce risk. The Indian Derivatives market has achieved tremendous growth over the years. During December, 1995, the NSE applied to the SEBI for permission to undertake trading in stock index futures. Later SEBI appointed the Dr. L.C. Gupta Committee, which conducted a survey amongst market participants and observed an overwhelming interest in stock index futures, followed by other derivatives products. The LCGC recommended derivatives trading in the stock exchanges in a phased manner. It is in this context SEBI permitted both NSE and BSE in the year 2000 to commence trading in stock index futures. The question, therefore, becomes relevant—what are the benefits of trading in Derivatives for the country and in particular for choosing stock index futures as the first preferred product?

Following are some benefits of derivatives:

1. India's financial market system will strongly benefit from smoothly functioningindex derivatives markets.

2. Internationally, the launch of derivatives has been associated with substantial improvements in market quality on the underlying equity market. Liquidity and market efficiency on India's equity market will improve once the derivatives commence trading.
3. Many risks in the financial markets can be eliminated by diversification. Index derivatives are special in so far as they can be used by the investors to protect themselves from the one risk in the equity market that cannot be diversified away, i.e., a fall in the market index. Once the investors use index derivatives, they will stiffer less when fluctuations in the market index take place.
4. Foreign investors coming into India would be more comfortable if the hedging vehicles routinely used by them worldwide are available to them.
5. The launch of derivatives is a logical next step in the development of human capital in India. Skills in the financial sector have grown tremendously in the last few years. Thanks to the structural changes in the market, the economy is now ripe for derivatives as the next area for addition of skills.

2.8 FACTORS AFFECTING GROWTH OF DERIVATIVES

Growths of derivatives are affected by a number of factors. Some of the important factors are as below:

a) Increased volatility in asset prices in financial markets.
b) Increased integration of national financial markets with the international markets.
c) Marked improvement in communication facilities and sharp decline in their costa.
d) Development of more sophisticated risk management tools, providing economic agents, a wider choice of risk management strategies.
e) Innovation in the derivatives markets, which optimally combine the risk and returns, reduced risks as well as transactions costs as compared to individual financial assets.

2.9 SUMMARY

Derivatives markets have shown tremendous growth in recent years. Derivatives help the economy achieved an efficient allocation of risk. They assist in completing markets, theory providing firms and individuals with new investment opportunities. Derivatives provide information to financial market participants and may help reduce overall market volatility.

2.10 SELF ASSESSMENT QUESTIONS

1. Bring out the historical development of Derivatives market in India.
2. Discuss the functions of Derivatives market.
3. Describe the Derivative markets structure.
4. Interpret major recommendations of L. C. Gupta committee.
5. What are the benefits of Derivative in India?

2.11 NOTES

2.12 REFERENCES

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UNIT-3 : REGULATORY AUTHORITIES AND DERIVATIVE EXCHANGES IN INDIA

Structure :

3.0 OBJECTIVES

After studying this unit, you should be able to;

- Know about the Regulations of Derivatives Trading in India.
- Beware about the Regulatory objectives of Derivatives Market.
- Understand the Derivatives exchanges in India.
- Know about the categories of Derivatives Regulatory authorizes in India.

3.1 INTRODUCTION

India has started the innovation in financial markets very late. Some of the recent developments initiated by the regulatory authorities are very important in this respect.Futures trading have been permitted in certain commodity exchanges. Mumbai Stock Exchange has started futures trading in cottonseed and cotton under the BOOE and under the East India Cotton Association. Necessary infrastructure has been created by the National Stock Exchange (NSE) and the Bombay Stock Exchange (BSE) for trading in stock index futures and the commencement of operations in selected scripts.

3.2 REGULATION OF DERIVATIVES TRADING IN INDIA

The regulatory frame work in India is based on L.C. Gupta Committee report and J.R. Varma Committee report. It is mostly consistent with the International Organization of Securities Commission (IOSCO). The L.C. Gupta Committee report provides a perspective on division of regulatory responsibility between the exchange and SEBI. It recommends that SEBI's role should be restricted to approving rules, bye laws and regulations of a derivatives exchange as also to approving the proposed derivatives contracts before commencement of their trading. It emphasizes the supervisory and advisory role of SEBI. It also suggests establishment of a separate clearing corporation maximum exposure limits, mark to market margins, margin collection from clients and segregation of clients funds, regulation of sales practice and accounting and disclosure requirements for derivatives trading. The J.R. Varma committee suggests a methodology for risk containment measures for index-based futures and options and single stock futures. The risk containment measures include calculation of margins, position limits, exposure limits and reporting and disclosure.

3.3 REGULATORY OBJECTIVES OF DERIVATIVES MARKET

In India the derivatives trading activities are governed by the Securities Contract (Regulation) Act1956 and the Securities and Exchange Board of India Act, 1992. The framework for derivatives trading in India is laid down by L C Gupta Committee which was constituted by SEBI. SEBI has also framed suggestive Bye Laws for Derivative Exchanges/Segments and their Clearing Corporation/House, which lays down the provisions for trading and settlement of derivative contracts. The suggestive Bye-Laws become the base for any further changes in the Rules, Bye Laws & Regulations for derivatives segment through exchanges and their clearing corporation/house. SEBI has also laid out regulatory frameworks of the following activities for derivative trading in India - Eligibility conditions for Derivative Exchange/Segment and its Clearing Corporation/House; Types of Membership in the derivatives market in India; Eligibility of indices and stocks for futures and option Trading; Minimum size of derivatives contract and Measures to protect the rights of investor in Derivatives Market.

When derivatives were first introduced in India by L C Gupta Committee, it was strongly opposed by the brokers of Bombay Stock Exchange (BSE) and National Stock Exchange (NSE). But later the MD of NSE convinced the brokers and introduced derivatives in India for which it had prepared constantly and thoroughly.

Regulatory objectives

The Committee believes that regulation should be designed to achieve specific, well-defined goals. It is inclined towards positive regulation designed to encourage healthy activity and behavior. It has been guided by the following objectives:

a. Investor Protection: Attention needs to be given to the following four aspects:

i. Fairness and Transparency:

The trading rules should ensure that trading is conducted in a fair and transparent manner. Experience in other countries shows that in many cases, derivatives brokers/ dealers failed to disclose potential risk to the clients. In this context, sales practices adopted by dealers for derivatives would require specific regulation. In some of the most widely reported mishaps in the derivatives market elsewhere, the underlying reason was inadequate internal control system at the user-firm itself so that overall exposure was not controlled and the use of derivatives was for speculation rather than for risk hedging. These experiences provide useful lessons for us for designing regulations.

ii. Safeguard for clients' moneys:

Moneys and securities deposited by clients with the trading members should not only be kept in a separate clients' account but should also not be attachable for meeting the broker's own debts. It should be ensured that trading by dealers on own account is totally segregated from that for clients.

iii. Competent and honest service:

The eligibility criteria for trading members should be designed to encourage competent and qualified personnel so that investors/clients are served well. This makes it necessary to prescribe qualification for derivatives brokers/dealers and the sales persons appointed by them in terms of a knowledge base.

iv. Market integrity:

The trading system should ensure that the market's integrity is safeguarded by minimizing the possibility of defaults. This requires framing appropriate rules about capital adequacy, margins, clearing corporation, etc.

3.4 DERIVATIVE EXCHANGES IN INDIA

Indian Derivative Exchanges are of two types, they are;

(i) Over the Counter (OTC) markets;

(ii) Exchange Traded Markets.

SBI and RBI are regulatory authority to permit the following stock exchanges for Equity, Debt and Forex related derivatives.

(i) National Stock Exchange;

(ii) Bombay Stock Exchange;

(iii) United Stock Exchange; and

(iv) MCX-SX

It may be noted that Forward Markets Commission (FMC) headquartered at Mumbai, is the regulatory authority under the Ministry of Consumer Affairs, Food and Public Distribution, Govt. of India. It is a statutory body set up in 1953, under the Forward Contracts (Regulation) Act 1952. It grants recognition to an association for commodity derivative trading.

The following are recognized derivative (commodity) exchanges in India.

Sl. No.	Commodity Exchanges
1.	Bhatinda Om & Oil Exchange Ltd., Batinda.
2.	The Bombay Commodity Exchange Ltd., Mumbai
3.	The Rajkot Seeds oil & Bullion Merchants` Association Ltd
4.	The Kanpur Commodity Exchange Ltd., Kanpur
5.	The Meerut Agro Commodities Exchange Co. Ltd., Meerut
6.	The Spices and Oilseeds Exchange Ltd.
7.	Ahmedabad Commodity Exchange Ltd.
8.	Vijay Beopar Chamber Ltd., Muzaffarnagar
9.	India Pepper & Spice Trade Association, Kochi
10.	Rajdhani Oils and Oilseeds Exchange Ltd., Delhi
11.	National Board of Trade, Indore
12.	The Chamber Of Commerce, Hapur
13.	The East India Cotton Association, Mumbai
14.	The Central India Commercial Exchange Ltd., Gwalior
15.	The East India Jute & Hessian Exchange Ltd.
16.	First Commodity Exchange of India Ltd, Kochi
17.	Bikaner Commodity Exchange Ltd., Bikaner
18.	The Coffee Futures Exchange India Ltd, Bangalore
19.	Esugarindia Limited
20.	National Multi Commodity Exchange of India Limited
21.	Surendranagar Cotton oil & Oilseeds Association Ltd
22.	Multi Commodity Exchange of India Ltd
23.	National Commodity & Derivatives Exchange Ltd
24.	Haryana Commodities Ltd., Hissar
25.	e-Commodities Ltd.

Of these 25 commodities exchanges the MCX, NCDEX and NMCEIL are the major Commodity Exchanges.

a. Multi commodity exchange of India Ltd.:

MCX is an independent and de-mutualized exchange based in Mumbai. Established on 10 November, 2003, it is the third largest bullion exchange and fourth largest energy exchange in the world. Recognized by the Government of India it deals in numerous commodities and carries out online trading, clearing and settlement processes for commodities future marketcountrywide.MCX COMDEX is India's foremost and sole composite commodity futures price index.

b. National Commodity & Derivatives Exchange of India Ltd (NCDEX):

It is located in Mumbai, is a public limited company incorporated on 23rd April 2003. Promoted by national level establishments it is run by professional management. Regulated by the Forward Market Commission with reference to futures trading in commodities, it trades in various commodities online. The NCDEX is covered by:

1. Companies Act
2. Stamp Act
3. Contracts Act
4. Forward Commission (Regulation) Act

c. National Multi-Commodity Exchange of India Limited (NMCEIL):

It is considered the first de-mutualized, online exchange dealing in numerous commodities. Incorporated on 20th December 2001, it is promoted and run by:

1. Central Warehousing Corporation
2. National Agricultural Cooperative Marketing Federation of India Limited
3. Gujarat Agro Industries Corporation Limited
4. National Institute of Agricultural Marketing
5. Gujarat State Agricultural Marketing Board
6. Neptune Overseas Limited

The Commodity Exchanges with their extensive reach embrace new participants, resulting in a powerful price discovery process.

3.5 CATEGORIES OF DERIVATIVES TRADING AND REGULATORY AUTHORITIES IN INDIA

There are six categories of derivatives traded in India. These are regulated by the appropriated regulatory authorities in India. A brief outline of these derivatives are as follows:

1. Commodity Futures:		
Derivative Contract	**Underlying Asset**	**Regulatory Authority**
Commodity Futures	Coffee, oil seeds oil, gold, silver, pepper, cotton, jute	Forward Market Commission
2. Index Futures: It is contract on a stock index or other index:		
Single Index Futures	Sensex Index, NIFTY Index	SEBI
3. Forward Rate Agreement:		
FRA / Interest Rate Swap (IRS)	Short-term security of national principal	RBI
4. Stock Option:		
Stock Options	Individual Shares	SEBI through NSE & BSE
5. Stock Futures on Individual Securities:		
Futures on Individual Security	Stocks	SEBI through NSE and BSE
6. Interest Rate Futures:		
Interest Rate Futures	91-days T-Bills 19 Years Bonds 10 Years Zero Coupon Bonds	RBI

3.6 OTC DERIVATIVES MARKET IN INDIA

Over-the-counter (OTC) contracts are bilaterally negotiated between two parties. There is no fixed expiry date of OTC contracts and are often customized to fit the specific requirement of the user. In the recent year, the OTC derivatives market has witnessed a tremendous growth across the world due to their flexibility, low operating cost and zero regulatory cost. However the OTC contracts have substantial credit risk borne by the counter party default.

3.7 REGULATORY FRAMEWORK FOR OTC DERIVATIVES

In India, the regulations of all OTC derivatives are completely within the purview of the RBI. Legally, the RBI received this power from the Reserve Bank of India Act, 1935, the Banking Regulation Act, 1949, the Foreign Exchange Management Act, 1999 and the Securitization and Reconstruction of Financial Assets and Enforcement of Security Interest Act, 2002 (Gopinath 2010). The Reserve Bank of India (Amendment) Act, 2006 was a key milestone for regulation of OTC interest rate, foreign currency and credit derivatives. According to this Act, at least one of the parties in OTC derivatives transaction should be a RBI regulated entity. To start with, RBI permitted Primary Dealers (PDs)16, all scheduled commercial banks (SCBs) excluding regional rural banks and the financial institutions17 to undertake transactions in interest rate swap (IRSs) and forward rate agreements (FRAs) for their own balance sheet management and also for the purpose of market making. The non-financial institutions have been allowed to use IRS and FRA to hedge their exposure.

3.8 EXCHANGE-TRADED DERIVATIVES (ETD) MARKET IN INDIA

Two exchanges in India have been permitted to trade in derivatives contracts, the National stock exchange (NSE) and the Bombay stock exchange (BSE). NSE's contribution to the total turnover in the market is nearly 99%. Hence, the market design enumerated in the study is the derivative segment of NSE. The different aspects of market design for Future and Option segment of the NSE can be summarized as follows:

Trading Mechanism:

The future and option trading system of NSE, called NEAT-F&O trading system, provides a fully automated screen-based trading for Index futures and options and stock futures and options on a nationwide basis as well as on line monitoring and surveillance mechanism. It supports an order driven market and provides complete transparency of trading operations.

There are four entities in the trading system as follows:

i) Trading members who can trade either on their own account or on behalf of their clients including participants.

ii) Clearing members who are members of National Securities Clearing Corporation Limited (NSCCL) and carry out risk management activities and confirmation / inquiry of trades through the trading system. These clearing members are also trading members and clear trades for themselves and/or others.

iii) Professional clearing members (PCMs) are clearing members who are not trading members. Typically, banks and custodians become PCMs and clear and settle for their trading members.

iv) Participants who are client of trading members like financial institutions. These clients may trade through multiple trading members, but settle their trades through a single clearing member only.

3.9 SUMMARY

This unit explores about Derivatives trading in India, regulatory objectives of Derivatives market, Derivatives exchanges in India, Derivatives trading and regulatory authorities in India and OTC and ETD market in India.

3.10 SELF ASSESSMENT QUESTIONS

1. Discuss regulation of Derivatives Trading in India
2. What is meant by Derivatives Regulatory Authorities?
3. Describe Derivatives exchange in India
4. Difference between OTC market and ETD market

3.11 NOTES

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UNIT-4: PARTICIPANTS IN DERIVATIVES MARKET

Structure :

4.0 OBJECTIVES

After studying this unit, you should be able to;

- Understand the participants in Derivative Market.
- Analyse the Risks faced by the participants.
- Describe the participants in future market.
- Understand the structure of Future Market Trading Mechanism.

4.1 INTRODUCTION

Derivative contracts have several variants. The most common variants are forwards, futures, options and swaps. The following three broad categories of 4— participants - hedgers, speculators, and arbitrageurs trade in the derivatives market. Hedgers face risk associated with the price of an asset. They use futures or options markets to reduce or eliminate this risk. Speculators wish to bet on future movements in the price of an asset. Futures and options contracts can give them an extra leverage; that is, they can increase both the potential gains and potential losses in a speculative venture. Arbitrageurs are in business to take advantage of a discrepancy between prices in two different markets. If, for example, they see the futures price of an asset getting out of line with the cash price, they will take offsetting positions in the two markets to lock in a profit.

4.2 DERIVATIVES MARKET PARTICIPANTS

Greater liquidity among the traders has increased the growth of derivatives market worldwide. Finding a party to a contract has become an easier job. The different types of traders in derivatives market are;

a) Hedgers

b) Speculators

c) Day Traders / Scalpers;

d) Floor Trader; and

e) Arbitrageurs.

a) Hedgers:

Hedger is a user of the market, who enters into futures contract to manage the risk of adverse price fluctuation in respect of his existing or future asset. Hedgers are those who have an underlying interest in the commodity and are using futures market to insure themselves against adverse price fluctuations. Examples could be stockists, exporters, producers, etc. They require some people who are prepared to accept the country-party position(speculators).

b.Speculators:

A trader, who trades or takes position without having exposure in the physical market, with the sole intention of earning profit is a speculator. Speculators are those who may not have an interest in the ready contracts, etc. but see an opportunity of price movement favourable to them. They are prepared to assume the risks, which the hedgers are trying to cover in the futures market. They provide depth and liquidity to the market. They provide a useful economic function and are an integral part of the futures the market. It would not be wrong to say that in absence of speculators the market will not be liquid and may at times collapse.

c. **Day Traders:**

Day traders take positions in futures or options contracts and liquidate them prior to the close of the same trading day. A floor trader is an Exchange member or employee of a member, who executes trade by being personally present in the trading ring or pit. The floor trader has no place in electronic trading systems.

d. Floor Traders:

A floor trader is an Exchange member or employee of a member, who executes trade by being personally present in the trading ring or pit. The floor trader has no place in electronic trading systems.

e. Arbitrager:

Arbitrage refers to the simultaneous purchase and sale in two markets so that the selling price is higher than the buying price by more than the transaction cost, resulting in risk-less profit.

4.3 RISKS FACED BY PARTICIPANTS

The different kinds of risks faced by participants in derivatives markets are:

a. Credit Risk;

b. Market Risk;

c. Liquidity Risk;

d. Legal Risk; and

e. Operational Risk.

a. Credit Risk:

Credit risk on account of default by counter party: This is very low or almost zeros because the Exchange takes on the responsibility for the performance of contracts.

b. Market Risk:

Market risk is the risk of loss on account of adverse movement of price.

c. Liquidity Risk:

Liquidity risks is the risk that unwinding of transactions may be difficult, if the market is illiquid

d. Legal Risk:

Legal risk is that legal objections might be raised, regulatory framework might disallow some activities.

e. Operational Risk:

Operational risk is the risk arising out of some operational difficulties, like, failure of electricity or connectivity, due to which it becomes difficult to operate in the market.

4.4 PARTICIPANTS IN THE FUTURES MARKET

There are two main participants within a futures market.

a. Hedgers; and

b. Speculators.

a. Hedger:

Hedging is done to manage price risk. Hedgers wish to protect themselves from unfavorable price movement by foregoing a profit if the price moves in their favor. There are different reasons why hedging might be undertaken. A wheat farmer can hedge against a possible price decline in the future and on the other hand a cookie maker can hedge against an increase in the price of wheat in the future. A lender can hedge against a possible decline in the interest rate, whereas a borrower can hedge against a possible increase in the interest rate. To hedge, you either have the underlying commodity (ie. Farmer) or you require the underlying commodity at some point in the future (ie. Baker)

TYPES OF HEDGING

1. Short hedging:

Here the producer of a particular commodity wants to ensure that they get at least a given price in the future. If the price of a bushel of wheat for a December contract is currently $8.50 and the farmer feels that due to whatever reasons he might not be able to get more than this price in the future, he can enter into a contract to sell wheat at $8.50/bushel in December. Let us suppose that he has made a contract of 10,000 bushels. If the price of wheat in December is $8.10/bushel he would still be getting $8.50/bushel as per the contract. Hence the final amount he is able to get is $85,000($8.50*10000). If he did not hedge he would have got $81,000 by selling the wheat in the open market. Hence he is able to get a profit of $4,000 and is able to protect his income through hedging. On the flip side if the open market price of wheat increases to $9.50/bushel he would have made $95,000 by selling the wheat in the open market. But because of the contract he is able to get only $85,000 giving him a loss of $10,000. Besides the profit the major advantage is that he knows the amount he will get on his crop which allows him to plan accordingly for the season.

2. Long Hedging:

A jeweler can hedge for Gold as a consumer of the commodity. If gold is trading at $1200.00 per troy ounce in the 6 month future contract and the jeweler feels that the price of gold will increase he can purchase a contract to buy gold at $1200.00 6 months from now. This way if the price of gold increases he will be protected from the unfavorable price movement as a consumer of the commodity. Let us say that the price of gold increases to $1260.00 in 6 months and he has purchased a contract to buy 100 troy ounces of gold. He will have to give $120,000 to purchase the gold instead of spending $126,000 in the open market. Hence he has been able to reduce his cost by $6,000. However if the price of gold decreases to $1,150 in 6 months he still has to spend $1,200 per troy ounce to purchase gold. Here his net loss would be $5,000. Again here the major benefit is that it will allow smoother functioning of his operations. Due to sudden changes in the market he does not have to change his operations.

b. Speculators:

The other part of futures market is made of speculators. They provide liquidity to the market. If a farmer wants to short sell a contract for 5,000 bushels of wheat expiring in 3 months it is highly unlikely that he will immediately find another consumer who wants to long buy a similar amount of wheat at the same time. The speculators, although they do not have any interest in the underlying asset or commodity, still buy the contract looking to profit through ideal market timings. This helps the entire system by bringing in much needed liquidity.

TYPES OF SPECULATORS

1. Going Long:

If a speculator believes that the price of a commodity will increase in the future he will buy or "go long" a futures contract. If the price does increase in the future he will be able to get a profit by selling the contract at a higher price. For example a trader believes that the value of crude oil will increase in the future. The current price for a December contract of 1000 barrels is $90 per barrel. In 2 weeks the price of the contract increases to $92 per barrel. Selling the contract in two weeks will give him a profit of $2,000. However if the price of the contract decreases he stands to lose.

2. Going Short:

If a speculator believes that the price of a commodity will decrease in the future he can sell a futures contract now. When the price has decreased he can buy back the contract at a lower price to cover his position. For example a trader sells a December contract of 1000 barrels for crude oil at $88 per barrel. In 1 week the price of oil decreases to $85, he can now buy the contract and effectively cover or offset his position. This will give him $3 per barrel profit or $3,000 profit on the entire contract. Generally stop-loss and several other strategies are used to ensure that the losses are not magnified and one can get good returns from the trade.

4.5 FUTURE MARKET TRADING MECHANISM

Futures contracts are traded on an organized exchange and the contract terms are standardized by that exchange. The trading process of futures contracts are based on the following elements:

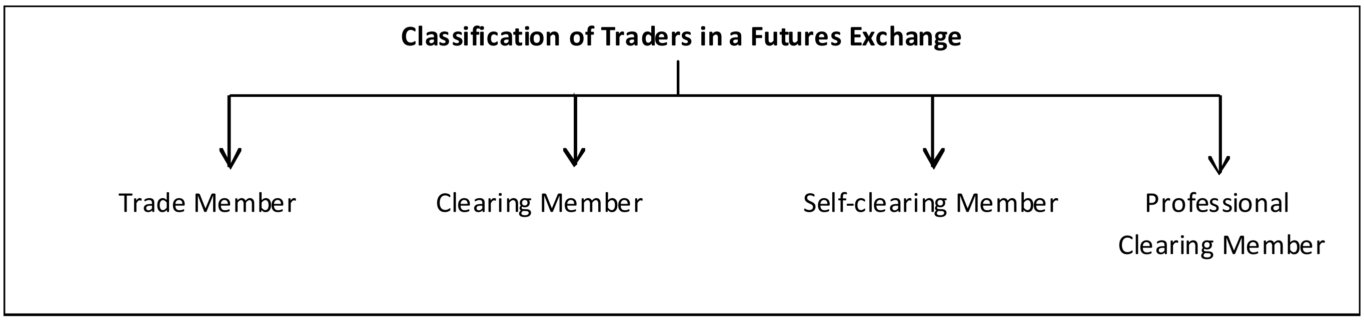
1. Futures Contract Design
2. Futures Market Operational Guidelines
3. Derivatives Trading Regulations
4. Futures Contract Delivery cum Settlement Procedure

FUTURES CONTRACT DESIGN

Futures are exchange traded contracts. The term of the contracts are standardized by the exchanges. The most important principle for designing a future contract is to take into account the systems and practices being followed in the cash market. A well-designed futures contract is based on the following foundation:

(A) The Parties:

The traders and investors are the original parties to a future contract. They are the buyers and sellers of futures contracts.



1. Trading Member:

He trades on his own behalf and on behalf of his own clients. The exchange assigns a trading member ID to each trading member. There may be more than one user of each TM. The exchange notifies the number of users allowed for each TM. Each user of the TM must be registered with the exchange. Accordingly, the Exchange assigns a unique user ID to each user. The unique trading member ID functions as a reference for all orders / trades of different users. This ID is common for all users of a particular TM.

2. Clearing Member:

Generally, a clearing member performs the settlement obligations of his own trading claims as well as the trading claims of other non-clearing members.

3. Self-Clearing Members:

When a member trades, clears and settles his own trade only he is called a self-clearing member.

4. Professional Clearing Member:

He performs only clearing functions only. He does not trade on his own account or on behalf of his client.

4.6 THE FACILITATORS OF FUTURES TRADING

The facilitators support the original traders for smooth functioning of futures deal. These facilitators are:

1. The Exchange
2. The Clearing House
3. The Brokers
4. The Regulators

4.6.1 EXCHANGE

An exchange itself does not trade but acts like a facilitator. In India, there are two categories of future exchanges, i.e. Commodity Future Exchanges and Financial Future Exchanges. All the commodities are not suitable for future trading. For a commodity to be suitable for future trading, it must possess the following characteristics.

a. The commodity should have s suitable demand and supply conditions, i.e., volume and marketable surplus should be large.

b. Prices should be volatile to necessitate hedging through future trading. In this commitment face a price risk. As a result, there should be a demand for hedging facilities.

c. The commodity should be free from substantial control from Government regulations imposing restrictions on supply, distribution and prices.

d. The commodity should be homogeneous or alternatively it must be possible to specify a standard grade and to measure deviations from that grade. This condition is essential for the futures exchange to deal in standardized contracts.

e. The commodity should be storable. In the absence of this condition, arbitrage would not be possible and there would be no relationship between the spot and futures market.

The Securities and Exchange Board of India has permitted the following stock exchanges to facilitate the futures trading in India:

1. Bombay Stock Exchange
2. National Stock Exchange
3. United Stock Exchange

4.6.2 *THE CLEARING HOUSE*

Every futures exchange has a clearing house associated with it which clears all the transactions of that exchange. A cleaning house is a financial institution that provides clearing and settlement services for financial and commodity derivatives and securities transactions.

4.6.2.1 Constitution and Status of a Clearing House

A clearing house may be formed as a separate body corporate or it may be a part of the future exchange. It carries the obligation to clear all the transactions of the affiliating or constituent future exchange. For example, National Securities Clearing Corporation Limited (NSCCL) acts as the clearing house of National Stock Exchange (NSE).

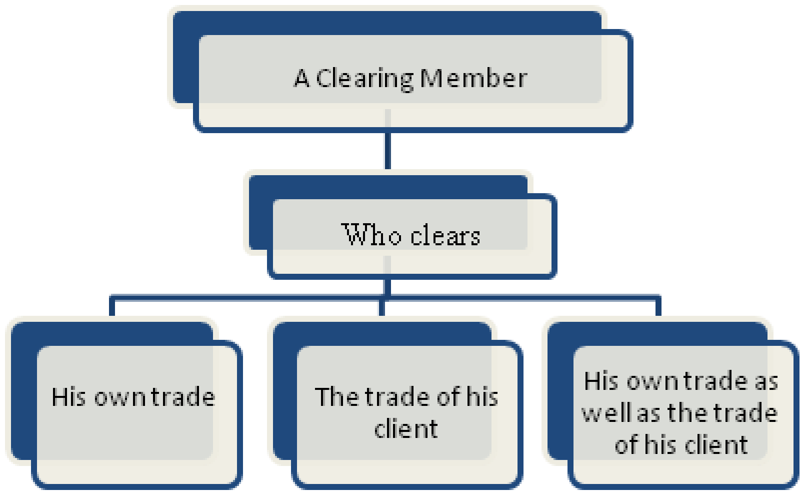
A clearing house acts as an intermediary between two traders (Clearing Members) with an obligation to reduce the risk of one of such clearing member when the counterparty fails to honour the trade obligation. It has a number of members who are only allowed to trade. Sometimes, brokers or commission merchants who are not clearing house members, they may channel their trade transactions through the clearing member.

4.6.2.2 Functions of a Clearing House

An associated clearing house is an integral part of derivative exchange. It performs the following important functions.

1. It Acts a Legal Counterparty to the Buyer as well as seller: First, the buyers and sellers agree to price, quantity, quality, expiration month and the underlying asset etc. as per the specification of the exchange. The moment the deal is concluded, the clearing house act as a third parties to all future contracts – as a buyer to every clearing member seller and a seller to every clearing member buyer. In other words, the clearing house assumes the obligation to buy the seller’s contract and to sell it the buyer. As a result, the original parties to the trade will have to deal only with the clearing house. Because the clearing house is the trade to both parties, they don’t have to worry about performance of the contract. Furthermore, the clearing house allows each trader to close out his position independently of the other. It may be notes that in case of cash market, the intermediary will never become the legal counterparty to the transactions, but in case of futures derivative, the clearing house plays a distinct role as a legal counterparty to both the buyer and seller.

2. It Records and Settles the day-do-day Trading Results: At the beginning, a clearing member enters his futures order. He should clearly specify whether the transaction is his own or his client. Accordingly, the clearing house records all transactions and works out the open positions of all the trading members. Thus:



3. It gives Guarantee to the Performance of Future Contracts: A clearing house acts as a legal counterparty to both buyers and sellers of future contracts. It regulates, monitors and protects the clearing members. It gives guarantee to the performance of all future contracts. As netting is permissible, so a clearing house normally adopts the facility of clearing on a net basis.

4.6.3 THE FLOOR BROKER

A floor broker is a person who executes transactions on the trading floor on behalf of clients of a firm (member of an exchange). In contrast with the floor trade who makes deals on his or her own behalf?

Floor brokers take the responsibility for executing the orders to trade futures contracts that are accepted by the clients. These stock market professionals can work for client firms of all sizes, and they may specialize in a particular type of commodity, or work more generally in a stock exchange.

4.6.3.1 Functions of Floor Broker:

A floor broker is also known as pit broker. He receives order from his client firm and executive the order on the floor. His objective is to get the best deal, whether he involves in buying or selling for the clients. Once the order is completed, it is recorded and the client is informed that the deal has been successfully completed. One of the advantages of working as a floor broker is that one is not exposed directly to risks of market volatility when a deal goes badly.

A floor broker should be capable to deal with a wide range of personalities, and to deal with a past paced work environment. He should possess some more basic skills like his ability to clearly project his voice in the floor so that he can be heard over the din of the trading floor, and the aggressiveness to make a good trade and confirm it.

Every exchange has slightly different conventions and rules which floor brokers must become familiar with. It conducts specialized training programmes for the floor brokers to update their skills.

4.6.4 THE REGULATORS OF FUTURES CONTRACTS AND MARKET

To regulate the future derivatives each nation has set up the statutory regulators. In India, the following regulatory system is in practice:

a. **For Commodity Futures:** Forward Contracts (Regulation) Act, 1952 was passed in India. It is implemented by Forward Market Commission under Ministry of Consumer Affairs, Food and Public Distribution, Government of India.

b. **For Financial Futures:** The Securities Contract and Regulation Act (1952) was passed. It is implemented by SEBI since 1992 (the year of set-up).

4.7 SUMMARY

This unit discussed about the Derivatives Market Participants, Risks faced by the participants, Future Market Trading Mechanism. The role of facilitators in future trading isalso discussed in the length. An account of functions of floor brokers is given in this unit.

4.8 SELF ASSESSMENT QUESTIONS

1. Who are the participants in forward / future markets? Discuss.

2. What kinds of risks do participants face in derivatives market?

3. Briefly discuss the functions of clearing house in a future market.

4. Discuss the role of various facilitators in futures market.

4.9 CASE STUDY

Case Study 1

You are back in Mumbai after a grueling day in New Delhi. You were called by themandarins in the North Block to explain the cause of the crash in the price of the stock of your company- a leading Indian Software MNC. The investors were aghast at the stock price crash. The main charge was simple. Your company used futures trading for speculation Instead of normal hedging.

Before you can get out of our Shining Merc (which might get auctioned soon) mediapersonsare already all over the place thrusting microphones in your face- waiting for a sound bite. You barely mumble 'no comments' to the gathering but promise to get back with detailed description of events, to be transmitted live on the television, in a couple of hours.

As you sit down at your office table, and call for a RT (room-temperature) glass of Narial paanee (coconut water)-Since your friends tell that it is god when you have hyperacidity; you need a strong stomach lining to digest all the vitriol being offered to you.

When you look at the documents spread in front of you, the following details emerge:

(a) Since the exposure of your company is in USD, you chose to buy 6-month USD futures at a price that was above spot price for a long time, and you sell GBP futures for 9-months since pricing is very attractive, and you are expecting to receive payments for services rendered in about 8-months' time.

(b) As the maturity of USD futures approached, US of A attacked Iraq, leading to a jump in oil prices.

(c) Sensing trouble you immediately bought 3-months interest rate futures which weretrading below spot.

(d) Within a week of your purchase, markets started stabilizing and returned to normal behavior.

(e) But your board was uncomfortable with your position, and margin calls. They ask you to settle your position and face the jury, charging you for speculation in the markets with company money.

Questions

1. What additional information will you need?
2. How will you defend your case?

4.10 NOTES

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MODULE- II

FORWARDS AND FUTURES

UNIT - 5 : INTRODUCTION TO FORWARDS AND FUTURES

Structure:

5.0 OBJECTIVES

After studying this units, you will be able to:

- Understand the basic meaning of forwards and futures,
- Clearly distinguish between forwards and futures,
- Grasp why futures are traded
- Make a list of different futures contracts traded

5.1 INTRODUCTION

The forward contract is the most basic derivative contract. It just represents a commitment today to transact in the future. Forward markets for future delivery of commodities have been in existence for many centuries. Organized futures markets, however, are a relatively modern development dating only to the 19th century. Futures markets replace informal and privately traded forward contracts with highly standardized exchange-traded securities. Futures contract is simply the standard version of a forward contract. A considerable terminology surrounds these contracts. This unit introduces basic terminology and features of forward contracts vis-à-vis futures contracts and the mechanics of trading in these markets, followed by a brief note about pricing of these contracts.

5.2 FORWARDS

A forward contract is an agreement to buy or sell something in the future. The agreement is made today to exchange cash for a good or service at a later date. This differs from a spot transaction, where one party pays for a good or service, and immediately receives that good or service. In a forward contract there are two parties: the buyer and the seller. The buyer is said to have a long position, and seller a short position. The terms of the contract are agreed upon today, and delivery and payment take place in the future, at what is called either the delivery date, the settlement date, or the maturity date of the contract.

Money rarely changes hands when a forward contract is originated. Payment from the buyer of the forward contract to the seller is generally made only upon the delivery of the good. On the day that forward contract is originated, both parties face potential default risk, arising out of uncertainty concerning the other party's ability and willingness to fulfill the terms of the contract. For most of the forward transactions, there is no system to ensure performance of the contract.

A forward contract is to buy or sell a specific good on a specific future date; at a specified price. This price is called the forward price. Thus, a jewellery firm may agree today to buy 1000 grams of gold 3 months hence, at Rs.27550/10 gms. The forward price is Rs.27550/10gms. The forward price is likely to differ from the spot price, which is today's price for delivery of gold today. There may be many forward prices, one for each possible delivery date. For example, the forward price for delivery 6 months hence may be Rs.27890/10 gms.

A fair forward price will result in a forward contract that has no value when it is originated. Subsequently, the forward contract will likely become valuable for only one of the two parties. For the party that has a long position, the contract will have a positive value, or become an asset, when the forward price (for delivery on the settlement date of the original contract) rises.

For example, suppose that today is March 1, and Mr. X has agreed to buy gold 3 months hence, on June 1, at a price of Rs.27550/10 gms. The next month (say April 1), Rs. 27590/10 gm is the fair price for delivery of gold on June 1, (note that this is no longer a 3-month forward contract; it is a 2-month forward contract . Mr. X's long position now valuable. He has a contract that entitles him to buy gold at Rs.27550/10 gms. But new agreements, being originated on April 2, have a forward price of Rs.27,590/10 gms. His contract to buy gold at only Rs.27550/10 gms is a "bargain". The contract is a valuable asset for Mr.X. It then follows that the forward contract to sell gold at Rs.27550/10 gms has become a liability for the counterparty to the forward contract. The seller of the forward contract is obliged to deliver gold on June 1,at only Rs.27,550/10 gms, while new contracts are being created to sell gold at a higher price. Forward contracts, like all derivatives, are zero-sum games. Whatever one party gains, the other party must lose.

Table 1: Profit/Loss on a Forward Contract

Position	Forward Price	
	Rise	Fall
Long a forward contract	profit	loss
Short a forward contract	loss	profit

Table 1 summarises how the parties that are long and short a forward contract make profit or incurr losses when forward prices change from the original forward price that was agreed upon in the original contract.

The profits and losses associated with forward contracts are typically realised at delivery. Before delivery, as forward prices for delivery on the settlement date of the original contract fluctuate, each party could experience unrealised gains and losses. For either party, the forward contract may change from being an asset on some dates to being a liability. But the actual profit or loss is realised only on the delivery date. Payoff profile of forward contract on gold is demonstrated in table 2 with the assumed gold price in the spot market on expiry date of the contract.

Table 2 : payoffs to long and short positions

Spot price of gold in 4month(per gram)Rs	Payoff to forward contract (per gram)Rs (Forward Price = 2900/g)	
	Long Position	Short Position
3400	500	-500
3200	300	-300
3000	100	-100
2800	-100	100
2600	-300	300
2400	-500	500

Many forward contracts are cash settled. This means that no delivery takes place on the settlement date. The party with the profitable position receives a cash payment from the party with the loss position.

Traders and firms around the world transact in forward markets. There are well developed forward markets in many commodities such as coffee, rubber, etc., and precious metals such as gold. Forward contracts do not trade on organised exchanges. Instead, firms usually trade with financial institutions that make markets in forward contracts. This market is often called the OTC market; or the over-the-counter market.

Before winding up the discussion on forwards, the following unique features may be noted:

5.3 FEATURES OF FORWARDS

a) Forwards are transactions involving delivery of an asset or a financial instrument at a future date, and therefore, are over-the-counter (OTC) contracts. OTC products are customized contracts which are written across the counter or struck on telephone, fax or any other mode of communication by financial institutions to suit the needs of their customers.

b) Both the buyer and seller are committed to the contracts. They have to take delivery and deliver respectively, the underlying asset on which the forward contract was entered into.

c) Forwards perform the function of 'price – discovery' for commodities and financial assets. Both the buyer and seller of a forward contract are fixed to the price decided upfront.

d) As there is no performance guarantee in a forward contract, there is always counterparty risk.

e) In most cases, one of the counterparties of a forward contract is a banker or a trader squaring up his positions by entering into reverse contracts. These transactions do not take place simultaneously, so the banker or trader will normally keep a large bid-ask spread to avoid any loss due to price fluctuations. This procedure increases the cost of hedging.

5.4 FUTURES

A futures contract is an agreement to buy or sell an asset at a certain time in the future for a certain price. It is an agreement to deliver (sell) or take delivery (buy) of a standardised quantity of an underlying commodity/instrument, at a pre-established price agreed on a regulated exchange at a specified future date.

Futures have evolved out of forwards and are exchange – traded versions of forward contracts. They are one of the most popular and widely used derivative instruments.

5.5 FEATURES OF FUTURES

a) Futures are traded on organized exchanges with clearing associations that act as intermediaries between the contracting parties.

b) Futures are standardised contracts that provide for the performance of the contract either through deferred delivery of an asset or a final cash settlement.

c) Both the parties pay a margin to the clearing association. This is used as a performance bond by contracting parties. The margin paid is generally marked to the market price every day.

d) Each futures contract has an association month which represents the month of contract delivery or final settlement, for example – a September T-bill, a March Euro, A November Nifty futures, etc.

a) Why Futures are traded?

Futures contracts are bought and sold by a large number of individuals and businesses, and for a variety of purposes. Most individuals buy and sell futures because they wish to speculate about future price levels of the commodity that underlies a futures contract, whether it is silver, gold, corn, or crude oil. Businesses usually buy and sell futures for the opposite reason: to eliminate (or hedge) their risk exposure due to changes in the price of a commodity. Managers of a large pools of money, such as pension funds or mutual funds, may also use futures as a less costly way of achieving their portfolio goals.

(a) Speculation

It is easier for traders to take bigger deals in futures market with small investment than in the cash market as shown in box 1.

Box 1 Trading in Futures Vs Cash Market

Company X : Desired position: 1000 shares

Future Market	Cash Market
* Current stock price: Rs.200	* Current stock price : Rs.200
* Required Margin : 11%	* Value of purchase : Rs.2,00,000 (200 x 1000)
* Margin Money available Rs.22,000	
* Value of purchase : Rs.2,00,000	

Total Money required to take position in 1000 shares

Rs.22,000 Rs. 2,00,000

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If the stock price goes up by 10%

* profit =Rs.20,000 * profit Rs.20,000

$(2,00,000 \times \frac{10}{100})$

* Gain on amount invested * Gain on amount invested

$(\frac{20,000}{22,000} \times 100) = 92\%$ $(\frac{20,000}{2,00,00} \times 100) = 10\%$

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If the stock price falls…………..

* Loss is equal in both the markets

* Extra margin required to roll over F & O position

Speculators buy and sell futures contracts with the expectation of making windfall gains from changes in the price of the underlying commodity. A speculator who believes that gold prices will be higher in the future may buy gold now and hold it until a future time when he can sell it at the higher price. This is something not everyone may be willing to do, since it involves taking delivery of gold bullion and storing it. Another alternative is for speculators to buy a futures contract that permits them to take delivery of gold at some time in the future, presumably at a time when the price of gold is higher. Of course, for this strategy to be profitable, the futures price that a speculator pays now will have to be les than the price he will be able to sell the gold for after he takes delivery. Assuming that current futures prices are below what our speculator thinks gold prices will be in the future, he will buy a futures contract today, plan to take delivery (or otherwise offset his delivery obligation) of the gold at some point in the future, and then sell the gold at the later time for a profit. If he is wrong, and gold prices do not rise but in fact fall, the speculator will lose money. Thus trading futures is an easy and low-cost way for speculators to make bets on the future prices of various commodities.

(b) Hedging

Hedgers seek to protect themselves against price changes in a commodity in which they have an interest. They take a futures position with the objective of reducing their risk. Speculators, in contrast, willingly take an additional risk with the objective of profiting from price changes.

Take the simple case of a farmer, who has planted his cotton crop and is waiting to harvest it. He does not know the price at which he will be able to sell the cotton once it is harvested. Suppose that it is now April and that the farmer anticipates that he will be ready to sell his cotton by next September, five months from today. Although the current price of cotton is know, no one knows what the price of cotton will be in five months – it might be higher or lower.

The farmer is exposed to price risk. The price of cotton will fall significantly before he has a chance to bring the cotton to market and sell it. The futures markets enable the farmer to hedge (or reduce) his price risk. He can accomplish this by selling his cotton now, for future delivery: by simply selling (or shorting) September cotton futures contracts. For example, he can agree now, in April, to sell (or deliver) his cotton in September when he harvests it, at a price that he agrees to now (in April).

The price that the farmer will have agreed to sell cotton in September is the current price that is quoted for the September cotton futures contract. This price reflects the market's best guess as to what the price of cotton will be next September. This guess, of course, could turn out to be wrong: the price might be much higher or lower than everybody now thinks it will be. Many things can happen between April and September . For example, the weather maybe very dry, making crop yields low. This would cause a sharp rise in prices. Or the opposite could occur. Whatever happens, our farmer, by shorting futures contracts, is protected. He has locked in his selling price. He no longer has any price risk. If he had not hedged, on the other hand, lower prices might have significantly reduced his income.

5.6 SOCIO-ECONOMIC BENEFITS OF FUTUREs

An interesting question would be: why do futures contracts exist? Do they serve any useful purpose, or are they merely gambling instruments that have created speculation – based price volatility? Futures markets exists for several reasons:

a) Futures prices contain information. This is called "price discovery" function of futures. Commodity producers and consumers can get to know what the future spot price will be, and what future supply and demand of a good will be, by observing the current futures price. This would help them make better production and storage decisions.

b) The economic benefits of having a more accurate price estimate in advance are well known. More accurate price estimates result in a superior allocation of resources as both producers and consumers make better decisions about which commodities to produce, which to consume, how much to produce and consume in the present versus the future.

c) Futures make transactions across time easier. They allow firms and individuals to quickly create low cost agreements to exchange money for goods at future times. The transactions costs of trading futures are minimal relative to the rupee amount of the commodity underlying most contracts.

d) Futures allow businesses and individuals to hedge against undesirable price changes. Genuine producers and uses of commodities need not bother about unexpected price volatilities. They can transfer price risk to speculators and concentrate on doing what they do best: produce and use.

So long as futures are used for genuine hedging purposes, there are no risks. The potential risks arise mainly out of excessive use of futures for speculative gains. There are living examples of financial debacles suffered by companies like Procter and Gamble , Kashima Oil co., Orange County and others mainly due to the use of futures markets for the purposes other than genuine hedging.

5.7 FUTURES VS FORWARDS

A key distinction between futures and forward contracts is that the terms of a futures contract are standardized. Buyers or sellers of a gold futures contract cannot individually negotiate about how much gold must be delivered, the form and quality of the gold that will have to be delivered, and where delivery must take place. Indeed, a NCDEX gold futures contract requires the delivery of 1 Kg of gold bullion with a carat fitness of 0.999 at only exchange-approved warehouses. The parties to an analogous forward contract would customarily negotiate each of these terms.

Although highly standardized, a number of futures contracts with different delivery dates are commonly traded on a particular commodity exchange at any moment in time. There may, for example, be several gold futures contracts traded, each with a different delivery date, starting from the current month and going out one year into the future. Thus, traders can choose among several futures contracts which differ only by their delivery dates.

Table 3 Distinction between Forwards and Futures

Nature of Difference	Forwards	Futures
1. Size of Contracts	Customised	Standardized
2. Marked-to-market	Not done	Done
3. Margin	Not required	Required
4. No. of contracts	There can be many	Max. 12 a year
5. Hedging	These are tailor-made	Perfect hedging difficult
6. Market Liquidity	Illiquid	Liquid
7. Nature of market	Over-the-counter	Exchange traded
8. Mode of delivery	Specifically decided.	Most are cash settled

The purpose of standardizing futures contracts is to create an instrument that reduces to a minimum the transaction costs associated with trading a deferred delivery instrument. If all terms of a futures contract had to be individually negotiated by the parties to the contract, as they are in a forward contract, the costs would be much higher. Table 3 lists differences between forwards and futures. Further, by permitting trading in a contract with a limited number of designated delivery dates, trading is concentrated in relatively few discrete time intervals so that liquidity is enhanced.

5.8 TYPES OF FUTURES

Futures are broadly classified into commodity futures and financial futures. Commodity futures fall into four commodity groupings: agricultural (cotton, Jute, coffee, oilseeds, food grains, tea, sugar, wheat, yarn etc.) energy (oils), metals (both precious and industrial, bullion, silver, iron and steel, etc.) and chemicals and plastics.

Financial futures consist of stock futures, interest rate futures, foreign currency futures and stock index futures. *Interest rate futures* are futures contracts written on fixed-income securities or instruments. A fixed–income security or instrument requires the payment of interest in the form of fixed rupee amounts at predetermined points in time. Dealing in interest rate securities entails interest rate. It is the risk that the price (or market value) of a security will change. Two factors have contributed to the introduction and growth of interest rate futures: The enormous growth of the debt market and increased volatility of interest rates. Both factors have increased the need for an instrument to hedge or manage interest-rate risk involved in holding and trading fixed income obligations.

Foreign currency futures provide a mechanism for managing currency risk. A major impetus to their introduction was the end of a system of fixed exchange rates and the widespread adoption of floating exchange rates, which resulted in a sharp increase in exchange rate volatility (and therefore in exchange rate risk). The fixed exchange rate system that existed prior to 1973 was formalised in 1944 when the International Monetary Fund was created.

Stock index futures are contracts based on stock indexes such as sensex and nifty. These indexes provide summary measures of changes in the value of particular segments of the equity market – that covered by the specific index. Stock index futures are useful in managing large stock portfolios.

5.9 NOTES

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5.10 A CASE STUDY ON SPECULATION / HEDGING

June 2016 sugar futures are traded today (i.e. 7^{th} April) at MCX at a price of Rs. 2850 per quintal. The size of each futures contract on MCX is 10 tons. The margin money required to be deposited is 8% of total value of futures contracts.

A dealer in sugar is anticipating decline in sugar prices in the coming months. Accordingly he plans to take up June sugar futures contracts for a total of 38 tons.

Required:

1. What position will he be taking in the futures market?
2. How many contracts he needs to take?
3. How much margin money he has to deposit with the clearing house?
4. Suppose in the month of May 2016, June futures price fell by 10%. The dealer wants to wind up his position in the futures market. How can he do that?
5. What is the percent of profit/loss on his investment?

5.11 SUMMARY

The forward contract is the most basic derivative contract. A forward contract is an agreement to buy or sell something in the future. Both the buyer and seller of forward contract are committed to take delivery and deliver, respectively, the underlying asset. There is no performance guarantee in a forward contract.

Futures have evolved out of forwards and are exchange-traded. Trading in futures is subject to margin requirements. Future are traded both for hedging and speculative purposes.

The principal advantages of futures markets are price discovery and hedging price risk. The popularly traded futures contracts are interest rate futures, currency futures, stock futures and

5.12 KEY WORDS

Forwards Futures Speculation Hedging

5.13 SELF ASSESSMENT QUESTIONS

1. Define a forward contract. Discuss its features with suitable examples.
2. Distinguish between a spot contract and a forward contract.

3. Briefly explain the features of futures contracts.
4. Distinguish between a forward contract and a futures contract
5. Why futures are traded? Explain with suitable examples.
6. What are the different types of futures contracts?

5.14 REFERENCES

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UNIT- 6 : TRADING IN FORWARDS AND FUTURES

Structure :

6.0 OBJECTIVES

After studying this units, you will be able to:

- Understand the basics of trading in forwards and futures,
- Clearly grasp the concept of M2M,
- Clearly understand the concept of continuous compounding,
- Calculate the prices of futures , and
- Understand the modes of closing out a futures contract.

6.1 INTRODUCTION

The mechanics of trading in futures contracts are more complex than for ordinary stock transactions. In a stock purchase, a broker simply acts as an intermediary to enable the investor to buy shares from or sell to another investor through the stock exchange. In futures trading, however, the clearing house plays a more active role. A brief discussion of basic terms and institutions involved in futures trading is presented below.

6.2 CLEARING HOUSE

A clearing house also known as clearing corporation, plays an important role in the trading of futures contracts. It acts as an intermediary for the parties who trade in futures contracts. It ensures the performance of contracts by the parties, and thus boosts confidence in the system. The clearing house becomes the seller of the contract for the long position and the buyer of the contract for the short position. This arrangement makes the clearing house the trading partner of each trader, both long and short. The clearing house, bound to perform on its side of each contract, is the only party that can be hurt by the failure of any trader to observe the obligations of the futures contract. This arrangement is necessary because a futures contract calls for future performance, which cannot be as easily guaranteed as an immediate stock transaction.

The clearing house makes it possible for traders to liquidate positions easily. If one is currently long in a contract and want to undo his position, he simply instructs his broker to enter the short side of a contract to close out his positions. This is called a reversing trade. The broker nets out his long and short positions, reducing his net position to zero.

6.3 OPEN INTEREST

The open interest on the contract is the number of contracts outstanding. (Long and short positions are not counted separately, meaning that open interest can be defined as the number of either long or short contacts outstanding). The clearinghouse's position nets out to zero, and so is not counted in the computation of open interest. When contracts begin trading, open interest is zero. As time passes, open interest increases as progressively more contracts are entered. Almost all traders, however, liquidate their positions before the contract maturity date.

Instead of actually taking or making delivery of the commodity, virtually all market participants enter reversing trades to cancel their original positions, thereby realizing the profits or losses on the contract. Actual deliveries and purchases of commodities are then made via regular channels of supply, usually via warehouse receipts.

6.4 MARGIN REQUIREMENTS

When two parties trade a futures contract, the futures exchange requires some good faith money from both, to act as a guarantee that each will abide by the terms of the contract. This money is called **margin**. The margins are of three types: Initial margin, maintenance margin and varibale margin.

Initial margin: The initial margin is required at the start of a new transaction. It can be bought in the form of cash or Treasury bills. Usually the initial margin is a tiny fraction of the underlying notional principal amount. For instance, in NSE, if the initial margin for taking a position in the stock futures market for a given stock is 11%, a trader can take a contract of value of Rs.2,00,000 with a sum of Rs.22,000 as initial margin. Thus, futures are highly levered instruments which imply that with a very small amount, one can command large resources. Computer algorithms such as SPAN (Standard Portfolio Analysis of risk) are commonly used for establishing initial margin requirements. The algorithms analyse historical price data to derive VaR (Value at Risk) which measures the potential loss in a worst-case one-day price movement.

More specifically, exchanges commonly set initial minimum margin levels equal to m + 3s, where m is the average of the daily absolute changes in the rupee value of a futures contract and s is the standard deviation of these daily changes, measured over some time period in the recent past.

Let us take coffee futures contracts as an example. Each coffee futures contract is, say, for 100 bags of coffee. Let us assume that the current market price of coffee is Rs.12000 per bag, and that the average daily absolute price change is Rs.550 per bag. Further, assume that the standard deviation of the distribution of recent absolute daily price changes is Rs.230 per bag. Thus, m is equal to Rs.550 x 100 or Rs.55000; s is equal to 230 x 100, or 23000; and m + 3s = Rs.55000 + Rs.69000, or Rs.124000. This would be the initial margin requirement on a coffee futures contract. An exchange can change the required margin anytime. If price volatility increases, or if the price of the underlying commodity rises substantially, the initial margin will be increased.

Maintenance margin: The maintenance margin represents the minimum margin which needs to be maintained in individual margin accounts. It is akin to the minimum balance prescribed by banks in the case of savings deposit accounts.

Variable margin: The variable margin is calculated on a daily basis for the purpose of marking-to-market all outstanding positions at the end of each day. This is to be deposited most often in cash only. The day's closing price is generally used as the basis for the purpose of marking-to-market.

6.5 MARKING TO MARKET (M2M)

The process of marking profits or losses that accrue to traders on daily basis is called marking to market. Futures prices may rise or may fall everyday. Instead of waiting until the maturity date for traders to realize all gains and losses, the clearinghouse requires all positions to recognize profits as they accrue daily. If the futures price of cotton rises from Rs.4000 to Rs.4,100 per quintal , the clearinghouse credits the margin account of the long position for 500 quintals times Rs. 100 per quintal or Rs. 50,000 per contract. Conversely, for the short position, the clearinghouse takes this amount from the margin account for each contract held. This daily settling is called marking to market. It means the maturity date of the contract does not govern realization of profit or loss. Marking to market ensures that, as futures prices change, the proceeds accrue to the trader's margin account immediately.

Illustration of M2M

M2M helps to maintain the financial stability of the market by enabling losses in futures contracts to be collected in small increments as they are occurring rather than waiting until a contract matures. Consider that the spot price of gold is Rs 3000 per gram and the one year futures price is Rs 3150. Assume that each futures contract is for 1 Kg (i.e. 1000grams). And hence each contract value is 31,50,000. Further assume that the initial margin for gold futures contract traded at a recognized exchange is 4 pc, i.e., is Rs 1,26,000. Therefore, both the buyer and seller of the futures contracts would be required to deposit Rs 1,26,000 with their brokers.

Assume that an investor enters into a long position in a single gold futures contract at a price of Rs 3150 per gram on day 0. Suppose the next day the settlement price rises by Rs 50 per gram from Rs 3150 to Rs 3200 per gram. Price changes over the remainder of the year are shown in table 1.

Table 1 : Hypothetical settlement price in 1-year gold futures

Day	Futures price (Rs)	Change in Future price (Rs)	Cumulative change (Rs)	
			Per gram	Total for 1 contract
0	3150	Not applicable	-	-
1	3200	+50	+50	+50000
15	3240	+40	+90	+90000
50	3210	-30	+60	+60000
240	3140	-70	-10	-10000
365	3100	-40	-50	-50000

Even though the investor entered into a contract to buy gold at Rs 3150 per gram, the next day his contract is rewritten at a contract price of Rs 3200 per gram. To compensate him for agreeing to buy gold at a price Rs 50 higher than his original contact price, the clearing house of the exchange gives him Rs 50 per gram or Rs 50,000. This amount is credited to his brokerage account at the end of day 1, so at that point he would have Rs.1,26,000+Rs 50,000=Rs 1,76,000 in his account. Where does the Rs 50,000 come from? It comes from an investor who held short position in gold futures contract. Like him, the contract price of investor with short position is also reset to Rs 3200 per gram. But he has to pay the exchange Rs 50 per gram or Rs 50,000 for having his selling price adjusted upward in his favour. At the end of day 1, an investor who established a short position on day zero would now have Rs 1,26,000-Rs 50,000=Rs 76,000 in his brokerage account.

This adjustment continues till the last day of the contract. Suppose on the last settlement day the futures price is Rs 3100 per gram. By day 365 the gold futures price has gone up and down at least once. At the end of day 365, both long and short investors will be contracting to buy and sell gold at Rs 3100 per gram. Over the 365-day period, the long investor will have paid his broker a net Rs 50 per gram, and the short investor would have received Rs 50 per gram. Note that if the long investor will be required to buy gold at Rs 3100 per gram. After adding the Rs 50 per gram he has paid his broker in daily settlement, the total amount paid for the gold is Rs 3100+Rs 50 =Rs 3150, the initial contract price, similarly, the investor who is short will be required to sell for Rs 3100 per gram, but with Rs 50 he has received in daily settlement, he effectively sells gold for Rs 3150 per gram.

6.6 SETTLING A FUTURES POSITION

Once having established a futures position, traders have an obligation under the terms of the futures contract either to take delivery (a long position) or to make delivery (a short position) of the underlying commodity. However, making or taking *physical* delivery is only one of several ways that futures contracts can be settled. There are three common ways of liquidating a futures position: physical delivery; by making an offsetting futures transaction (called *offsetting*); and by *cash delivery*.

(1) Physical Delivery

Liquidating a futures position by making or taking physical delivery is usually the most cumbersome way to fulfill contractual obligations. It requires actually purchasing or selling a commodity, something traders would normally not want to do unless they had a particular need for the commodity (and in the large amounts required). A commercial firm, which deals in commodities, might very well wish to settle by physical delivery. In addition, at certain times it might be financially desirable to settle by physical delivery, even if it is inconvenient. To see how physical delivery works, let us take a particular futures contract: coffee traded on National Commodities and Derivatives Exchange (NCDEX). A trader who is short one coffee futures contract is required to make delivery of 50 bags of Coorg coffee of arabica quality.

The operational procedure for making physical delivery on futures differ by the type of futures contract. At the beginning of the delivery month on the exchange–designated notice days, let us say for the February 05 contract, exchange rules require that all traders having open positions in the February 05 contract notify their respective members that they intend to make or take delivery during February, and when and in what quantities such deliveries are desired. The exchange members in turn must notify the clearinghouse of their customers' intentions. After this nomination process is complete, the clearinghouse matches longs and shorts, usually by matching the oldest short position to the oldest long position until all short quantities are matched with a long. Delivery notices are then sent, via the customer's exchange members, to all parties, indicating to whom their delivery obligation runs and when, where, and in what quantities delivery is to be made. Exchange rules provide for substantial default penalties in the event that a party fails to perform. When delivery is satisfactorily made, the clearinghouse is notified and extinguishes on its books the obligations of the respective clearing exchange members. These exchange members in turn extinguish the corresponding customer obligations to them.

Physical delivery imposes obvious costs on traders: warehouse expenses, insurance costs, possibly shipping costs, and brokerage fees. In addition, if a long does not need the commodity for commercial purposes, he or she will have to re-sell it at an additional cost. Similarly, the short may have to purchase the commodity before he or she can make delivery. However, there are alternative ways of liquidating futures obligations which would avoid these costs.

An important aspect of physical delivery is its relationship to the *deliverable stock* of a commodity. By *deliverable stock* of a commodity is commonly meant the amount of a commodity that meets exchange -–specified quality standards and is available for delivery at exchange –specified locations (such as warehouses). Deliverable stocks, of course, may (and usually do) constitute far less of a commodity's stock than actually exists, in India and the rest of the world. Since it may sometimes be difficult to bring such stocks into *deliverable position*, however, the concept of a deliverable stock is relevant.

(2) Offsetting

The most common way of liquidating an open futures position is to effect an offsetting futures transaction – in effect, to reverse the initial transaction which established the futures position (shown earlier in Figure 9.1). Figure 9.2 Shows the order flow that would accompany such as offsetting transaction. The initial buyer (long) liquidates his position by selling (or going short) an identical futures contract (same commodity and same delivery month). Similarly, the initial seller (short) liquidates his position by buying (going long) an identical contract. After these trades are executed and reported to the clearinghouse, both traders' obligations are extinguished on the books of the clearinghouse and on the exchange members.

Let us suppose that on Jan 1, Mr. A takes up a long position (i.e., to buy) in the future market for one Kg of gold for April month; for Rs 2700/gm of gold. On 25th Feb, he decides to close out his position, and hence, enters into another future contract, now for short position, at Rs 2800/gm of gold for the same delivery month, i.e., April.

Mr. A's Account	Quantity	Cash flow on 30th April (Rs)
To pay for long position	+1000 grams	- 27, 00,000.00
To receive for short position	-1000 grams	+28, 00,000.00
Gain	nil	Rs 1,00,000.00

Offsetting the futures contract is an important technique to get out of a futures position. Movements in forward price generate paper gains and losses for those holding futures positions. By taking the offsetting position, the holder of futures contract locks the difference of price between the two period, i.e., t and t_{+1}. This gain or loss is not realized until the expiration date T. In simple term, once the party has offset the position, there will be no further gain or losses out of the forward position.

In comparison to making or taking physical delivery, settlement by offset is relatively simple. It requires only a liquid futures market to facilitate offsetting trades, and entails only the usual brokerage costs.

(3) Cash Delivery

This procedure is a substitute for physical delivery and completely eliminates having to make or take physical delivery. It is available only for futures contracts that specifically designate cash delivery as the settlement procedure. Physical delivery is not permitted on these contracts. Contracts on stock index futures use cash delivery to settle contracts.

The mechanics of cash delivery are simple: the price of the relevant futures contract, at the close of trading in that contract, is set equal to the cash price of the underlying commodity at that time. Any money owing to either the short or the long at that time, because of setting the futures price equal to the cash price, is transferred (via the clearing house) from the party who owes the money to the party who is owed the money. This procedure is obviously much simpler than making and taking physical delivery, since it avoids having to handle the physical commodity at all. It also means, however, that a buyer can no longer use a futures contract to acquire the physical commodity. He will have to buy the commodity elsewhere, if that is what he wants.

Exchanges have adopted cash delivery as an alternative to physical delivery for two reasons. First, the nature of the underlying commodity may not permit feasible physical delivery. For example, stock index futures would require physical delivery of hundreds or thousands of shares of stock in calculated proportions, requiring a cumbersome and costly delivery procedure. Second, cash delivery avoids the problem that it may be difficult for traders to acquire the physical commodity at the time of delivery because of a temporary shortage of supply. Cash delivery also makes it difficult for traders to manipulate or influence futures prices by causing an artificial shortage of the underlying commodity. The popularity of cash delivery has grown substantially in recent years, and has enabled exchanges to offer futures contracts that would not have been feasible without such a delivery mechanism.

6.7 PRICING OF FUTURES AND FORWARDS

The forward price of an asset is the price that is quoted today for delivery of the asset in the future, the price is contracted today but is paid when the asset is delivered in the future. This section explains the theory of pricing and valuation of forwards contracts. In particular, it describes the cost-of-carry price relationship and other key pricing concepts such as *contango, backwardation* and *basis.*

(1) Newspaper Quotes

Table 2 : Futures on NSE

	Price (Rs.)					
October	open	High	Low	close	Open Interest (000)	No. of contracts
ACC	1056	1078	1056	1064.6	1023.5	2074
Allahabad Bank	92.45	94.02	90.00	90.95	4676	2001

Source: www.nseindia.com

Many newspapers carry future quotations. In The Economic Times, futures quotations can currently be found in the NSE 'Derivatives' section. Table 2 shows the quotations for stocks as they appeared on NSE website on Nov. 21, 2013. These refer to the trading that took place on preceding day (NOV. 21, 2013).

a) Open: The price for the day's first trade that occurs during the time period designated as the opening of the market (or the opening call).

b) High: The highest price of a trade recorded during the day.

c) Low: The lowest price of a trade recorded during the day.

d) close: The closing price is usually determined by formula using the range of prices recorded within the closing period (such as the last minute of trading). It is determined by the exchange's settlement committee and is intended to indicate the fair value of the futures contract at the close of trading. As such, the settlement price is not usually the last trading price of the day, and sometimes may not even be within the day's price range.

e) Open Interest: This refers to the number of futures contracts that are open (or being held) at the close of the previous day's trading. In Table 6.2, the Nov. 2013 ACC futures contract shows an open interest of 10,23,500 at the close of trading on Nov.20.

f) Trading Quantity: Quantity is the total value of futures contracts at the end of the day for each stock.

g) Number of Contracts: This refers to the total number of futures contracts that are traded during the day. There were, for example, 200 futures contracts for Andhra Bank stock on Nov.20.

(2) Cost of Carry

Table. 3: NCDEX Barley Futures Prices

Spot price	Rs.1381.4
Dec. 2013	Rs.1384.5
Jan.2014	Rs.1422.0

Source: www.ncdex.com 22.11.2013

The first obvious feature of the price relationship shown in Table 3 is that the Jan(2014) futures price is always above the cash price. Second, the extent to which the Jan. futures price exceeds the cash price is largely determined by the time to delivery. The longer the time period before expiration, the more the futures price exceeds the cash price. Third, as the delivery date approaches the futures price slowly but inevitably converges to the cash price.

The extent to which the Jan.(2014) futures price exceeds the cash price at any moment is determined by what is commonly known as the *cost-of-carry*. This term refers to the costs associated with purchasing and carrying (or holding) a commodity for a specified period of time. These costs would include the financing costs associated with purchasing cash gold, storage costs, insurance, and any other costs involved in carrying the commodity forward in time. A measure of financing costs is the amount of money that would have to be used to purchase the cash commodity times the relevant interest rate for the period of time that the commodity is carried (such as three months or a Year).

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

Futures = cash + interest + storage
Price price costs per unit costs per unit

Symbolically,

$$FP_{t,T} = CP_t + CP_t \text{ x } R \text{ x } \frac{T\text{–}t}{365} + CS_{t,T} \qquad \ldots\ldots\ldots\ldots(1)$$

Where:

$FP_{t,T}$ = the futures price at time t for a futures contract requiring delivery at time T.

CP_t = the cash price at time t.

R = the risk-free interest rate per annum

$CS_{t,T}$ = the costs of storing the physical commodity per unit for the time period T minus t.

The formula (3.1) does not allow for the continuous compounding of interest costs but captures only the simple interest. In addition, the formula assumes that there are no transactional costs, all borrowing and lending is done at the same risk-free interest rate and commodities can be stored indefinitely without any change in their characteristics.

On the basis of these assumptions, let us use the above formula to see just how well it describes the price relationships that we observe between cash and futures gold prices. Suppose on Feb., 2014, the cash price of gold was Rs.2800 per gram. At the close of trading on Feb.28, the settlement price of the April 2014 gold futures contract was Rs.3258 per gram. The time duration of the contract is 2 months. The annualized borrowing rate was about 10.50 per cent. Finally, the cost of storing gold is significantly high at Rs.409. Inserting these numbers into equation (3.1) above, we have

$$2800 + [2800 \text{ x } 0.105 \text{ x } 2/12 + 409] = \text{Rs.}3258$$

Thus, the simple cost-of-carry formula works quite well in describing the relationship between cash and futures gold prices. However, this may not be true for all commodities at all times.

6.8 CONTINUOUS COMPOUNDING

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 the investment is

$A(1+r)^n$

If it is compounded m times per annum, the terminal value of the investment is

$$A\left(1+\frac{r}{m}\right)^{mn}$$

suppose that A = Rs.100, r = 10% per annum, and n = 1, so that we are considering one year. When we compound once per annum (m = 2), this formula shows that the Rs.100 grows to

Rs.100 x 1.1 = Rs.110

When we compound twice a year (m = 1), we earn 5% interest per six months, with the interest being reinvested, and the Rs.100 grows to

Rs.100 x 1.05 x 1.05 = Rs.110.25

When we compound four times a year (m=4), we earn 2.4% per 3 months, with the interest being reinvested, and the Rs.100 grows to

Rs.100 x 1.0254^4 = Rs.110.38

When we compound 365 times a year (m = 365), we earn 0.0274% per day with the interest being reinvested, and the Rs.100 grows to

Rs.100 $(1.000274)^{365}$ = Rs.110.52

The limit as m tends to infinity is known as continuous compounding. With continuous compounding, it can be shown that an amount A invested for n years at rate r grows to

$Ae^{r\,n}$

Where e is the mathematical constant, 2.71828. Suppose A = 100, n = 1, and r = 10% (or 0.1), so that the value to which A grows with continuous compounding is

$100e^{(0.1)\,(1)} = 110.52$

This is (to two decimal places) the same as the value using daily compounding. For most practical purposes, continuous compounding can be thought of as being equivalent to daily compounding. Compounding a sum of money at a continuously compounded rate r for n years involves multiplying it by $e^{r\,n}$. Discounting it at a continuously compounded rate r for n years involves multiplying by $1 / e^{r\,n}$ or $e^{-r\,n}$.

(i) Price of an Asset That Pays No Dividends

In this section and subsequent sections it is assumed that there are some market participants for whom the following are true:

a) the market participants are subject to no transactions costs when they trade.

b) the market participants are subject to the same tax rate on all net trading profits.

c) the market participants can borrow money at the same risk-free rate of interest as they can lend money.

d) there are no arbitrage opportunities.

The following notations will be used to explain pricing of different types of assets:

T: time when the forward contract matures (years)

S_o: price of asset underlying the forward contract today

F_o: forward price today

I: Present value of dividends/income on assets

r: risk-free rate of interest per annum, with continuous compounding, for an investment maturing at time T. (For derivation of continuous compounding formula, see Appendix 9A)

Subject to assumptions and notations mentioned above, the forward price of an asset providing no income is given by

$$F_0 = S_0 e^{rT} \qquad \ldots\ldots\ldots\ldots\ldots(2)$$

Example

Consider a forward contract to buy a zero-coupon bond that will mature in six months from today. The current price of the bond is Rs.850. Aassume that the risk-free rate of interest (continuously compounded) is 10 pc per annum. Using equation (3.2) with T = 6/12, r = 0.10, and S_o = Rs.850 to obtain the forward price,

$$F_o = 850e^{0.10x6/12} = \text{Rs. } 894$$

This would be the delivery price in a contract negotiated today.

(ii) **Price of a Fixed Income Generating Asset**

The price of an asset that provides income with a present value of I during the life of a forward contract is given by

$$F_0 = (S_0 - I)e^{rt} \qquad \ldots\ldots\ldots\ldots\ldots\ldots(3)$$

Example

Consider a 10-month forward contract on a stock with a price of Rs.150. We assume that the risk-free rate of interest (continuously compounded) is 8% per annum for all maturities. We also assume that dividends of Re.0.75 per share are expected after three months, six months, and nine months. The present value of the dividends, I, is given by

$$I = 0.75e^{-0.08x3/12} + 0.75e^{-0.08x6/12} + 0.75e^{-0.08x9/12} = 2.162$$

The variable T is 10 months or 10/12 years so that the forward price, F_0, from equation (3.3) is given by

$$F_0 = (150 - 2.162)e^{0.08x10/12} = Rs.158.04$$

(iii) The Effect of a Known Dividend Yield

Consider a situation where the asset underlying a forward contract provides a known dividend yield. This means that the income, when expressed as a percentage of the asset price, is known. We assume first that the dividend yield is paid continuously at a constant annual rate of q. To illustrate what this means, suppose that q=0.05 so that the dividend yield is 5% per annum. When the asset price is Rs.10, dividends in the next small interval of time are paid at the rate of 5% of Rs.10(or 5 paise) per annum; when the asset price is Rs.100, dividends in the next small interval of time are paid at the rate of Rs.5 per annum; and so on. In practice, dividends are not paid continuously, but in some situations the continuous dividend yield assumption is a good approximation of reality.

The forward price for an investment asset providing a continuous dividend yield at rate q is given by

$$F_0 = S_0e^{(r-q)T} \qquad \ldots\ldots\ldots\ldots\ldots\ldots(4)$$

Example

Consider a six-month forward contract on an investment asset that is expected to provide a continuous dividend yield of 5% per annum. The risk-free rate of interest (with continuous compounding) is 9% per annum. The asset's price is Rs.150. In this case S_0 = 150, r = 0.09, T = 0.5 (6/12), q = 0.05. From equation, the forward price F_0 is given by

$$F_0 = 150e^{(0.09-0.05)x0.5} = \text{Rs.}160.07$$

When the dividend yield is continuous, but varies throughout the life of the forward contract, q should be set equal to the average dividend yield during the life of the contract. Equation (3) can also be used in situations where there is a known dividend yield, but it is paid at discrete points in time. It is necessary to find the continuous dividend yield that is equivalent to the discrete dividend yield.

6.9 NOTES

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6.10 CASE STUDY

Mr. Amith Raj after completing his master's degree in commerce with finance specialization joined JP tyres Ltd as finance executive. He observed that the company is hardly using derivatives for controlling the price risk of inputs, particularly the rubber. Mr. Gopalam who is in charge of purchasing is having his own reservations about the futures market as they involve deposits of margin requirements and other rigidities. However, Mr. Raj was able to convince Mr. Gopalam to use atleast the forward market for hedging the rubber price exposure.

The company's practice is to procure rubber on the basis of quarterly budget. At the beginning of first quarter on 1st April. Mr. Gopalam took a long position in the June forward market for June delivery of 500 tons of rubber at a price of Rs.16000/quintal. Starting from 1st week of May the downtrend in rubber price sustained throughout and at the end of June reached the level of Rs.12000/quintal. This lead to the verbal exchange between Mr. Raj and Mr. Gopalam who all along used to manage without recourse to derivatives.

Questions:

1. What is the extent of loss incurred or profit made on the forward contract?
2. If the forward contract resulted in a loss, who is to be blamed?
3. If Mr. Raj had to take futures contract, do you think the profit made or loss incurred would have been different?
4. Under the given circumstance of the case, discuss the merits and limitations of using forwards as hedging tools vis-à-vis futures contracts.
5. What are the other derivative products Mr. Raj would have tried to hedge rubber price exposure?

6.11 SUMMARY

Trading in futures is subject to margin requirements. Future are traded both for hedging and speculative purposes. The principal advantages of futures markets are price discovery and hedging price risk. The popularly traded futures contracts are interest rate futures, currency futures, stock futures and commodity futures.

Clearing house plays an important role in futures trading by creating a platform for buyers and sellers and ensuring the performance of the contract through margin requirements and M2M. Majority of futures contracts are settled at maturity either by off-setting trade or by cash settlement. Settlement by physical delivery is common to forward contract but not to futures contracts.

Cost-of-a carry is the basic relationship that describes the pricing of futures contracts in commodities. In case of financial assets, theoretical futures price is based on time value of money with the assumption of continuous compounding. The value of a forward contract at initiation will be zero. Subsequently the forward contract becomes valuable to the parties depending on whether the price of underlying moves upward or comes down.

6.12 KEY WORDS

Clearing House Margin Marking to Market Cost of Carry

6.13 SELF ASSESSMENT QUESTIONS AND PROBLEMS

1. Briefly discuss the functions of a clearing house in a futures market.
2. What is margin money? Why it is collected? What are the different forms of margin money?
3. What is M2M? Illustrate the M2M procedure.
4. Briefly discuss the futures market trading mechanism in India.
5. How do you determine the price for the following investment assets

   (a) Investment asset which generates no income

   (b) Investment asset which generates a known cash income

   (c) Investment asset which generates a known dividend.
6. Calculate forward price from the following data

   Underlying = Coupon (interest) bearing bond

   Face value = Rs. 20,000

   Date of maturity = 31^{st} March 2016

   Coupon interest payments:

   On 30^{th} September 2013 = Rs. 1000

   On 31^{st} March 2014 = Rs. 1000

   Risk-free interest rates (continuously compounded)

   - 8% p.a. for six months

   - 10% p.a. for one year
7. Determine the futures price from the following data:

Spot price of the commodity = Rs. 90,000

Storage cost = 6% p.a. of spot price

Insurance cost = 4% p.a. of spot price

Transportation cost = 3% (fixed)

Financing cost = 12% p.a.

Carry period = 6 months

Use cost-of-carry model.

6.14 REFERENCES

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5. Introduction to Futures and Options Markets – By John Hull (PHI)
6. Derivatives – By D.A.Dubofsky and T.W.Miller (Oxford)

UNIT - 7 : USING FUTURES FOR HEDGING

Structure:

7.0 OBJECTIVES

After studying this units, you will be able to:

- The basic principle of hedging,
- The distinction between long hedge and short hedge,
- The meaning of 'basis risk',
- The concept of hedge ratio, and
- The mathematical expression of hedge ratio.

7.1 INTRODUCTION

The basics of futures contracts were discussed in the previous units. One of the major reasons for the existence of futures contracts is that they can be used for hedging the risk. Hedging involves transfer of risk by one party to another .The party who undertakes a futures contract with the objective of transferring risk is called the 'hedger'. The basic idea in a hedging strategy using futures market is to lock in a price today for a contract that expires on some future date. The companies with sizeable exposure in currency, commodity and interest rate markets use futures markets for bringing stability in their earnings.

7.2 HEDGING PRINCIPLES

The various factors that need to be considered while using futures to hedge are:

1) ***Size***: The quantity of a commodity or asset that is subjected to price risk is to be ascertained.

2) ***Type:*** The hedger has to chose an appropriate futures contract for hedging purpose. For example, a dealer in edible oils may choose a representative commodity like ground nut futures contract for hedging.

3) ***Time:*** The hedger should decide a futures contract of a particular month that is closer to the required timing of purchase or sale of the underlying commodity or asset. For example, a coffee curing firm which plans to buy raw coffee in the beginning of January may trade in January coffee futures.

4) ***Number of contracts***: The number of futures contracts that should be used to hedge is to be determined. For example, a bullion dealer who needs to hedge for 1.8 kilo of bullion may make use two futures contracts of 1 kilo each.

5) ***Hedge ratio****:* In order to determine the optimum size of the exposure to the size of the position taken in the futures market, appropriate hedge ratio needs to be determined.

The two special features of futures hedging strategies are described below:

1) Because futures contracts are standardised, the underlying asset, the delivery location, the quantity, and the delivery date may all differ from the asset that is being hedged. This risk is called basis risk.

2. If the underlying asset of the futures contract is sufficiently different from the asset being hedged, it is important to determine the degree to which price changes of the two assets are correlated. This is called hedge ratio.

One of the main reasons cited for the existence of futures markets is that they provide an effective way to transfer price risk at a low cost. Futures contracts are used to manage risk by taking a futures position that is opposite of the existing or anticipated cash position. In other words, a hedger sells futures against a long position in the cash asset or buys futures against a short position in the asset.

7.3 SHORT HEDGE

A short hedge is a hedge that involves a short position in futures contracts. A short is basically used to guard against the possible fall in the price of an asset to be sold later. It is appropriate when the hedger already owns an asset and expects to sell it at some time in future. It can also be used when a hedger does not own an asset right now, but knows that the asset will be owned at some time in the future. Consider for example, an exporter knows that he will receive U.S. dollars in 2 months. The exporter will realise a gain if the U.S. dollar increases in value relative to Rupee and incurs loss if dollar decreases in value relative to Rupee. A short futures position leads to a loss if dollar appreciates and a gain if it depreciates in value. It has the effect of offsetting the exporter's risk.

Example

Suppose that a cotton merchant has negotiated a contract to sell 850 quintals of long staple cotton on March 10. It has been agreed that the price that will apply in the contract is the market price on June 20. The merchant is therefore, in a position where he will gain Rs.8500 for each Rs.10 increase in the price of cotton per quintal over the next three months and lose Rs.8500 for each Rs.10 decrease in the price during this period. Suppose that the spot price on March 10 is Rs.4210 per quintal and the June cotton futures price is Rs.4190 per quintal. Suppose each futures contract is for the delivery of 50 bales of 170 kgs. each on NCDEX , the merchant can hedge his exposure by shorting 10 June futures contracts. If the merchant closes out his position on June 20, the effect of the strategy should be to lock in a price close to Rs.4190 per quintal.

Suppose that the spot price on June 20 proves to be Rs.4050 per quintal. The merchant realises Rs.34,42,000 for the cotton under its sales contract. Since June 20 is the delivery date for the futures contract, the futures price on June 20 should be very close to Rs.4050 on that date. The merchant, therefore, gains Rs.4190 – 4050 = Rs.140 per quintal or Rs.1,19,000 in total from the short futures position. The total amount realized from both the futures position and the sales contract is, therefore, Rs.4190 per quintal or Rs.35,61,000 in total.

For an alternative outcome, suppose that the price of cotton on June 20 proves to be Rs.4250 per quintal. The merchant realises Rs.4250 per quintal for the cotton and loses Rs.60(4250-4190)per quintal on the short futures position or Rs.51,000 in total from the short features position. The total amount realised from both the futures position and the sales contract is, therefore, Rs.4190 per quintal or Rs.35,61,500.

7.4 LONG HEDGE

A long hedge is a hedge that involves a long position in futures contracts. It is used to guard against the possible rise in the price of an asset to be acquired later. The hedger is either currently short the cash good or has a future commitment to buy the good at the spot price that will exist at a later date. In either case, the long hedger faces the risk that prices will rise. Because the long hedger has a long futures position and a short cash position, any subsequent price rise should lead to a profit in the futures market and a loss in the cash market. The hedger must also be aware that prices may fall, in which case a profit will be earned on the spot position, while a loss will be sustained in the futures market.

Example

Suppose that a tyre manufacturing company knows it will require 1000 quintals of rubber on May 15. It is, say, Jan.15 today. The spot price of rubber is Rs.20,350 per quintal and the May futures price is Rs.20,210 per quintal. The company can hedge its position by taking a long position in 10 May futures contracts and closing its position on May 15. The strategy has the effect of locking in the price of the rubber that is required at close to Rs.20, 210 per quintal.

Suppose that the price of rubber on May 15 proves to be Rs.20,260 per quintal. Since May is the delivery month for the futures contract, this should be very close to the futures price. The company gains on the futures contracts.

1000 x (Rs.20,260 – 20,210) = Rs.50,000

It pays 1000 x Rs.20,260 = Rs.2,02,60,000 for the rubber. The total cost is therefore Rs.2,02,60,000 – Rs.50,000 = 2,02,10,000 or Rs.20,210 per quintal. For an alternative outcome, suppose that the futures price is Rs.20,050 per quintal on May 15. The company looses approximately:

1000 (Rs.20,210 – Rs.20,050) = 1,60,000

on the futures contract and pays Rs.1000 x Rs.20,050 = Rs.2,00,50,000 for the rubber. Again the total cost is Rs.2,02,10,000 or Rs.20,210 per quintal.

Note that it is better for the company to use futures contracts than to buy the rubber on Jan 15 in the spot market. If it does the latter, it will pay Rs.20,350 per quintal instead of Rs.20,210 per quintal and will incur both interest and storage costs. It may thus be observed that any gains in the futures market offsets losses in the cash market so that futures hedging does not necessarily make financial position better.

7.5 CROSS HEDGE

For various reasons, hedging through futures contracts does not work perfectly in real life. For instance, the asset whose price is to be hedged may not exactly match with the asset underlying the futures contract. Such a situation prompts the hedger to use a similar asset underlying a futures contract for hedging purpose. This is called cross hedging. For example, an airlines company may use a future contract where the underlying is Arabian Gulf Jet fuel, though it needed aviation turbine fuel futures contract.

7.6 BASIS RISK

Basis refers to the difference between the futures price and spot price. *Basis risk* is the risk attributable to uncertain movements in the spread between a futures price and on spot price.

The basis risk arises in the following situations;

1) The asset being hedged is different from the asset underlying the futures contract

2) The date on which the hedge is to close out is different from the delivery date of the futures contract

3) The amount of asset being hedged is not an integer multiple of the contract size of the futures contract used to hedge.

If the asset being hedged exactly matches the asset underlying the futures contract, the basis risk can be reduced significantly. However, if there are no futures contracts on the asset being hedged, the hedger will have to carry out a careful analysis of all available futures contracts in order to decide which of these contracts have futures prices that are highly correlated with the price of the asset being hedged. Similarly, basis risk will be high if the time gap between the expiry date of the hedge and the delivery date of the asset is large. Generally, the rule is to chose a date later in the delivery month but as close to the expiry date of the hedge. For example, if the delivery month is August, the delivery date according to the contract is August 20 and the date the exposure ends is August 27, it would be better to take up a September contract rather than August Contract, this is because, if one hedges using a August Contract, the position is not covered for a period of seven days from August 20 to August 27, and the hedger faces the risk of unknown price movement in the spot market for these 7 days.

The basis in a hedging situation is :

Basis = Spot price of asset to be hedged _ Futures price of contract used

When the spot price increases by more than the futures price, the *basis* increases. This is referred to as a strengthening of the *basis*. When the futures price increases by more than the spot price, the *basis* declines. This is referred to as a weakening of the *basis*. To examine the nature of basis risk, the following notation is used:

S_1 : spot price at time t_1

S_2 : spot price at time t_2

F_1 : futures price at time t_1

F_2 : futures price at time t_2

b_1 : basis at time t_1

b_2 : basis at time t_2

Let a hedge is put in place at time t_1 and closed out at time t_2 . As an example, consider the case where the spot and futures prices at the time the hedge is initiated are Rs.1250 and Rs.1220, respectively, and that at the time the hedge is closed out they are Rs.1200 and Rs.1190 respectively. This means that

$$S_1 = 1250,\ F_1 = 1220,\ S_2 = 1200, \text{ and } F_2 = 1190.$$

From the definition of the *basis*

$$b_1 = S_1 - F_1$$
$$b_2 = S_2 - F_2$$

and in our example, $b_1 = 30$ and $b_2 = 10$.

Consider first the situation of a hedger who knows that the asset will be sold at time t_2 and takes a short futures position at time t_1. The price realized for the asset is S_2 and the profit on the futures position is $(F_1\text{-}F_2)$. The effective price that is obtained for the asset with hedging is, therefore,

$$S_2 + F_1 - F_2 = F_1 + b_2$$

In our example, this is Rs.1230. The value of F_1 is known at time t_1. If b_2 were also known at this time, a perfect hedge would result. The hedging risk is the uncertainty associated with b_2. This is known as *basis risk*. Consider next a situation where a company knows it will buy the asset at time t_2 and initiates a long hedge at time t_1. The price paid for the asset is S_2 and the loss on the hedge is $(F_1 - F_2)$. The effective price that is paid with hedging is, therefore,

$$S_2 + F_1 - F_2 = F_1 + b_2$$

This is the same expression as before and is Rs.1230 in the example. The value of F_1 is known at time t_1 and the term b_2 represents *basis risk*.

Choice of Contract

One key factor affecting *basis risk* is the choice of the futures contract to be used for hedging. This choice has two components:

i) The choice of the asset underlying the futures contract.

ii) The choice of the delivery month

If the asset being hedged exactly matches an asset underlying a futures contract, the first choice is generally fairly easy. In other circumstances, it is necessary to carry out a careful analysis to determine which of the available futures contracts has futures prices that are most closely correlated with the price of the asset being hedged.

The choice of the delivery month is likely to be influenced by several factors. In the examples earlier in this chapter, we assumed that when the expiration of the hedge corresponds to a delivery month, the contract with that delivery month is chosen. In fact, a contract with a later delivery month is usually chosen in these circumstances. This is because futures prices are in some instances quite erratic during the delivery month. Also, a long hedger runs the risk of having to take delivery of the physical asset if he holds the contract during the delivery month. This can be expensive and inconvenient.

In general, *basis risk* increases as the time difference between the hedge expiration and the delivery month increases. A good rule of thumb is, therefore, to choose a delivery month that is as close as possible to, but later than, the expiration of hedge. This rule of thumb assumes that there is sufficient liquidity in all contracts to meet the hedger's requirements. In practice, liquidity tends to be greatest in short maturity futures contracts. The hedger may, therefore, in some situations be inclined to use short maturity contracts and roll them forward.

Example

Suppose an Indian company has struck a sales contract with a Japanese firm on 2nd May and expects to receive 40 million Japanese yen at the end of November. The company is worried about the possible depreciation of Yen and, therefore, plans a short position in the Yen currency. Futures contracts have delivery months of March, June, September and December. The December futures price for the yen is currently Re.0.3900 (per Yen). Suppose one contract is for delivery of 10 million yen.

Strategy

The company can

1. Short four December yen futures contract on May 2.
2. Close out the contract at the end of November.

Basis Risk

The basis risk arises from the hedger's uncertainty as to the difference between the spot price and December futures price of the Japanese yen at the end of November.

The Outcome

When the yen arrived at the end of November, it turned out that the spot price was 0.36 and the futures price was 0.3625. It follows that:

Basis = 0.3600 – 0.3625 = -0.0025

Gain on futures = 0.3900 – 0.3625 = 0.0275

The effective price in Rupees per yen received by the exporter is the end-of-November spot price plus the gain on the futures:

0.3600 + 0.0275 = 0.3875

This can also be written as the initial December futures price plus the basis:

0.3900 – 0.0025 = 0.3875

7.7 THE HEDGE RATIO

Hedge ratio is concerned with the determination of proper number of futures contracts to buy or sell when one is hedging. The process of selecting which futures contract and the number of futures contracts to trade is frequently described as an "art". There is a need for gathering as much information as possible and carefully analysing the data to establish an 'estimate' of relationship between the price of the cash good being hedged and a futures price.

The hedge ratio is defined to be the ratio between the number of futures contracts (each on one unit of an underlying asset) required to hedge one unit of a cash asset that must be hedged. For example, if 0.90 rubber futures contracts (each on one quintal of rubber) must be sold to hedge the future production of one quintal of rubber, then the hedge ratio is 0.90.

A critical factor for a hedger is to determine the optimal futures position to assume, or to determine the optimal hedge ratio. If, for example, the hedger wishes to minimize risk, he must take a futures position (i.e., the number of futures contracts times the quantity represented by each contract) that will result in the maximum possible reduction in the variability of the value of his total (hedged) position.

A general definition of a hedge ratio (HR) is :

$$HR = \frac{Q_f}{Q_c} \qquad \ldots\ldots\ldots\ldots\ldots\ldots\ldots(1)$$

Where Q_f is the quantity (or units) of the commodity represented by the futures position, and Q_c is the quantity (or units) of the cash commodity that is being hedged. If, for example a 4000 bags coffee short futures position is taken to hedge a 5000 bags coffee cash position, the HR equals 0.80. Though a hedge ratio of 1.0 was considered in the previous examples, a ratio of less than 1 a reality. In the previous example, the hedger's exposure was on 1000 bags of coffee beans and futures contracts were entered into for the delivery of exactly this quantity of beans. As the objective of the hedger is to minimise risk, setting the hedge ratio equal to 1 is not necessarily optimal. The hedge ratio that minimizes risk (HR^*) is defined as

$$HR^* = \frac{Q^*_f}{Q^*_c} \qquad \ldots\ldots\ldots\ldots\ldots\ldots\ldots(2)$$

Where Q^*_f is the quantity (or units) of futures that minimizes risk. To understand how the value of this ratio is determined, consider the following:

“V_H = “ CP x Q_c - “ FP x Q^*_f ....…..………(3)

Where “ V_H is the change in value of the total hedged position, “ CP is the change in the cash price, “ FP is the change in the futures price, Q_c is the cash position, and Q^*_f is the futures position that minimizes risk. Both Q_c and Q^*_f are assumed to be constant for the life of the hedge. If the change in the value of the hedged position is set equal to zero (making variability equal to zero), then

“CP x Q_c = “ FP x Q^*_f

and

$$\frac{\text{“CP}}{\text{“FP}} = \frac{Q^*_f}{Q_c} \quad \text{…..………(4)}$$

Since $HR^* = Q^*_f / Q_c$, the value of optimal hedge ratio is

HR^* = “CP/”FP …………….(5)

or is equal to the ratio of the change in the cash price to the change in the futures price. For example, if cash price changes by Re.1 for every Rs.1.2 change in the futures price, the minimum–variance hedge ratio will be

$$HR^* = \frac{\text{Re. } 1.00}{\text{Rs. } 1.20} = 0.83$$

This ratio can be used to determine the number of futures contracts with which to hedge. For this purpose, equation (4.4) can be restated as

$$Q^*_f = Q_c \times \frac{\text{“CP}}{\text{“FP}} \quad \text{…....………(6)}$$

or as

Q^*_f = Q_c x HR^* ….......………(7)

As Q^*_f is equal to the product of number of futures contracts (N^*_{fc}) that minimises risk and the quantity (or units) of the commodity represented by each futures contract (Q_{fc}) :

$$Q^*_f = N^*_{fc} \times Q_{fc} \qquad \text{.................(8)}$$

Therefore,

$$N^*_{fc} \times Q_{fc} = Q_c \times HR^* \qquad \text{.................(9)}$$

And

$$N_{fc} = \frac{Q_c}{Q_{fc}} \times HR^* \qquad \text{...................(10)}$$

The equation (4.10) is the general formula used to determine the number of futures contracts with which to hedge in order to achieve the minimum–variance hedge.

To illustrate how this formula is used, consider the case of hedging a long cash position of 5000 bales of long staple cotton by selling cotton futures on NCDEX. Assume that for every Rs.50 change in the cotton futures price, there is a Rs.35 change in the cotton cash prices. To establish the minimum–variance hedge, how many futures contracts should be sold? Using equation (4.5), we know that

$$HR^* = \frac{0.35}{0.50} = 0.70$$

and as each contract on NCDEX is for a delivery of 50 bales, using equation (10)

$$N^*_{fc} = \frac{5000 \text{ bales}}{50 \text{ bales}} \times 0.70 = 70$$

Thus, the minimum-variance hedge requires selling 70 contracts on NCDEX.

Estimating HR^*

The hedge ratio is a key concept in hedging. Much of the discussion about hedging strategy focuses on how best to estimate and calculate this ratio. The optimal hedge ratio, HR^*, is the slope of the regression equation when DCP is regressed against DFP:

$$DCP = a + b\,DFP$$

or

$$y = a + bx \qquad \text{.................(11)}$$

where y is dependent variable, i.e., DCP and x is independent variable, i.e., DFP. The parameters 'a' and 'b' in equation (11) are usually estimated from historical data on DCP and DFP. A number of equal non-overlapping time intervals are chosen and the values of DCP and DFP for each of the intervals are observed. Ideally, the length of each time interval should be the same as the length of the time interval for which the hedge is in effect.

Alternatively, the optimal hedge ratio is the product of coefficient of correlation between DCP and DFP and the ratio of standard deviation of DCP to the standard deviation of DFP.

$$HR^{*} = r \frac{s_{DCP}}{s_{DFP}} \qquad \text{………..(12)}$$

7.8 NOTES

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7.9 ILLUSTRATIVE PROBLEM

Company X has negotiated a contract on June 15 to sell 100 M.T (1 M.T = 1,000 kgs.) of sugar (standard grade). The price in the sales contract is the spot price on September 16. The spot price of sugar is Rs.2,550 /q and the September futures price is Rs.2,510 /q. Devise a hedging strategy such that the company should receive a price close to Rs.2,510 /q. Show the result if the price on September 16 happens to be (a) Rs.2,470 /q (b) Rs.2,565 /q.

Solution

Hedging Strategy

June 16 : Short 10 September futures contracts on sugar

(as minimum lot size is 10 MT on NCDEX)

September 16: Close out futures position

Result

(a) Price of sugar on September 16 is Rs.2470.00

The price received on sales contract 2470.00

Gain on futures contract 40.00

(2510 – 2470)

Total 2510.00

(b) Price of sugar on September 16 is 2565.00

The price received on sales contract 2565.00

Loss on futures contract -55.00

(2510 – 2565)

Total 2510.00

7.10 CASE STUDY 1 : GOLDEX LTD.

Mr. Amla, a post-graduate in finance, joined Goldex Ltd. as its CFO. Goldex is engaged in the production and marketing of gold jewellery. On resuming duty as CFO, Mr. Amla found that the company has not used futures market for hedging price risk. The purchasing committee which met on Jan 5, decided to buy 100 kgs. of gold in June. The current spot price is Rs.29,560 /10 gms. The one-year interest rate is 8% and the present value of storage cost of each 10gms of gold for six months is determined to be Rs.285

Mr.Amla found that the actual June futures price equals the theoretical futures price. Further, he has collected the data relating to weekly average percentage change in the spot and future price of gold for 20 weeks (Table). He is planning to trade futures on NCDEX. Though the management was sceptical about the proposal to use futures market, Mr. Amla succeeded in convincing the management about the utility of futures market.

Table : weekly average percentage change in spot and futures price of gold for the last 20 weeks

Trading Week	Spot Price(%)	Future Price(%)	Trading Week	Spot Price(%)	Future Price(%)
1	2.1	2.8	11	-0.5	1.1
2	2.3	3.4	12	1.1	2.4
3	1.8	2.9	13	0.6	1.9
4	-0.2	1.3	14	0.9	2.8
5	0.7	1.5	15	1.3	2.5
6	1.3	3.6	16	1.8	3.3
7	0.9	1.8	17	0.6	2.1
8	1.2	2.7	18	0.7	2.2
9	0.5	1.3	19	1.4	3.1
10	1.5	3.6	20	0.6	1.8

Discussion Questions:

(1) In order to hedge the price risk due to possible rise in the price of gold in June, guess what strategy Mr. Amla would have put to work?

(2) Determine the hedge ratio Mr. Amla would have used in his Strategy.

(3) How many contracts do you think Mr.Amla would have traded in the futures market, given that each gold futures contract is for the delivery of I kg. of gold?

(4) Suppose on the settlement date (after 6 months from now) the spot price of gold turned out to be Rs.30,290/10 gms., what will be the impact on the profitability of the company ?

(5) What would have been the impact on company's profitability if Mr. Amla did not trade futures contracts?

7.11 SUMMARY

This unit provided a brief discussion of hedging decisions using futures contracts. By buying futures when a price risk leads to a loss, and selling futures when price declines are undesired, one can avoid the adverse consequences of price changes. The hedger should identify the net exposure to risk. He should determine what happens if price rise or fall. This helps in deciding whether futures should be bought or sold. The hedge ratio is the ratio of the size of the position taken in futures contracts to the size of the exposure. If the hedgers wish to minimise the variance of their total positions, it may be optimal to use a hedge ratio different from 1.0.

7.12 KEY WORDS

Hedging principles Long hedge Short hedge Cross hedge Hedge ratio

7.13 SELF ASSESSMENT QUESTIONS AND PROBLEMS

1. Define hedging. What principles need to be considered while using futures for hedging?
2. Define a short hedge and long hedge. Under what circumstances a short hedge and a long hedge are appropriate?
3. Define ' Basis Risk' . Illustrate with a suitable example.
3. Illustrate, with a suitable example, the procedure for estimating hedge ratio.
4. A trader enters into a short Long staple cotton futures contract when the futures price is Rs.4,892 per quintal. The contract is for the delivery of 10 tons. How much does the trader gain or lose if the cotton price at the end of the contract is (a) Rs.4810 per quintal; (b) Rs.5,005 per quintal.
5. Suppose that the standard deviation of quarterly changes in the price of a commodity is Rs.65, the standard deviation of quarterly changes in a futures price on the commodity is Rs.81, and the coefficient of correlation between the two changes is 0.8. What is the optimal hedge ratio for a three-month contract? What does it mean?
6. An investor has invested in 2000 shares of MTN Ltd. The spot market value of stock is Rs.135. He wants to keep the investment for another one month but expects a fall in its price. The investor chooses to hedge by buying futures contracts on NIFTY. The standard deviation of the change in the price of MTN stock over a one-month period is 12. The standard deviation of change in futures price of NIFTY Index over a one-month period is Rs.21 and the co-efficient of correlation between the one-month change in price of

MTN stock and one-month change in the NIFTY futures price is 0.64. Determine the minimum-variance hedge ratio (HR*) and the number of NIFTY contracts required.

7.14 REFERENCES

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6. Derivatives – By D.A.Dubofsky and T.W.Miller (Oxford)

UNIT - 8 : STOCK INDEX FUTURES

Structure :

8.0 OBJECTIVES

After studying this units, you will be able to:

- understand the basic meaning of stock index and stock index futures,
- The basics of trading specifications stock index futures,
- Make a list of popularly traded stock indices in India,
- Find the price of a stock index future, and
- Illustrate the application of stock index futures for portfolio hedging.

8.1 INTRODUCTION

Stock index futures are the contracts written on a particular stock index like SENSEX. These are one of the earliest financial futures introduced. The first index future contract was traded at Kansas Board of Trade, USA, in 1982. Since then many leading derivative exchanges throughout the world have started trading index futures. The basic objective behind creation of index futures can be attributed to the need of portfolio managers to hedge their portfolio risk. Index futures are ideal for hedging the risk of a portfolio of stocks. In recent times, index futures are also increasingly used for speculative, arbitrage and portfolio insurance. Therefore, index futures have turned out to be versatile instruments in derivatives market all over the world. Trading of BSE Sensex futures commenced at BSE on 9th June, 2000. Trading of Nifty futures commenced at NSE on 12th June 2000. This chapter provides an overview of stock index futures and their specifications and illustrate the procedure for using index futures for hedging purpose.

8.2 MEANING OF STOCK INDEX FUTURES

An 'index' is just a number that is computed to measure the price movements of stocks, bonds and commodities. Stock market indexes are meant to capture the overall price behavior of equity markets. A stock market index is created by selecting a group of stocks that are representative of the whole market or segment of the market. For example, the BSE sensex index is made up of 30 stocks that are traded on the BSE. The index value tracks the movement of the market as a whole, which simply means that index measures the changes in the value of a portfolio of stocks. An index is calculated with reference to a base period and a base index value. Major stock indices actively traded in Indian stock exchanges are listed in Appendix 6A.

Stock index futures are futures contracts in which the underlying asset is some stock index. A stock index future is a distinctive financial derivative for the following reasons:

1) It is basically an exchange traded derivative

2) The price of index futures is always quoted in terms of index points and not in terms of currency.

3) The contract size is specified as a multiplier. The multiplier for the BSE Sensex future contract is 15. This means that contract size is 15 times the Sensex index points. If the Sensex index is 20,100 points, the contract value is Rs.3,01,500.

4) The mode of settlement is compulsorily on cash basis. This is because indexes are not physically deliverable.

5) The price of index futures is different from value of index futures. The price of index futures is always quoted in terms of index points and not in term of currency. The value of futures contract is calculated in terms of currency by multiplying index points by the contract size (ie., multiplier).

6) The creation of stock index future contract is attributed to the need of stock market investors, particularly portfolio managers who are concerned about possible decrease in the value of portfolio. Managing the risk by dealing in individual stocks would be very expensive. Instead stock index futures proved to be an ideal derivative for hedging price risk of a portfolio of stocks.

8.3 MAJOR INDICES TRADED IN THE INDIAN CAPITAL MARKET

(1) Sensex

Sensex is the most widely used equity price index in the country. It is constructed with the base year to be 1978-79, and comprises of 30 scrips of listed companies on the Bombay Stock Exchange. The index has been serving the purpose of quantifying the price movements and also the sensitivity of the market in an effective manner.

(2) BSE – 200 and the Dollex

Bombay Stock Exchange introduced a new index series in May 1994 with the title BSE-200 along with the dollar-linked version of the BSE-200 called Dollex. For construction of this index, equity shares of 200 companies selected on the basis of their market capitalization and other factors from the specified and non-specified categories of listed companies on The Stock Exchange, Mumbai, are included. The index is constructed taking the year 1989-90 as the base. The index is constructed on the weighted aggregative basis, with the number of equity shares outstanding as weights. On a given day, the index is calculated as the percentage of the aggregate market value of the equity shares of all the companies (in the sample) on that day to the average market value of those companies during the base period.

(3) NIFTY

The NSE-50 index was launched by the National Stock Exchange of India Limited, taking as base the closing prices of November 3, 1995 when one year of operations of its Capital Market segment were completed. It was subsequently renamed S&PCNX Nifty – with S&P indicating endorsement of the index by Standard and Poor's and CNX standing for CRISIL NSE Index. The index is based on the prices of the shares of 50 companies (chosen from among the companies traded on the NSE). The base value of the index has been set at 1000.

(4) NIFTY Junior

While S&PCNX Nifty index includes highly liquid companies with a market capitalization of more than Rs.5 billion, the S& P Nifty Junior includes companies which are highly liquid, have a market capitalization of at least Rs.2 billion and which are other than those included in the S& P CNX Nifty index set. It was introduced on January 1, 1997, with a base date as November 4, 1996 and base value as 1000.

(5) BSE National Index

BSE started a new index in January 1989, called National Index comprising of 100 scrips from the specified and non-specified categories of listed companies on the country's five major stock Exchanges at Mumbai, Kolkata, Delhi, Ahmedabad and Chennai. In addition to being a relatively broad-based index, this index enabled the assessment of stock price movements on a national level. However, since October 1996, the prices of The Stock Exchange, Mumbai, only are taken in to account for calculation of the index, which is now designated as the BSE Index.

(6) BSE 500

The BSE 500 Index is a broad-based index comprising of 500scrips chosen from among top 750 companies listed on The Stock Exchange, Mumbai, in terms of market capitalization. The index is very broad-based covering all the 23 major industries and 102 sub-sectors of the economy. The index has the base date fixed at February 01, 1999 and has the base value set at 1000.

8.4 CONTRACT SPECIFICATIONS

A typical stock index contract specifies the underlying stock index, the contract size, the tick size, and the margins to be maintained. It also contains the month in which the contract is going to expire. Some samples contracts on stock indices are given in Box 1 and Box 2. Box 6.1 contains contract specification in respect of the Sensex Futures, traded on the BSE. Another example of contract specification of an S&P NIFTY futures contract are given in Box 1

It may be noted that every index futures contract has a "multiplier" which for instance is 15 for SENSEX. This is used for determining the value of a futures contract. For example, the value of a futures contract on SENSEX, when SENSEX value is 20,000, would be equal to 20,000 X 15 = 3,00,000. The minimum and maximum movements in prices of futures contracts are provided by exchange. It is evident that the underlying in these contracts are, respectively, SENSEX and S&P CNX Nifty indices. In each of these contracts the life time of every series is 3 months at any point in time, 3 series are open for trading including those expiring in the near month, next month and far month. In each case the contract matures on the last Thursday of the designated month.

Nifty Futures

Underlying symbol denotes the underlying index which is S&P CNX Nifty.

S&P CNX futures contracts have a maximum of 3-month trading cycle – the near month (one), the next month (two) and the far month (three). A new contract is introduced on the trading day following the expiry of the near month contract. The new contract will be introduced for a three month duration. This way, at any point in time, there will be 3 contracts available for trading in the market i.e., one near month, one mid month and one far month duration respectively. S&P CNX Nifty futures contracts expire on the last Thursday of the expiry month. If the last Thursday is a trading holiday, the contracts expire on the previous trading day. The permitted lot size of S&P CNX Nifty futures contracts is 200 and multiples.

Box 1 : Contract specifications for futures on Sensex

Source : *The Stock Exchange, Mumbai* – www.bse.india.com

The price step in respect of S&P CNX Nifty futures contracts is Re. 0.05. Base price of S&P CNX Nifty futures contracts on the first day of trading would be theoretical futures price. The base price of the contracts on subsequent trading days would be the daily settlement price of the futures contracts.

There are no day minimum/maximum price ranges applicable for S&P CNX Nifty futures contracts. However, in order to prevent erroneous order entry by trading members, operating ranges are kept at $\pm$ 10%. In respect of orders which have come under price freeze, members would be required to confirm to the Exchanges that there is no inadvertent error in the order entry and that the order is genuine. On such confirmation the Exchange may approve such order. Quantity Freeze for S&P CNX Nifty futures contracts would be

20,000 units or greater. However, in exceptional cases, the Exchange may, at its discretion, not allow the orders that have come under quantity freeze for execution for any reason whatsoever including non-availability of turnover/exposure limits.

Sensex Futures

The underlying for the SENSEX futures is the BSE Sensitive index of 30 scrips, popularly called the SENSEX. The contract multiplier is 15. This means that the Rupee notional value of a futures contract would be 15 times the contracted value. The ticker symbol is BSX. Regulations permit introduction of futures upto 12 months maturity initially. However, futures for the three near months have been introduced. The expiry date has been fixed as the last Thursday of the month for each month.

Box 2 :Contract specifications for Futures on S&P CNX Nifty

Item	*Specification*
Security Description	UDITX NIFTY
Underlying Unit	S&P CNX Nifty Index
Contract Size	200 or multiples thereof
Price Steps	Re. 0.05
Price Bands	Not applicable
Trading Cycle	A maximum of three month trading cycle the near month (one), the next month (two) and the far month (three). New contract is introduced on the next trading day following the expiry of near month contract.
Last Trading/Expiration day	The last Thursday of the expiry month, or the preceding trading day if the last Thursday is a trading holiday
Settlement	In cash on T+1 basis
Final Settlement Price	Index closing price of the last trading day.[1]
Daily settlement price	Closing price of futures contract
Settlement day	Last trading day

1. On the last day, the futures closing price for each Nifty futures contract is computed by taking the weighted average price for the last half-an-hour's trades.

Source: *NSE Fact Book 2000*

The day after the expiry, a new future would come into existence for next month maturity. For example on 30th of June the September future would come into existence offer expiry of August futures. The tick size is "0.1". This means that the minimum price fluctuation in the value of a future can be only 0.1. In Rupee terms, this translates to minimum price fluctuation of Rs.1.5 (Tick size X contract Multiplier = 0.1 X Rs.15).

The futures closing price will be calculated based on a set of 120 price points of the cash sensex values taken between the last half an hour of trading. The highest and lowest 20 price points will be ignored and closing price computed as an average of the remaining 80 price points. This process will ensure that manipulation of the closing price by moving it in one direction for a short duration or for only a few contracts is eliminated.

The profits and losses would depend upon the difference between the price at which the position is opened and the price at which it is closed. Consider the followings examples:

Position – Long –Buy June Sensex Futures @ 18,000

Payoff : Profit – If the futures price goes up

Loss – if the futures price goes down

Calculation – The profit or loss would be equal to fifteen times the difference in the two rates. If June Sensex Futures is sold at 19,000 there would be a profit of 1000 points which is equal to Rs.15,000 (1000X15)

However if the June Sensex Futures is sold at 17,500 there would be a loss of 500 points which is equal to Rs.7,500 (500X15).

8.5 PRICING OF INDEX FUTURES

A Stock index traces the change in the value of a hypothetical portfolio of stocks. The value of a futures contract on a stock index may be obtained by using the *cost of carry model*. For such contracts, the spot price is the "spot index value", the carry cost represents the interest on the value of stocks underlying the index, while the "carry return" is the value of the dividends receivable between the day of valuation and the delivery date. Accordingly, indices are thought of as securities that pay dividends, and the futures contracts valued accordingly. The valuation of stock index futures may be done as follows:

Case 1 : When the securities included in the index are not expected to pay any dividends during the life of the contract:

F = $\boldsymbol{S_0 e^{rt}}$

Where F is the value of futures contract, S_0 is the spot value of index, r is the continuously compounded risk-free rate of return, and *t* is the time to maturity (in years).

Example

Calculate the value of a futures contract using the following data:

Spot value of index = 16,550

Time to expiration =76 days

Contract multiplier = 100

Risk-free rate of return = 7.7% p.a.

From the given information, we have

Spot value, = 16,550

Time to expiration =76/365 year

Accordingly,

$$F = S_0 e^{rt}$$

$$= 16{,}550 \left(\frac{76}{365}\right)(0.077$$

$$= 16{,}550 * 1.01615$$

$$= 16817.2825$$

Thus, the value of a contract = 16817.2825 *100 =16, 81,728.25

Case 2: : When the securities included in the index are expected to pay any dividends during the life of the contract. Pricing of index futures contracts is based on the same principle as applicable to any others financial asset, i.e,

$$F = (S_0 - D)\, e^{rt}$$

Where, S_o = index value at present

F= Futures price

r = risk-free rate; and

T = time to maturity

D = present value of dividends on all stocks in the index.

In case the estimated dividend yield (d) is provided, the above formula can be restated as;

$F = S_o \times e^{(r-d)T}$

Example

Consider a 3-month futures contract on the BSE 30 Sensex index. Assume that the dividend yield is estimated to be 4%. The current value of the index is 19,600 points, and the risk-free rate is 8%. What will be the price of the futures contract with expiry in three months?

Since $F = S \times e^{(r-d)T}$

$=19,600 \times e^{(0.08-0.04)(90/365)}$

$=19,794.21$

Thus, the value of the future contract will be $19,794.21 \times 15$ = Rs. 2,96,913.15

8.6 PORTFOLIO HEDGING

A portfolio of shares can be hedged by selling an appropriate number of index futures contracts. This requires: (1) Selection of an appropriate index that matches with the portfolio.(2) Estimating beta of the portfolio. If the portfolio to be hedged is typically different from the portfolio of stocks underlying the index on which the futures are written, hedging will not be optimal.

The beta (b) of the portfolio indicates the degree of correlation between the returns in portfolio and market index. For instance, b value of 1 means that the return in the portfolio tends to follow the return on the market. If b=0.5, given 1% increase in the return on market, there shall be 0.5% increase in the return on portfolio. Therefore, b value is the determining factor in deciding the number of future contracts to be taken up for hedging:

$$N = b \times S/F$$

Where, S is the value of the portfolio and F s the price of the futures contract(i.e., futures price x size of each contract).

Example

A investor has a portfolio of five stocks of value of Rs.78,98,000 . On June 1st he is expecting a possible fall in the prices of the shares in the near future. Accordingly, he decides to use Nifty futures to hedge against the possible fall in the value of his portfolio.

i. The current Nifty value is 5850

ii. Nifty futures can be traded in units of 200 only

iii. Risk-free rate of interest is 8%.

iv. Expected dividend yield on portfolio is 3%

v. Portfolio beta is 1.5

The current futures price should be:

$$F = S_o \times e^{(r-d)T}$$

$$= 5850 \times e^{(0.08-0.03)0.25}$$

$$= 5923.58$$

Then, the value of future contract will be

$$5923.58 \times 200 = 11{,}84{,}716$$

The number of futures contracts to be taken is given by

$$N = b \times S/F$$

$$= 1.5 \times 78{,}98{,}000 / 11{,}84{,}716$$

$$= 9.9$$

This means that a short position will be taken in 10 future contracts. Suppose, on 75th day from the origin of the futures contract, the investor wants to wind up his futures contracts. Suppose that Nifty is trading at Rs 5,600 on 75th day (i.e., somewhere in the middle of August). Then the futures price for maturity in august will be:

$$F = S \times e^{(0.08-0.03)15/365}$$

$$= 5600 \times 1.00205$$

$$= 5611.49$$

Gain from the futures contract will be:

Gain = [opening price – closing price] x size x No. of contracts

$$= [\,5923.58 - 5611.49] \times 200 \times 10$$

$$= [312.09] \times 200 \times 10$$

$$= \text{Rs. } 6{,}24{,}200$$

This shows that the gain on future contract compensate for decline in the value of portfolio investment due to fall in Nifty from 5850 to 5600 level as shown below:

1) Fall in the value of market index

$$\left[\frac{\text{Index value on day 1 - index value on } 75^{th} \text{ day}}{\text{Index value on day 1}} \times 100 \right]$$

$$= \frac{5923.58 - 5611.49}{5923.58}$$

$$= 5.27\ \%$$

2) Fall in the value of portfolio will be equal to:

5.27 pc x 1.5 = 7.9 %

3) Therefore, the fall in the value of portfolio

= 7.9 % x 78,98,000

= 6,23,942

It can be observed that the gain in futures contract is not exactly equal to the fall in the value of portfolio due to approximation of 9.9 as 10 futures contracts.

8.7 NOTES

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8.8 ILLUSTRATIVE PROBLEMS

Problem 1

The current value of Sensex is 21,100 points. Assume that the dividend yield is 2% and the risk free rate of interest is 8%. What will be the value of futures contract with expiry in 90 days and a lot size of 15?

Solution

Since $F = S \times e^{(r-d)\,T}$

$= 21{,}100 \times e^{(0.08 - 0.02)\,(90/365)}$

$= 21{,}416.50$

The value of futures contract will be

$= 21{,}416.50 \times 15$

= Rs. 3,21,247.50

Problem 2

On March 31st 2014 an investor has a portfolio of 5 shares as given below:

Share	Price	No. of Shares	Beta
A	60	5000	1.05
B	80	8000	0.35
C	100	10000	0.80
D	125	15000	0.85
E	140	1500	0.75

In view of volatile stock market gripped by bearish trend, the investor plans to hedge his portfolio investment by trading June index futures with a strike price of 1500.

Required:

(1) What position would investor take in the futures market? Why?

(2) If the index futures has a minimum lot size of 250 units; find the number of contracts the investor needs to trade in order to get full hedge until June for his portfolio.

(3) Calculate number of future contract the investor should trade if he desires to reduce beta of his portfolio to 0.50.

Solution

Share	Price	No. of Shares	Total	Weights	Beta	Beta of Portfolio
A	60	5000	3,00,000	0.075	1.05	0.07875
B	80	8000	6,40,000	0.159	0.35	0.05565
C	100	10000	10,00,000	0.248	0.80	0.1984
D	125	15000	18,75,000	0.466	0.85	0.3961
E	140	1500	2,10,000	0.052	0.75	0.039
			40,25,000			0.7679

(1) The investor has to take a short position in futures market.

(2) The value of each futures contract:

$$1500 \times 250 = 3,75,000$$

No. of futures contracts required :

$$= \frac{40,25,000}{3,75,000} \times 0.7679$$

$$= 8.23 \text{ or } 8 \text{ contracts}$$

(3) Total value of the portfolio = Rs. 40,25,000

Target beta value = 0.5

No. of futures contracts required will be

$$= \frac{40,25,000}{3,75,000} \times 0.5$$

$$= 5.36 \text{ contracts or } 5 \text{ contracts}$$

8.9 CASE STUDY

Mr. Anmol is the manager of a large mutual fund. The stock portfolio which accounts for more than 60% of total investment corpus of mutual fund with sector-wise composition as follows:

Sector	% investment
IT	28
BANK	22
FMCG	18
ENERGY	16
PHARMA	16

The values of the portfolio on June 1st is Rs200 millions. Mr. Anmol is expecting down trend in the stock market over next 3 month. He is considering index futures to hedge the portfolio. He has collected information on stock index futures on June 1st. Table below provides details of the futures contracts on NSE and BSE on June 1.

Name of futures	lots size	current value (Rs)	price of futures expiring 30th Aug
S&P CNX NIFTY	200	5,990	6,100
BANK NIFTY	200	9,950	10,140
CNX IT	200	5,140	5,230
SENSEX	200	20,130	21,180

Mr.Anmol has estimated the values of return on the portfolio with the indexes as well as beta

Name of futures	correlation	Beta
S&P CNX NIFTY	0.92	0.97
BANK NIFTY	0.90	0.85
CNX IT	0.85	0.89
SENSEX	0.98	1.01

Mr. Anmol is looking at various hedging options.

Discussion Question:

1) Which index do you think is more appropriate for hedging the portfolio?

2) What position would Mr. Anmol take in the futures market?

3) Determine the No. of futures contracts that could be used for hedging in this case.

4) Calculate the value of the portfolio on Aug 30 if the chosen index futures fell by 10% at the time of closing out the futures contract.

5) What is the gain in the value of hedged portfolio compared to the value without hedge?

8.10 SUMMARY

Stock index future is one of the most popular financial derivative serving the hedging needs of stock investors and portfolio houses. A stock index future is simply a futures contract with the underlying asset being a stock index such as Nifty or Sensex. Stock index futures are available today on all major stock indexes all over the world.

The value of a stock index future is not just equal to the index points. It is arrived at after multiplying the index price by the multiplier (i.e., lot size) which is different for each specific index futures contract. The valuation procedure of stock index future is similar to the valuation of other futures contracts. The unique feature of a stock index futures contract is that it ought to be cash settled, as the underlying index is physically non-deliverable. Though stock index futures are available on a wide range of stock indices in India, all of them are suitable for hedging only on short term basis, not exceeding 3 month duration.

8.11 KEY WORDS

Stock index   Stock index futures   Multiplier   Portfolio hedging

8.12 SELF ASSESSMENT QUESTIONS AND PROBLEMS

1. What are stock index futures? Why were they created?

2. Discuss the distinctive features of stock index future as a financial derivative.

3. What are the contract specifications of following stock index futures contracts?

(a) Nifty futures

(b) Sensex futures

4. Explain, with a suitable example, the application of stock index futures for hedging risk of a stock investment portfolio.

5. The current value of Sensex is 20,500 points. Assume that the dividend yield is 3% and the risk free rate of interest is 9%. What will be the value of futures contract with expiry in 90 days and a lot size of 15 ?

6. On Jan. 1st 2014 an investor has a portfolio of 6 shares as given below:

Share	Price/share	No. of Shares	Beta
P	160	800	1.05
Q	180	1800	0.35
R	200	2000	0.80
S	225	1500	0.85
T	140	2500	0.75
M	120	1200	1.20

In view of volatile stock market gripped by bearish trend, the investor plans to hedge his portfolio investment by trading March Nifty index futures with a strike price of 6100.

Required:

1) What position would investor take in the futures market? Why?

2) Determine the portfolio beta.

3) If Nifty futures have a minimum lot size of 200 units; find the number of contracts the investor needs to trade in order to get full hedge until March for his portfolio.

4) Calculate number of future contract the investor should trade if he desires to reduce beta of his portfolio to 0.50.

7. Nifty future is currently trading at 6,120 points. The value of equity portfolio owned by a mutual fund is Rs.40 million. The risk-free rate is 8% and the dividend yield on the index is 3% and the beta of portfolio is 1.2. The fund manager plans to use futures contract on Nifty to hedge the portfolio over the next 3 months. The lot size of futures contract is given as 200 times. Determine how many futures contract are required to hedge the risk. Suppose the value of Sensex after 90 days drops to 5,900 show how the gain on index futures contract compensates the loss in the value of investment portfolio.

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MODULE-III
FORWARDS AND FUTURES

UNIT-9 : CALL OPTIONS BOUNDS

Structure:

9.0 OBJECTIVES

After reading this unit, you should be able to;

- Describe intrinsic and time value of options.
- Identify classification and market quotes of options.
- Explain the concept of options bounds.
- Ascertain upper and lower bounds of call options.

9.1 INTRODUCTION

Options like futures, are also derivative instrument which gives the holder the right to buy or sell a specified amount of underlying asset at a stipulated price (strike price) within a specified period of time. Since options give a right to buy or sell, the holder of the contract are not obliged to carry out the transaction in future. This is in contrast to forwards and futures where both the parties have an obligation to perform their commitments.

In case of options contract, there are two parties – one takes a long position, that is, holder (buyer) of the contract and the other takes a short position, that is, the writer (seller) of the contract. Options are generally categorized as calls and puts, where in one gives a right to purchase and the other gives the right to sell. A trader can purchase any of these contract based on their expectation about future price movement to construct their trading strategies.

India joined the league of countries that trade options on exchanges in the year 2001 with introduction of Sensex options on 1st June and Nifty50 option on 4th June at BSE and NSE respectively. Subsequently, on July 9, 2001 and November 9, 2001 both BSE and NSE respectively added options trading in individual stocks. In the coming section/chapters let us have a glance on basics of options, option prices, its minimum and maximum value and few commonly used option trading strategies.

9.2 OPTIONS' CLASSIFICATION

Options has several features, certainly more than forwards and futures making several differentiations possible in the basic products of calls and puts. Based on several considerations, the options can be categorized in a number of ways, such as:

9.2.1 On the basis of Nature of Contract

- **Call:** A call option contract gives the holder the right to buy an asset by certain date for a certain price.
- **Put:** A put option contract gives the holder the right to sell an asset by a certain date for certain price.

9.2.2 On the basis of Exercise Style

- **American Option:** It can be exercised at any time up to the expiration date.
- **European Option:** This type of option contract can be exercised only on the expiration date itself.

9.2.3 On the basis of Trading Place

- **Exchange Traded Options:** Contract that should be bought and sold on the specific exchanges where the two contracting parties are not be known to each other but instead enter into a contract on the floor/screen of an exchange.
- **OTC Options:** Contracts which are specific, customized and negotiated by two contracting parties mutually with direct negotiations.

9.3 OPTIONS POSITION

There are two sides to every option contract. On one side is the investor/trader who has taken the long position (i.e., *has bought the options contract*). On the other side is the investor/trader who has taken a short position (i.e., *has sold or written the options contract*).

There are four types of option positions that a trader can have. They are:

- A long position in call option contract wherein a trader holds or purchases a call option contract from an exchange.
- A short position in call option contract wherein a trader writes or sells a call option contract.
- A long position in put option contract wherein a trader holds or purchases a put option contract from an exchange.
- A short position in put option contract wherein a trader writes or sells a put option contract.

The writer of an option receives cash up front, but has potential liabilities later. The writer's profit or loss is the reverse of that for the purchaser of the option. Let us see through an example about the payoffs of writer and holder of an options contract.

Mr. Shikhar purchases a call option contract from an exchanges which is written by Mr. Rohith. The option price and exercise price specified in the European call option contract is Rs. 6 and Rs. 280 respectively. The contract will expire on the last Thursday of the current month. Here, *Shikhar's position on call option contract is long* as he holds the contract and *Rohith's position is short* as he wrote the contract. If on the day of expiry, the underlying asset price is Rs.250 or Rs.260 or Rs.270 or Rs.280 or Rs.290 or Rs.300, the payoffs (i.e., profit or loss) of Shikhar and Rohith's position will be:

(Figures in Rs.)

Stock Price (A)	**Exercise Price (B)**	**Option Premium (C)**	**Pay off**	
			Shikhar's Position	*Rohith's Position*
250	280	-6	-6	6
260	280	-6	-6	6
270	280	-6	-6	6
280	280	-6	-6	6
286	280	-6	0	0
290	280	-6	4	-4
300	280	-6	14	-14

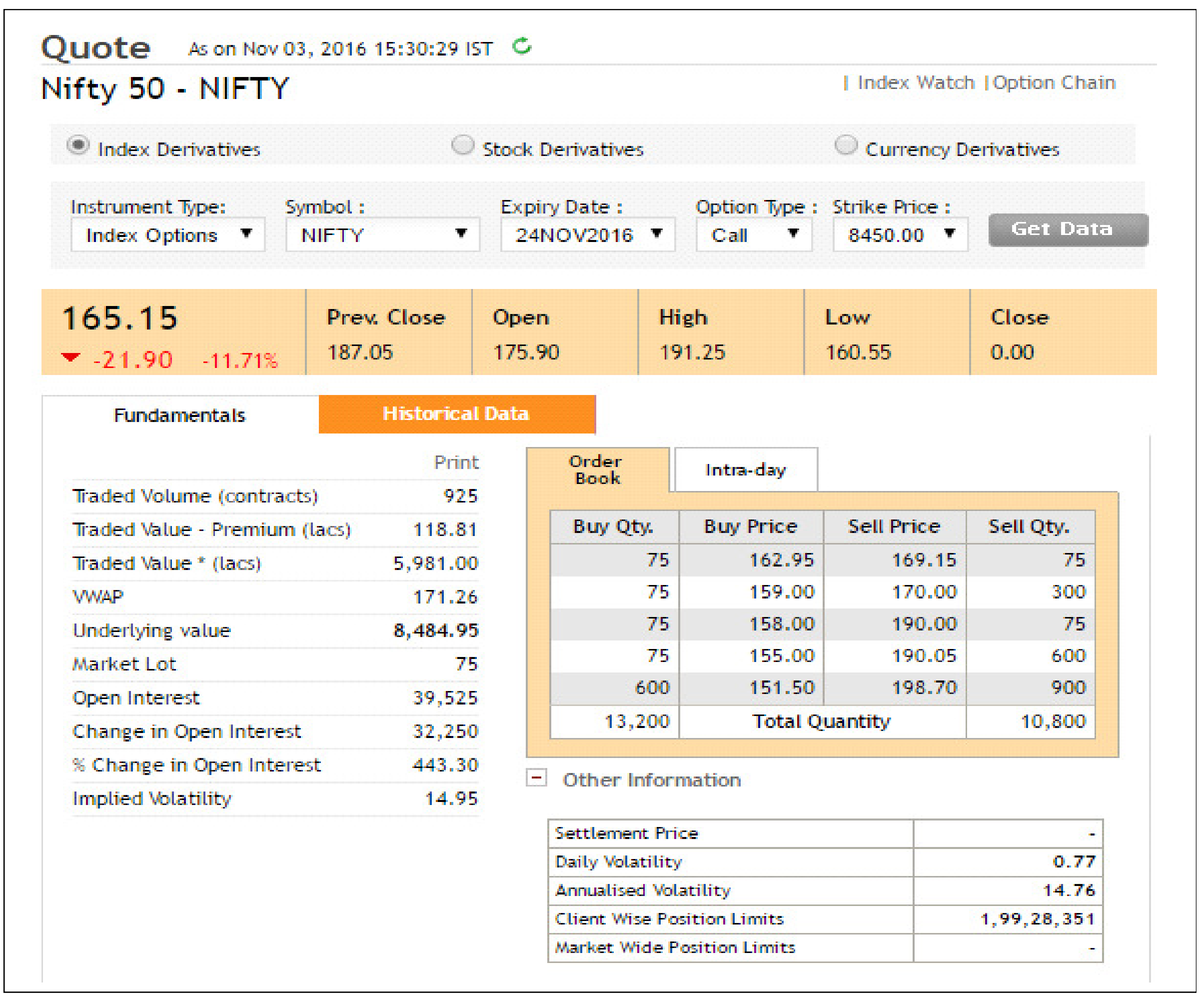
On the day of expiry, if the stock price is Rs.250, Mr. Shikhar will not exercise his right purchase instead he can purchase the same stock from the market by paying Rs. 250 instead of Rs.280/-. Here, loss to Shikhar is the premium which he paid (i.e., Rs.6) to Rohith at the time of entering the contract. As contract is not exercised, Rohith can keep the premium which will be his profit from the transaction. On the other hand, Shikar will execute the contract only when stock price exceeds the exercise price as shown in above table. The stock price level of Rs.286 will act as a break-even point where there is no profit or no loss for the buyer and seller of the contract and it is also clearly indicated in the table that the contract long position holder has limited loss and unlimited profit potential and seller will have limited profit and he may bear unlimited loss.

9.4 OPTION PRICE

A Price of an options contract refers to the price or premium that should be paid to purchase an option contract (call or put). In contrast to forwards and futures, to purchase an option contract it will cost a few rupees to the trader as it gives a right which he can enjoy at the time of expiration of the contract or before the expiration of the contract. Option bounds, in the following discussion, generally indicates the minimum or maximum value an option can have if one intends to purchase. This is generally computed based on the perspective of option writer who takes unlimited risk. Option price acts as a compensation that option buyer gives to the option writer to purchase a right from the latter by the former.

9.5 UNDERSTANDING OPTIONS QUOTATIONS

Options prices are read in the same way as that of any stock. Following screenshot of option quotes from NSE indicates various trading terminologies used by the exchange in quoting options metrics. The last traded price of the call was Rs.165.15. This is the premium of Nifty50 call option as underlying asset with an exercise price of Rs.8450.00, while the current value of the index is Rs.8484.95.



Quote As on Nov 03, 2016 15:30:29 IST

Nifty 50 - NIFTY | Index Watch | Option Chain

Index Derivatives · Stock Derivatives · Currency Derivatives

Instrument Type: Index Options · Symbol : NIFTY · Expiry Date : 24NOV2016 · Option Type : Call · Strike Price : 8450.00 · Get Data

165.15	Prev. Close	Open	High	Low	Close
-21.90 -11.71%	187.05	175.90	191.25	160.55	0.00

Fundamentals | Historical Data

	Print
Traded Volume (contracts)	925
Traded Value - Premium (lacs)	118.81
Traded Value * (lacs)	5,981.00
VWAP	171.26
Underlying value	8,484.95
Market Lot	75
Open Interest	39,525
Change in Open Interest	32,250
% Change in Open Interest	443.30
Implied Volatility	14.95

Order Book | Intra-day

Buy Qty.	Buy Price	Sell Price	Sell Qty.
75	162.95	169.15	75
75	159.00	170.00	300
75	158.00	190.00	75
75	155.00	190.05	600
600	151.50	198.70	900
13,200	Total Quantity		10,800

Other Information

Settlement Price	-
Daily Volatility	0.77
Annualised Volatility	14.76
Client Wise Position Limits	1,99,28,351
Market Wide Position Limits	-

Source: NSE, F&O Quote, as on 3rd Nov, 2016.

The expiration date of the contract is 24th November, 2016 which is the last Thursday of the month. Generally, the equity F&O contracts expires the last Thursday of every month in the country. Option type here is call, which is an indication that this index option contract is call of European style of execution. At NSE, we don't have Nifty option contract with American style of execution, however, individual stock options are available both the styles. This means if you purchase a call or put on Nifty50, you cannot exercise you are right before the expiry date. You can exercise only on the day of expiry. Apart from these data, market also quotes previous close – which is previous day's closing option price and high, low option prices of the current. In the above template, the close price is '0', this is because market is not yet closed at the time of taking screen shot.

Other information pertaining to order book details, open interest (i.e., number of contract which are not yet exercised), trading volume data, etc., are also available for one's perusal. The business dailies also provides information of options trading of the previous day regularly. With this overview on option quotation, let us move on to some of the conceptual framework of options contract, with first discussion on the intrinsic and time value of money.

9.6 INTRINSIC & TIME VALUE OF OPTIONS

The intrinsic value of an option is defined as the amount, by which an option is in-the-money, or the immediate exercise value of the option when the underlying position is marked-to-market.

- **For a call option:** Intrinsic Value = Spot Price - Strike Price

Symbolically, Intrinsic Value = Max (S-X, 0)

- **For a put option:** Intrinsic Value = Strike Price - Spot Price

Symbolically, Intrinsic Value = Max (X-S, 0)

The intrinsic value of an option must be a positive number or 0. It cannot be negative. For a call option, the strike price must be less than the price of the underlying asset for the call to have an intrinsic value greater than 0. For a put option, the strike price must be greater than the underlying asset price for it to have intrinsic value.

Time Value of Options:

Time value of an option contract is the premium that an investor is willing to pay over and above the intrinsic value of an option. It is the amount option buyers are willing to pay for the possibility that the option may become profitable prior to expiration due to favorable change in the price of the underlying. An option loses its time value as its expiration date nears. At expiration an option is worth only its intrinsic value. Time value cannot be negative.

Consider the following example of stock where in the information on option type, stock price, exercise price and option price details have been provided.

The intrinsic and time value of above four option contracts are:

S. No.	Option Type	Strike Price	Stock Price	Premium	Intrinsic	Time
1	Put	32	36	5.30	**0**	**5.30**
2	Call	50	48	4.10	**0**	**4.10**
3	Call	105	108	8.40	**3**	**5.40**
4	Put	45	41	9.70	**4**	**5.70**

9.7 OPTIONS BOUNDS - MEANING

One of the important principle while valuing options is that at any time, the value of a call or a put cannot exceed certain limits – on the higher side as well as on the lower side. In options literature, the maximum limit up to which an option value can go on the higher side is commonly referred to as 'upper bounds of an option' and the maximum limit below which an option value cannot fall is called the 'lower bounds of an option'.

We will discuss the lower bound and upper bound of European call option contracts in the following sections of the unit.

9.8 LOWER BOUND OF CALL PRICES

A call option gives a right to its holder/buyer to purchase an underlying asset in future at a strike price agreed up front. As this contract provides a right, generally, a call buyer may execute his contract if price of the underlying stock which he intends to purchase in future exceeds the strike price of the contract as discussed earlier in section 9.3. If the underlying stock price is lower than the strike price, he will not execute the contract because execution of the contract may result in reduction in call buyers wealth. Hence, under any circumstances call option contract cannot have negative value because no one can force the holder to execute his contract and intuitively, if call price is negative it indicates that call buyer should receive cash flow at the time of purchase of contract, which is meaningless. From, call writer\seller's perspective, lower bound of call represents the minimum price accepted by him. Let's see how we can compute the lower bound of call option contract in coming discussion.

9.8.1 Lower bound of European call values of non-dividend paying stock:

The calls with European style of execution can be exercised only on the day of expiration and hence, the lower bound of call with European style of execution will be equal to present value of its intrinsic value. Symbolically, the minimum price (lower bound) of European contract acceptable by the writer of the call is :

$$C_{min} = Max\ (0, S - X.e^{-rt})$$

Where, Xe^{-rt} indicates the present value of the strike price.

t = time to expiration.

r = risk-free rate

S = underlying asset price

Let's try an example – assume that an underlying asset value is Rs.102. One year European option call at strike price Rs.108 is available. If the risk free rate is considered to be 8%, the present value of 108 discounted at 8% would be

$$C_{min} = Max\ (0, 102 - 108.e^{-0.08})$$

$$= Max\ (0, 102 - (108\ X\ 0.92312))$$

$$= Max\ (0, 2.30)$$

= Rs.2.30/-

In this case, the value of the call cannot be less than Rs. 2.3 . If it falls to (say, Re 1) then –You can buy the call at strike 108 – you pay Re 1, You short sell the stock at 102 – You get 102. Your gain will be Rs.101 (i.e., Short sale – premium on call).

From that 101, you invest 100 in risk free bonds and get 108 at the year end. Use that 108 to exercise the call and get back your shares. Get a profit of Rs 1, risk free – immediately.

9.8.2 Lower bound European call on dividend paying stock:

We have seen in our previous discussion about how to compute the lower bound of European call option contract of a stock which pays no dividend till the period of expiration. But, when company pays a dividend within expiration period, it will have an influence on the call price and hence we need to consider dividend factor in arriving at minimum value of call option that pays dividend.

Following equation can be used to derive the minimum value of call option contract with European style of execution and it pays dividend during life of the contract.

$$C_{min} = Max\ (0, S - X.e^{-rt} - D.e^{-rn})$$

Where, Xe^{-rt} indicates the present value of the strike price.

t = time to expiration.

r = risk-free rate

S = underlying asset price

D = dividend per share

n = time to dividend payment.

Let's take an example where the stock value is at Rs.50 and three month call at strike price Rs.40 are available. The dividend to be received after 2 months from now later is estimated at Rs.5 per share. In this case, the value of the call cannot fall below the share value Less (present value of dividend expected + present value of strike value)

$$C_{min} = Max\ (0, S - X.e^{-rt} - D.e^{-rn})$$

$= Max\ (0, [50 – 20 \text{ X } e^{-0.08\ X\ 3/12}] - 5\ X\ e^{-0.08X2/12})$

$= Max\ (0, 50 - 39.20 – 4.80)$

= Rs.6.00/-

Hence, the lower bound value of a call cannot fall below Rs.6/-.

9.9 UPPER BOUNDS OF CALL PRICES

Upper bound of the call option contract indicates the maximum price a trader can pay to purchase the contract. Let us see how we can find the upper bound of call in the following discussion.

Upper Bounds of European Calls:

The upper bound of a European option contract depends on the stock price, as no trader ready to pay more than the stock price itself to purchase the contract. Hence, the maximum price is

The above relative expression indicates that the call prices cannot exceed the underlying asset price.

We know that an American call option can be exercised at any time during the contract period. The principle of upper bounds of American calls are the same as we saw in upper bounds of European call values. The difference in exercisability will not make any impact on the upper bound values. So, the upper bound value of an American call can never rise beyond the value of the underlying stock. When the dividend is known with certainty, the call values cannot rise beyond the spot value of the stock less present value of the dividend.

9.10 NOTES

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9.11 SUMMARY

An option gives a right to its holder to purchase or sell an underlying asset, depending upon the contract which he purchases, at an agreed price which is called as strike/exercise price in future, specifically at the end of expiration period. Options are generally categorized as calls and puts, where in one gives a right to purchase and the other gives the right to sell. In order to purchase an option contract a trader needs to incur an upfront cost which is called as premium or option price. One important principle while valuing options is that at any time, the value of a call or a put cannot exceed certain limits – on the higher side as well as on the lower side and these limits are referred to as upper and lower bounds of option contract respectively.

The minimum value of American call option contract cannot be negative and its value should vary in between zero and difference between stock price and exercise price. The upper bound value of a European call can never rise beyond the value of the underlying stock. When the dividend is known with certainty, the call values cannot rise beyond the spot value of the stock less present value of the dividend. The lower bound value of a European call can never fall below the difference between stock value and the present value of strike price. When the dividend is known with certainty, the call values cannot fall below the spot value of the stock minus present value of the dividend minus present value of the strike value.

9.12 KEY WORDS

- **American Style:** An option contract that can be executed any time between the dates of purchase and its expiration.
- **Arbitrage:**The purchase of commodity or financial instrument in one market at lower price and selling them in another market at a higher price.
- **European Style:** Contract that can be exercised only on the day of expiration.
- **Exercise / Execute:** Formal notification to implement the right under which the buyer (holder) of an option is entitled to buy or sell the underlying asset.
- **Strike Price or Exercise Price:** The strike or exercise price of an option is the specified/ predetermined price of the underlying asset at which the same can be bought or sold if the option buyer exercises his right to buy/ sell on or before the expiration day.
- **Exercise Date:** The date on which the option is actually exercised is called the Exercise Date.

- **Expiration Date:** The last day on which an option contract can be exercise. From Indian equity derivatives market perspective, generally, expiration day is last Thursday of every month.
- **Open Interest:** The total number of options contracts outstanding in the market at any given point of time.
- **Option Holder:** is the one who buys an option, which can be a call, or a put option. He enjoys the right to buy or sell the underlying asset at a specified price on or before specified time.
- **Option Premium:** Premium is the price paid by the buyer to the seller to acquire the right to buy or sell.
- **Option Seller/ Writer:** is the one who is obligated to buy (in case of put option) or to sell (in case of call option), the underlying asset in case the buyer of the option decides to exercise his option.

9.9 SELF-ASSESSMENT QUESTIONS

1. What are option price and option bounds?

2. European Style of options can never have negative premium. Discuss.

3. Explain the minimum value of a European Call can have.

4. What is the lower bound for the price of a 4-month call on a non-dividend paying stock when the stock price is Rs.280, the strike price is Rs.250 and the risk free rate of return is 8% per annum?

5. For a long call option with an exercise price of Rs.200 and an option price of Rs.28, currently trading at Rs.190. Determine the intrinsic and time value of the option contract.

6. A 4-month call option on a dividend paying stock is currently selling for Rs.5. the stock price is Rs.64, the strike price is Rs.60 and a dividend of Re.1 is expected in 1 month. The risk-free rate is 12% per annum for all maturities. What opportunities are there for an arbitrageur?

7. The price of a European call that expires in six months has a strike price of Rs.40 is available for Rs.7 in the market. The underlying stock price is Rs.34, and a dividend of Rs.1.50 is expected in 45 days. If the risk-less rate is 5%, what is the price of the option?

8. What is the upper and lower bound of a call that expires after a month having an exercise price of Rs.34, underlying asset price Rs.30 and risk-free rate of interest is 6%?

9. Illustrate how you can arrive at the upper bound of a European Call option contract?

10. An April call option on a stock, XYZ with European style of execution, currently priced at Rs.70 currently trades at $17. The current interest rate is 8.30% and stock price is Rs.60. A dividend of Rs.7 is due, with the ex-dividend date being 50 days away. The time to expiration is 135 days. Find out lower bound of call that should avoid riskless arbitrage opportunities?

11. ABC-ltd.'s stock is selling for Rs.50. ABC has decided to issue dividend of Rs.2 at the beginning of three months from now. If the risk-free rate of interest is 10%, then at what minimum price the following calls on the stock would sell for:

(a) A 1-month call with exercise price of Rs.45.

(b) A 2-month call with an exercise price of Rs.50.

(c) A 3-month call with an exercise price of Rs.55.

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UNIT-10 : AMERICAN OPTIONS

Structure :

10.0 OBJECTIVES

After reading this unit, you should be able to;

- Explain the concept of options bounds
- Describe the moneyness of options.
- Differentiate American option bounds from European bounds.
- Explain the principles of American option bounds.

10.1 INTRODUCTION

Remember that purchasing of a stock is completely different from purchasing of a stock option contract. The holder of the equity options contracts do not have any of the rights that owners of equity shares have, such as voting rights and the right to receive bonus, dividend etc. To obtain these rights a Call option holder must exercise his contract and take delivery of the underlying equity shares. But still, it can offer several benefits to investors.

Options can offer an investor the flexibility one needs for countless investment situations. An investor can create hedging position or an entirely speculative one, through various strategies that reflect his tolerance for risk. Investors of equity stock options will enjoy more leverage than their counterparts who invest in the underlying stock market itself in form of greater exposure by paying a small amount as premium. Investors can also use options in specific stocks to hedge their holding positions in the underlying (i.e. long in the stock itself), by buying a Protective Put. Thus they will insure their portfolio of equity stocks by paying premium.

Diverting from the benefits of options, let us see another variety of options execution style, its upper and lower bound computation and moneyless of these contracts in this unit.

10.2 MONEYNESS OF OPTIONS

Moneyness of options contract indicates whether exercising of options will result in positive payoff or not. An option is said to be "at-the-money", when the option's strike price is equal to the underlying asset price. This is true for both puts and calls.A call option is said to be "in the money" when the strike price of the option is less than the underlying asset price. For example, a Stock A" call option with strike of 3900 is "in-the-money", when the spot price of Stock "A" is at 4100 as the call option has a positive exercise value. The call option holder has the right to buy the Stock "A" at 3900, no matter by what amount the spot price exceeded the strike price. With the spot price at 4100, selling Stock "A" at this higher price, one can make a profit.

On the other hand, a call option is out-of-the-money when the strike price is greater than the underlying asset price. Using the earlier example of S&P BSE SENSEX call option, if the S&P BSE SENSEX falls to 3700, the call option no longer has positive exercise value. The call holder will not exercise the option to buy S&P BSE SENSEX® at 3900 when the current price is at 3700 and allow his "option" right to lapse.

Moneyness	CALL OPTIONS	PUT OPTIONS
In-the-money	Strike Price< Spot Price	Strike Price > Spot Price
At-the-money	Strike Price = Spot Price	Strike Price = Spot Price
Out-of-the-money	Strike Price > Spot Price	Strike Price< Spot Price

A put option is in-the-money when the strike price of the option is greater than the spot price of the underlying asset. For example, a Stock "A" put at strike of 4400 is in-the-money when the spot price of Stock "A" is at 4100. When this is the case, the put option has value because the put option holder can sell the Stock "A" at 4400, an amount greater than the current Stock "A" of 4100. Likewise, a put option is out-of-the-money when the strike price is less than the spot price of underlying asset. In the above example, the buyer of Stock "A"put option won't exercise the option when the spot is at 4800. The put no longer has positive exercise value and therefore in this scenario, the put option holder will allow his "option" right to lapse.

Consider another example of a hypothetical stock:

Option	Strike Price	Stock Price	Call Option Price	Classification
A	Rs.160	Rs.167	Rs.13.50	*In-the-money*
B	Rs.170	Rs.167	Rs.5.00	*At-the-money*

Here, the first call is in the money while the second one is out of the money, as may be observed from the stock price and respective exercise prices.

Each exchange quotes different strike prices for a day on call option contract. This is based on certain pre-determined proportions of In-the-money, At-the-money and Out-of-the-money options called "Strike Intervals". Each individual stocks will have their own strike intervals. Following tables depict Strike intervals of Nifty Indices and longer-dated options.

1. The Strike scheme for all near expiry (near, mid and far months) Index Options is:

Index Level	Strike Interval	Number of strikes In the money- At the money- out of the money
≤ 2000	50	8-1-8
>2001 ≤ 3000	100	6-1-6
>3000 ≤ 4000	100	8-1-8
>4000 ≤ 6000	100	12-1-12
>6000	100	16-1-16

Source: NSE

2. *The Strike scheme for Nifty 50 long term Quarterly and Half Yearly expiry option contracts is:*

Index Level	Strike Interval	Number of strikers In the money- At the money- out of the money
≤ 2000	100	6-1-6
>2001 ≤ 3000	100	9-1-9
>3000 ≤ 4000	100	12-1-12
>4000 ≤ 6000	100	18-1-18
>6000	100	24-1-24

Source: NSE

10.2 AMERICAN OPTIONS: MEANING

An American option is an option that can be exercised anytime during its life. It allow option holders to exercise the option at any time prior to and including its maturity date, thus increasing the value of the option to the holder relative to European options, which can only be exercised at maturity. The majority of the exchange traded options are American.

American options allow the holder to buy or sell a specified underlying asset, on or before a predetermined expiration date. Since investors have the freedom to exercise their American options at any point during the life of the contract, they are more valuable than European options, which can only be exercised at maturity. The last day to exercise a American option on individual stock is normally on the last Thursday of a month in which the option contract expires. Note that the name of this option style has nothing to do with the geographic location.

10.4 LOWER BOUND OF AMERICAN CALLS

The lower bound of call generally depends on whether the contract is of American style of execution or European style. We have already discussed about lower bound of European Calls in the previous unit. Let us study how the bounds of American options are different from its counterpart, the European.

As American style of option contracts can be executed any time within options' expiration period, the minimum price acceptable to the seller cannot be less than its intrinsic value, if call buyer intends to exercise his right. Thus the minimum value (lower bound) of American Call can be computed as :

$$C_{min} = Max\ (0, S - X)$$

$$C_{min} = Max\ (0, S - X)$$

Where,   indicates the strike price.

S = underlying asset price

The above expression means *"Take the maximum value of the two arguments, zero or S- X"*. If the call price is lower than its intrinsic value, it would trigger an arbitrage and due to this transaction pressure in some period of time, the price of the call will be equal to its lower bound.

To prove this, consider the following example

Assume the Strike price of an American style call with 3 months maturity is Rs.130, option premium attached to this contract is Rs.10 and the underlying stock price at present is Rs.141. As the price (i.e., premium) of the contract is less than its intrinsic value (Max (0, 141-130) , you could buy the call for Rs.10, exercise it — which would entail buying the stock for Rs.130 — and   then sell the stock for Rs.141 in the market immediately. This arbitrage transaction would give an immediate riskless profit of Re.1 for the trader. If such kind of opportunity is found in the market at any time, all traders may do this, which in turn drives up the option price. When the price of the call reached Rs.11, the transaction would no longer be profitable.

Therefore, ***Rs.11 is the minimum price of the above call option contract (***

.

$$C_{min} = Max\ (0, 141 - 130)$$

Illustration 1:

What is the lower bound of a 4-month American call option on a non-dividend paying stock when the stock price is Rs.56, the strike price is Rs.50 and the risk free interest rate is 9% per annum ?

As American style of option contracts can be executed any time within options' expiration period, the minimum price acceptable to the seller cannot be less than its intrinsic value, if call buyer intends to exercise his right. We assume here call is exercised by the holder immediately, if that is the case, to calculate lower bound , we need to find :

$$C_{min} = Max\ (0, S - X)$$

$$= Max\ (0, 56 - 50)$$

=Rs.6/-

10.5 UPPER BOUND OF AMERICAN CALLS

We know that an American call option can be exercised at any time during the contract period. The principle of upper bounds of American calls are the same as we saw in upper bounds of European call values. The difference in exercisability will not make any impact on the upper bound values.So, the upper bound value of an American call can never rise beyond the value of the underlying stock. When the dividend is known with certainty, the call values cannot rise beyond the spot value of the stock less present value of the dividend.

Let's assume that the call value of an option is Rs.55 and the underlying stock is trading at Rs.50 in the spot market. In such a scenario, anybody can write the call and sell the stock on spot, and take home the difference of 5 per share. Hence, it's clear that the call value at expiry cannot rise beyond the value of the underlying stock.

Now, let's further assume that the company has announced a dividend of 5 per share. Dividend, when paid, decreases the value of shares to that extent. Hence on expiry, the stock will be valued at 45 (50 – 5) in the spot market and logically, the call value cannot exceed 45 per share.

The gap here is associated with the observation that one can execute an American option immediately, but the holder of a European option cannot cash in until time T, when it will be discounted.

10.6 SUMMARY OF PRINCIPLES OF AMERICAN OPTIONS BOUNDS

The principles of American options are summarized as follows:

1) If the stock price is zero, the American call must have a value of zero.
2) The minimum price of an American call option contract is either zero or the difference between the underlying asset price and exercise price, whichever is greater.
3) An American call never be worth more than its underlying asset.
4) For a stock that does not pay dividend during options maturity, dividend will not affect the price of American call.
5) An American call can never be worth less than a European call.
6) Two American calls on the same stock having the same exercise price have to be priced such that the one with a longer maturity is worth as much or more than the one with shorter maturity.
7) If the underlying asset price is zero, the value of an American put must be its exercise price.
8) The minimum value of an American put is either zero or the difference between the exercise price and underlying asset price at start, whichever is greater.
9) The maximum value of an American put is its exercise price.
10) An American put is worth at least as much as the European put.

10.8 NOTES

10.9 SUMMARY

At the beginning of this unit, we started discussing about the usefulness of option.Options can offer an investor the flexibility one needs for countless investment situations.Investors can also use options in specific stocks to hedge their holding positions in the underlying. Then we moved on to a new topic called Moneyness of options contract which indicates whether exercising of options will result in positive payoff or not. It looks at the value of an option if you were to exercise it right away. A loss would signify the option is out of the money, while a gain would mean it's in the money. At the money means that you will break even upon exercising the option.A brief overview on American options was also provided in this unit wherein we described an American option can be exercised anytime during its life. The lower bound of the American option is difference between stock price and strike price or zero, whichever is greater, whereas, the upper bound value of an American call can never rise beyond the value of the underlying stock.

10.10 KEY WORDS

- **American Style :** An American style option is the one which can be exercised by the buyer at any time, till the expiration date, i.e. anytime between the day of purchase of the option and the day of its expiry.
- **At-the-Money:** An option is at the money if the strike price of the contract equals to the current market price of the underlying asset.
- **Exercise / Execute :** Formal notification to implement the right under which the buyer (holder) of an option is entitled to buy or sell the underlying asset.
- **Strike Price or Exercise Price :** The strike or exercise price of an option is the specified/ predetermined price of the underlying asset at which the same can be bought or sold if the option buyer exercises his right to buy/ sell on or before the expiration day.
- **Exercise Date :** The date on which the option is actually exercised is called the Exercise Date.
- **Expiration Date:** The date on which the option expires is known as the Expiration Date. On the Expiration date, either the option is exercised or it expires worthless.
- **In-the-money:** A call is in the money if the strike is less than current market price of the underlying asset and reverse is true in case of put.

- **Intrinsic Value:** The value of option price which is in excess of stock price over exercise price in case of call and excess of exercise price over stock price in case of put.
- **Long:** Option Buyer or holders' position.
- **Open Interest :** The total number of options contracts outstanding in the market at any given point of time.
- **Option Price:** The price or premium that should be paid to purchase an option contract.
- **Option seller/ writer :** is the one who is obligated to buy (in case of put option) or to sell (in case of call option), the underlying asset in case the buyer of the option decides to exercise his option.
- **Out-of-the-money:** A call is out of the money if the strike price is greater than the underlying asset price and vice versa in case of put option contract.
- **Short:** Option seller or writer's position.
- **Time Value:** It is the difference between the premium of the option contract and its intrinsic value.

10.11 SELF-ASSESSMENT QUESTIONS

1. State the underlying relationship between stock and strike prices for in-the-money and out-of-the-money call and put options.

2. From the following data, determine for each American Options, the intrinsic and time value.

S.No.	Option	Strike Price	Stock Price	Call Option Price
1	Put	360	320	53
2	Call	480	500	41
3	Call	1075	1050	84
4	Put	410	450	97
5	Put	196	192	08

3. An American call on a dividend paying stock can never be exercised early. Discuss.

4. You are given below information on some options. State whether each one of these is in-the-money, out-of-the-money or at-the-money.

S.No.	Option	Stock Price	Strike Price
1	Call	106	110
2	Call	80	80
3	Put	224	200
4	Put	208	220
5	Put	24	30
6	Call	74	70

5. Explain the relationship between moneyness of the contract and contract's intrinsic value?

6. The price of an American call on a non-dividend paying stock is Rs.15. the stock price is Rs.250, the strike is Rs.245 and the expiration period is 3 months. The risk free interest rate is 8%. Derive upper and lower bound for the price of the American Call?

7. How lower bounds of American calls different from its counterpart, the European?

8. Explain why American call on a dividend paying stock always worth at least as much as its intrinsic value. Is the same true in case of European call option? Explain your answer.

9. How option contracts are useful for a trader and investor?

10. How to arrive at maximum price of American Call? Illustrate.

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UNIT-11 : PUT OPTIONS BOUNDS

Structure :

11.0 OBJECTIVES

After reading this unit, you should be able to;

- Explain the concept of options bounds of put
- Describe the difference between lower bound value of American and European options.
- Understand the determinants of option prices.

11.1 INTRODUCTION

A put option contracts are generally purchased by those traders who are long on underlying asset and would like to sell the asset in the near future. The owner of a put option contract has the right, but not obligation, to sell the underlying asset at a specified strike price on or before a specified expiration day depending upon the style of execution of the purchased contract. On the other hand seller of the put option contract has the obligation to take delivery of the asset, if the put holder decide to exercise his option. When a put contract is entered, the buyer of the contract should pay a sum of money to the writer which is called as premium or option price. If the price of the asset rises above the strike price and stays there, the put expires worthless. The put writer gets to keep the premium as a profit, and the put buyer incurs a loss.

11.2 PUT OPTION BOUNDS - MEANING

A put option gives a right to sell the underlying asset at exercise price in future. Therefore, the maximum value that one would pay to get the right is the exercise price, if it is to be executed immediately. If there is still time remaining for exercise the value of put cannot exceed its strike\exercise price in present value terms. Hence, irrespective of the price of the underlying asset, a put options contract cannot be sold for more than the present value of exercise price.

Let us discuss in the following section on how to arrive at minimum and maximum value of put option that is acceptable in general.

11.3 LOWER BOUND OF PUT

When a trader purchases a put option contract, he is entitled to a right which he can execute at the time expiration of the contract to sell the underlying asset in future. Upon execution the holder of the put option contract may earn unlimited profit and the chances of loss which he may incur is limited only to the premium which he pays to the writer of the contract. Put option writer who takes unlimited risk will get a premium from the holder of the contract at the time of purchase of the contract. The minimum price which is acceptable to the seller/writer of the contract in technical terms is called as the lower bound of the put option contract. In the following explanation, let us see how to arrive at the minimum and maximum price of put option contract with American and European style of execution.

11.3.1 Lower Bound of American Put:

By purchasing a put with American style will provide a right to the buyer of the contract to exercise his right to sell at any time during the trading hours till the contracts expires.

The minimum value for an American put can be derived using following equation:

$$P_{min} = Max\ (0, X - S)$$

Where, indicates the strike price.

S = underlying asset price

The above expression, that is, Max (0, X-S) means "Take the maximum value of the two arguments, zero or E-S"

Let us consider an example wherein a put option contract on stock with an exercise price of Rs.40 currently trading at a price of Rs.2.70. The current spot price of the stock is Rs.37. If we assume this contract is of American style of execution then as per our lower bound argument the option price should be:

$$P_{min} = Max\ (0, 40 - 37)$$

= Rs.3

As the current option price (Rs.2.70) is lower than Rs.3, arbitrager will take advantage of this scenario and they will buy put option contract with a strike price of Rs.40 by paying Rs.2.70 and stock by paying Rs.37. This will result in a total outlay of

Rs.39.70 for the trader. Then, immediately they can sell the share for Rs.40 using the put, this will give him a risk-free net gain of 30 paise. Due to similar arbitrage activities, the option price will reach up to Rs.3.

Illustration 1:

An American put option contracts which will expire after 95 days is available in the market for Rs.2. the underlying asset price of the option is Rs.50 and the exercise price is Rs.45. the underlying asset will fetch a dividend of Rs.1.5 after 55 days, the risk free rate of interest prevailing in the economy is 10%, compute the lower bound of the contract?

Here, the option price is Rs.2, maturity time is 95 days, stock price is Rs.50 and strike price is Rs.45. Though dividend is declared during the option period, put holder can exercise it any time during the life of option and hence it may not affect put price. Thus, lower bound of put will be:

$$P_{min} = Max\ (0, X - S)$$

$$= Max\ (0{,}45 - 50)$$

=Re.0/-

11.3.2 Lower Bound of European Put

As European Put option contracts can be exercised only on the day of expiry, the lower bound of put will be the difference between its present value of exercise price and Spot price. If the stocks pays dividend then we need to consider present value of dividend in expressing lower bound of put option contract. Thus, the minimum price acceptable to the put writer will be:

$$P_{min} = Max(0, X.e^{-rt} - S + D.e^{-rn})$$

Let us consider a three month European put with an exercise price of Rs.50. Let the stock price be Rs.45. Let the risk free rate of return be 12% p.a. and the stock pays no dividend over the next three months.

The lower bound for the European put is :

$$P_{min} = Max\ (0, X.e^{-rt} - S + D.e^{-rn})$$

$$= Max\ (0, 50.e^{-0.12X\frac{3}{12}} - 45 + 0)$$

= Rs.3.52/-

Suppose option price is Rs.3, implying that the lower bound of put is violated. This will results in undervaluation of options and arbitrageurs will make use the opportunity to earn risk less profit and due to which option price will rises to its lower bound in short period of time.

Illustration-2 :

What is the lower bound for the price of a 3-month European put option contract on a non-dividend paying stock when the stock price is Rs.55, the strike price is Rs.60 and the risk free interest rate is 6% per annum?

To compute the lower bound of the European put we need details of Stock price and present value of exercise price. The stock price of Rs.55 which is provided in the question. Let us compute the present value of exercise first using strike price, maturity period and risk-free rate of interest.

Thus, present value of exercise = $X.e^{-rt}$

$$60.e^{-0.06\ X\ 3/12}$$

= 60 X 0.985125

=Rs.59.11/-

Therefore, minimum value of put is :

$$P_{min} = Max\ (0, X.e^{-rt} - S)$$

= Max (0 , 59.11 – 55)

= Rs. 4.11/-

Illustration-3 :

The price of a European put option that expires in six months has an exercise price of Rs.40 is Rs.10. The underlying stock price is Rs.35 and a dividend of Rs.2 is expected in 3 months. If the interest rate is 6%, then what will be the lower bound this put?

To compute the lower bound of the put on dividend paying stock we need to use following expression and then substitute the relevant value from the question to arrive at lower bound.

$$P_{min} = Max\ (0, X.e^{-rt} - S + D.e^{-rn})$$

$$= Max\ (0, 40.e^{-0.06\ X\frac{6}{12}} - 35 + 2\ .e^{-0.06\ X\frac{3}{12}})$$

= Max (0 , [40 X 0.97045 – 35] + 2 X 0.985125

= Max (0 , 5.79)

= Rs.5.79/-

11.4 UPPER BOUND OF PUT

Upper bound of the put option indicates the maximum price a trader can pay to purchase the contract that gives the right to sell the underlying asset at strike price irrespective of the price prevailing in the market. The maximum value of American put is its strike price and European put is its strike price measured in present value terms. Symbolically,

Upper Bound of Put $_{\text{American}}$: $P \leq X$ and

Upper Bound of Put $_{\text{European}}$: $P \leq X \cdot e^{-rt}$

Let's take an example – the stock of APL is trading at Rs.800 right now. 1month put options (PE) on this stock are available at a strike price of Rs.900. If we calculate the present value of Rs.900 at 12% risk free interest rate compounded continuously, we'll get Rs.891 (that is, 900 X 0.99005). Logically, the upper bound price of a European put cannot exceed that Rs.891 which is the present value of the strike. If price of the put is above then arbitrageurs will utilize the opportunity to earn risk-less profit, which will ensure the reestablishment of upper bound of put condition.

Now, if the dividend on stock is known, it doesn't make any difference. The only rule to be remembered in case of upper bound European out prices is that it cannot exceed the present value of the strike price.Not that, in the worst case the maximum loss that a put writer will suffer is the strike price. This loss is mitigated by investing the present value of strike at 8% risk free investments.

11.5 FACTORS AFFECTING OPTION PRICE

In this section, we consider what happens to option prices when one of the factors changes with all the others remaining fixed.

1) Current Stock Price:

If call option is exercised at some time in the future, the payoff from a call option will be the amount by which stock price exceeds the strike price. Therefore call option becomes more valuable as the stock price increases. For a put, the payoff on exercise is the amount by which the strike exceeds the stock price and hence, put behaves in an opposite way.

2) Exercise Price:

If call is exercised at some time in the future, the payoff from a call option will be the amount by which stock price exceeds the strike price. Therefore call option becomes less valuable the strike price increases. Reverse conditions applicable to put option, if strike price increases.

3) Time to Expiration:

Both put and call American options become more valuable as the time to expiration increases. To see this, consider two options that differ only as far as the expiration date is concerned. The owner of the long-life option has all the exercise opportunities open to the owner of the short-life option and more. The long-life option must therefore always be worth at least as much as the short-life option. European put and call options do not necessarily become more valuable as the time to expiration increases.

4) Volatility in Stock Prices:

Roughly speaking, the volatility of a stock price is a measure of how uncertain weare about future stock price movements.As volatility increases, the chance that the stock will do very well or very poorly increases. The owner of a call benefits from price increases but has limited downside risk in the event of price decreases. Therefore value of calls increases as volatility increases. The same logic applies to put options.

5) Risk-free Rate of Interest:

If the stock price is expected to increase, an investor can choose to either buy the stock or buy the call. Purchasing the call will cost far less than purchasing the stock. The difference can be invested in risk-free bonds. If interest increase, the combination of calls and risk-free bonds will be more attractive. This means that the call price will tend to increase with increases in interest rates. However, when you sell the stock by exercising the put, you receive certain amount of rupees. If interest rates increase, the rupees will have a lower present value. Thus, higher interest rates make put less attractive.

6) Amount of Future Dividends:

The dividend have the effect of reducing the stock price on ex-dividend date. That is a bad news for the value of call option and good news for the value of put option. The value of call, therefore, be negatively related to the size of an anticipated future dividend and vice versa in case of put option contract.

Summary of the effect on the price of the stock option of increasing one variable while keeping all others fixed

Variable	European Call	European Put	American Call	American Put
Current stock price	+	-	+	-
Strike price	-	+	-	+
Time to expiration	?	?	+	+
Volatility	+	+	+	+
Risk- free rate	+	-	+	-
Amount of future dividends	-	+	-	+

Notes:

+ indicates that an increase in the variable causes the option price to increase;

- indicates that an increase in the variable causes the option price to decrease;

? indicates that relationship is uncertain

10.8 NOTES

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11.7 SUMMARY

The owner of a put option contract has the right, but not obligation, to sell the underlying asset at a specified strike price on or before a specified expiration day depending upon the style of execution of the purchased contract.The minimum price which is acceptable to the seller/writer of the contract is its lower bound and is the difference between strike price and stock price or zero, whichever is greater in case of American put. In case of European, one needs to consider present value of strike price and dividend to arrive at lower bound. The maximum value of American put is its strike price and European put is its strike price measured in present value terms. Later we discussed about various determinants of call and put option prices to sum up this unit.

11.8 KEYWORDS

- **American Style:** An option contract that can be executed any time between the dates of purchase and its expiration.
- **Arbitrage:** The purchase of commodity or financial instrument in one market at lower price and selling them in another market at a higher price.
- **European Style:** Contract that can be exercised only on the day of expiration.
- **Exercise / Execute:** Formal notification to implement the right under which the buyer (holder) of an option is entitled to buy or sell the underlying asset.
- **Strike Price or Exercise Price:** The strike or exercise price of an option is the specified/ predetermined price of the underlying asset at which the same can be bought or sold if the option buyer exercises his right to buy/ sell on or before the expiration day.
- **Exercise Date:** The date on which the option is actually exercised is called the Exercise Date.
- **Expiration Date:** The last day on which an option contract can be exercise. From Indian equity derivatives market perspective, generally, expiration day is last Thursday of every month.
- **Open Interest:** The total number of options contracts outstanding in the market at any given point of time.
- **Option Holder:** is the one who buys an option, which can be a call, or a put option. He enjoys the right to buy or sell the underlying asset at a specified price on or before specified time.

- **Option Premium:** Premium is the price paid by the buyer to the seller to acquire the right to buy or sell.
- **Option Seller/ Writer:** is the one who is obligated to buy (in case of put option) or to sell (in case of call option), the underlying asset in case the buyer of the option decides to exercise his option.

11.9 SELF-ASSESSMENT QUESTIONS

1. How bounds computation of American style of contracts different from European style of contracts. Elucidate.

2. A stock is selling for Rs.500. If the risk-free-rate of interest is 10% p.a., then at what minimum price following put options of European style of execution will have?

(a) A put with a strike of Rs.450 maturing after 1 month.

(b) A put with a strike of Rs.500 maturing after 2 months.

(c) A put with a strike of Rs.550 maturing after 3 months.

3. Explain the determinants of Option Prices?

4. Given the following data, what is the highest price of an American put?

Stock Price = Rs.485

Strike Price = Rs.450

Time to Expiration = 3 months

Risk-free Rate = 8.4% p.a.

The next ex-dividend date will be two months hence. You have established the following probabilities for dividend amount:

Probability	Dividend Amount (Rs.)
0.25	15
0.40	10
0.35	05

5. Stock price of ABC-ltd's share is Rs.1800. if the risk free rate of interest is 6% p.a., then at what minimum price following options on the stock of ABC, maturing after a month would sell for:

(a) A call with a strike of Rs.1700.

(b) A put with a strike of Rs.1800.

(c) A call and put with a strike of Rs.1900 each.

6. How lower bounds of European put with non-dividend paying stock is different from dividend paying stock? Illustrate.

7. What is the minimum and maximum price put option contracts? Explain.

8. A 1-month put on a non-dividend paying stock is currently selling for Rs.25. the stock price id Rs.470, the strike price is Rs.500 and the risk-free rate of interest is 6% per annum. What opportunities are there for an arbitrageur?

9. Discuss the factors which will have varying influence on the price of call and put option contracts.

10. A stock is selling for Rs.75. A put option with a strike of Rs.80 maturing after three months are available on the stock. What should be the minimum price of the option if the risk-free rate of interest is 12% p.a.? What would be the price of the same option, if stock will fetch a dividend of Rs.3 at the end of two months?

11. Given the following data, what is the lowest price of an American put?

Stock Price = Rs.55

Strike Price = Rs.50

Time to Expiration = 3 months

Risk-free Rate = 10% p.a.

The next ex-dividend date will be two months hence. You have established the following probabilities for dividend amount:

Probability	Dividend Amount (Rs.)
0.01	1.5
0.10	1.7
0.50	1.9
0.38	2.1
0.01	2.3

8. Explain lower bounds of American & European put with illustration.

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UNIT-12 : OPTIONS COMBINATIONS

Structure :

12.0 OBJECTIVES

After reading this unit, you should be able to;

- Explain the concept of spreads and combinations
- Describe difference between various kinds of options trading/hedging strategies.
- Suggest suitable strategy for different market condition.

12.1 INTRODUCTION

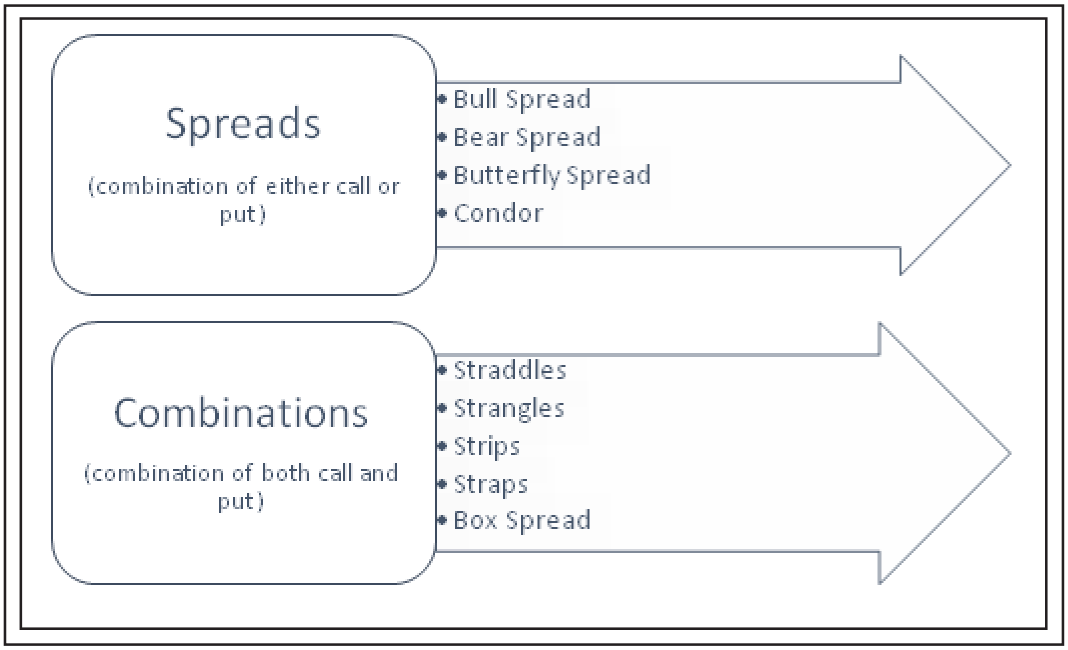
Holding or writing a single option, either call or put, results in uneven gains or losses with changes in the underlying asset prices. By making a payment of small premium a call gives unlimited profit for the holder in a bullish market and put gives higher profit in a declining market. Because of the non-symmetric profile of risk & reward of calls and puts, by making a combination of these instruments we can generate a vast number of risk return profiles to match our specific risk and return preferences. Due to this ability to bring a trade-off between risk & reward, is one of the reasons traders continue to trade in options.

Combination of options can be done in many ways. But, the most common and popular blends are spreads which involve a mixture of either calls or puts and combinations which involve a mixture of both calls and puts. These combinations or strategies are used for trading or hedging purpose. If you combines option contracts with the motive of managing risk, it would be called hedging but when they are combined to assume risk, it would become speculation. Hence, it is necessary to have little bit knowledge on these strategies under this course.

12.2 COMBINATIONS OF OPTIONS

The options literature often draws a distinction between spreads and combinations where spreads are defined as constructed using calls or puts, but not both , while combinations are constructed using both calls and puts, or options and the underlying asset. While an understanding of simple calls and puts is enough to understand simple strategies such as spreads, butterflies, condors, straddles and strangles that can help to better define risk and even open up many more trading opportunities. Because options prices are dependent upon the prices of their underlying securities, options can be used in various combinations to earn profits with reduced risk, even in directionless markets. Below is a list of the most common spreads and combinations strategies, but there are many more—infinitely more. But this list will give you an idea of the possibilities. If you are contemplating these strategies, you should keep in mind the risks, which are more complex than with simple stock options.

The most commonly used Options Spreads and Combination Strategies has been depicted in following diagram and explained in detail in the next section.



12.3 OPTIONS SPREADS STRATEGIES

Options spreads are the basic building blocks of many options trading strategies. A spread position is entered by buying and selling equal number of options of the same class on the same underlying security but with different strike prices or expiration dates.

In other words, an option spread is established by buying or selling various combinations of calls and puts, at different strike prices and/or different expiration dates on the same underlying security. There are many possibilities of spreads, popular among them are:

12.3.1 Bull Spread

A bull spread is used by one who is moderately bullish about underlying assets' price movement. Since the perspective is bullish, the first position a trader will take is long call or short put. However, as the trader does not have very aggressive view on the price movement he will try to reduce his risk by entering in to a counter (opposite) position. While establishing bullish spreads trader always buys lower strike price positions and sells higher strike price options irrespective of options type (calls or puts).

We can broadly classify a bull spread strategy into bull call spread and bull put strategy. Though underlying principle of these two strategies remains the same, that is, buying contract at lower strike and selling another contract with higher strike price having same expiration date and number of contract. The variation only in terms of type of contract used (i.e., call or put).

Let us see an example to understand the functioning of bull spread strategy. Let the strike price of a call option contract is Rs.100 and is available at NSE for Rs.18 and another contract with a strike of Rs.140 available for Rs.9. Mr. Ajith has purchased first contract and short the second one with the anticipation the price of the security will increase in future. His payoff at the time of expiry for a possible range of stock prices are:

Payoff of Bull Spread Strategy

(Figures in Rs.)

Stock Price	Payoff from Long Call	Payoff from Short Call	Net Payoff
0	-18	9	-9
50	-18	9	-9
80	-18	9	-9
100	-18	9	-9
120	2	9	11
140	22	9	31
160	42	-11	31
180	62	-31	31
250	132	-101	31

If you observe the value of net payoff from bull spread, the maximum loss is Rs.9, which is the cost strategy (i.e., Premium Received – Premium Paid) and maximum profit is Rs.31 which is the difference between the two exercise prices minus the net premium (i.e.,[140-100]-9). Thus, by constructing bull spread strategy a trader can fix his profit as well as his profit to acceptable limit based on his preference.

12.3.2 Bear Spread

A bear spread is a position where a trader has negative view on the stock. The first position taken by the trader is a short call or long put but as he does not have a very aggressive view he tries to reduce his exposure by adding a counter position. This spread may be established with the help of either two call options or two put options but, while establishing a bearish spread one must buy a higher strike price options and sell lower strike price options.

For instance, ABC ltd.'s stock is trading at Rs.38 in June. An options trader bearish on ABC decides to enter a bear put spread position by buying a JUL put with an exercise price of Rs.40 for a cost of Rs.3 and sell a JUL put with a strike of Rs.35 for a cost of Re.1 at the same time, resulting in a net debit of Rs.2 for entering this position. The price of ABC stock subsequently drops to Rs.34 at expiration. Both puts expire in-the-money with the JUL 40 call bought having Rs.6 in intrinsic value and the JUL 35 call sold having Re.1 in intrinsic value. The spread would then have a net value of Rs.5 (the difference in strike price). Deducting the debit taken when he placed the trade, his net profit is Rs.3 (that is net value – net debit of premium). This is also his maximum possible profit.

If the stock had rallied to Rs.42 instead, both options expire worthless, and the options trader loses the entire debit of Rs.2 taken to enter the trade. This is also the maximum possible loss.

12.3.3 Butterfly Spread

A butterfly requires more precision because, not only do you have to have an opinion on direction, but also a target price. Essentially, a butterfly is a combination of a bull spread with a bear spread using either all calls or all puts. The way a butterfly is formed is by buying an in-the-money and an out-of-the-money call or put, and then selling two calls or puts at the middle strike, which is your price target.To put it simple, to form a butterfly strategy, at first

- You need to purchase a call with relatively low strike price, say X1.
- Then buy another call option with relatively high strike price, say X3.
- Sell two call options with a strike price, X2 which is half way between X1 and X3.

Suppose, if a company's stock price is currently worth Rs.61. Consider a trader who feels that a significant price move in the next three month is unlikely. Suppose the market quotes of 3-month calls are as follows:

Strike Price (Rs.)	Call Price (Rs.)
55	10
60	7
65	5

The trader could create a butterfly spread strategy by buying one call with a strike price of Rs. 55 and another call with a strike of Rs.65 which will result in an outlay of Rs.15, the premium paid to purchase two call options. Then he needs to write two call option with a strike of Rs.60 on which he will receive a premium of Rs.14 (i.e., 7 X 2), hence the cost of the butterfly spread is Rs. 1, which is a difference between premium received and premium paid. If after 3 months the possible stock prices are (Rs.30, Rs.40, Rs.50, Rs.55, Rs.60, Rs.65, Rs.70, Rs.80, Rs.9 or Rs.100) any of these prices, then trader's net payoff will be:

Payoff of Butterfly Spread Strategy

(Figures in Rs.)

Stock Price @Maturity	Cost of the Strategy	Profit/loss on first long call	Profit/loss on second long Call	Profit/loss on 2 short calls	Net Payoff
30	-1	0	0	0	-1
40	-1	0	0	0	-1
50	-1	0	0	0	-1
55	-1	0	0	0	-1
60	-1	5	0	0	4
65	-1	10	0	-10	-1
70	-1	15	5	-20	-1
80	-1	25	15	-40	-1
90	-1	35	25	-60	-1
100	-1	45	35	-80	-1

When the stock price is in three months is greater than Rs.65 or less than Rs.55, the net payoff for the trader will be Rs.-1, which is the cost of the strategy. He can earn profit only when the price in future is in between Rs.55 and Rs.65 and the maximum profit is limited to only Rs.4 in case of butterfly strategy in above example.

The butterfly spreads can also be created using put options wherein, the trader should but put options with a low strike price and high strike price and then he need to sell two puts with the price in between lower and higher strike price of long puts.

12.3.4 Condor

Like butterflies, Condor require you to have an opinion on direction and a price target. Unlike butterflies, you can target a range in which you think the stock will be at expiration. Where a butterfly requires you to sell two options at a central strike price (which also is your price target), a condor could be profitable if the stock expires along a range of prices because it involves selling at two different strike prices. The advantage of a condor compared to a butterfly is it allows you to take a directional play, but it gives you a larger range where you may do pretty well. Like a butterfly, a condor is composed of either all calls or all puts.

Suppose, if the stock price is Rs.63, and we think the price after a month will be somewhere between Rs.70 and Rs.75 at expiration, a condor can let us maximize profit while limiting risk. We assume that in the market calls are quoted at a strike price of Rs.65, Rs.70, Rs.75 and Rs.80 with a premium of Rs.12, Rs.9, Rs.6 and Rs.4 respectively.

To form a condor strategy, we can buy Rs.65 and Rs.80 calls and we need to sell Rs.70 and Rs.75 calls. This will result in an upfront cost of Rs.1 which is difference between premium on short calls and long calls (i.e., [9+6] – 12+4).

Profit is maximized if we expire between Rs.70-Rs.75 and our wings give us protection if we miss our mark (i.e., Rs.70-75 range). Again, our maximum loss is the cost of the condor, plus commissions if any.

You can by yourselves verify what will be the payoffs of condor if the stock price at the time expiry happens to be Re.0 or Rs.40 or Rs.50 or Rs.60 or Rs.65 or Rs.70 or Rs.75 or Rs.80 or Rs.90 or Rs.100 or Rs.1000**?**

12.4 OPTIONS COMBINATIONS STRATEGIES

12.4.1 Straddles

The straddle is an unlimited profit, limited risk option trading strategy that is employed when the options trader believes that the price of the underlying asset will make a strong move in either direction in the near future. It can be constructed by buying an equal number of at-the-money call and put options with the same expiration date.

If you think a stock is about to make a big move either to the upside or downside but don't know which way it could break, a straddle can allow you to take advantage of that implied volatility. Typically, a long straddle involves buying an at-the-money call and an at-the-money put, thus straddling where the stock currently is trading.

For instance, you assume that a company's stock trading at Rs.50 and is going to make an earnings announcement in a month period. Although you do not know whether it is going to do well or poorly, you expect that there to be an outsized reaction to earnings, so he initiates a straddle by buying a Rs.50 call and a Rs.50 put and the stock price may reach to either Rs.80 or Rs.10. If it goes to Rs.80, then your put is worthless, but the call you purchased is will save Rs.30 as you can purchase the stock at Rs.50 than Rs.8. On the other hand, if the price goes to Rs.10, then call become worthless, but your put offers Rs.40 more since you could sell the stock for Rs.50 than for Rs.10.

A straddle makes the most sense if you think something exceptional is going to happen, but that implied volatility already likely is high, which would make the at-the-money call and put fairly expensive. Anything less than a 10% move can cause a loss because the position is so expensive to put on. Your maximum risk is right at the strike price. If in our example the stock only moves to Rs.53 or Rs.46, you may get Rs.3 or Rs.4 back on a position that may have cost Rs.5 or Rs.6 to initiate (i.e., to purchase call and put option contracts). If it works in your favor, though, the potential profit is open-ended.

A long straddle is established by buying both a put and call on the same security at the same strike price and with the same expiration. This investment strategy is profitable if the stock moves substantially up or down, and is often done in anticipation of a big movement in the stock price, but without knowing which way it will go. For instance, if an important court case is going to be decided soon that will have a substantial impact on the stock price, but whether it will favor or hurt the company is not known beforehand, then the straddle would be a good investment strategy. The greatest loss for the straddle is the premiums paid for the put and call, which will expire worthless if the stock price doesn't move enough. To be profitable, the price of the underlying asset must move substantially before the expiration date of the options; otherwise, they will expire either worthless or for a fraction of the premium paid. The straddle buyer can only profit if the value of either the call or the put is greater than the cost of the premiums of *both* options.

A short straddle is created when one writes both a put and a call with the same strike price and expiration date, which one would do if he believes that the stock will not move much before the expiration of the options. If the stock price remains flat, then both options expire worthless, allowing the straddle writer to keep both premiums.

12.4.2 Strangles

Like the straddle, a strangle is also a strategy that has limited risk and unlimited profit potential. The difference between the two strategies is that out-of-the-money options are purchased to construct the strangle, lowering the cost to establish the position but at the same time, a much larger move in the price of the underlying is required for the strategy to be profitable. A strangle is the same as straddle except that the put has a lower strike price than the call, both of which are usually out-of-the-money when the strangle is established. The maximum profit will be less than for an equivalent straddle.

For the long position, a strangle profits when the price of the underlying is below the strike price of the put or above the strike price of the call. The maximum loss will occur if the price of the underlying is between the 2 strike prices. For the short position, the maximum profit will be earned if the price of the underlying is between the 2 strike prices. As with the short straddle, potential losses have no definite limit, but they will be less than for an equivalent short straddle, depending on the strike prices chosen.

Let us reconsider our previous example of Rs. 50 stock, but in this case you buy the 45 put and the 55 call to form a strangle strategy. The advantage is that by buying out-of-the-money options, your initial cost is much lower, but at the same time you need to have a bigger move in the underlying for it to be profitable. If you were able to buy both the put and call for Rs.1 each, then stock will have to reach Rs.57 or Rs.43 just to break even (not including any transaction cost).

You also are able to short a strangle, but the same issues apply as if you were to short a straddle. With all of these strategies, you need to be aware of your positions going into expiration. If a portion of your strategy is in-the-money and you do not want to take possession, then you need to ensure you are able to exit that position before expiration. Although these strategies allow you to balance your risk- reward profile to your liking, you always should consider the worst-case scenario when taking on a trade.

12.4.3 Strips

A strip position is just an extension of straddle. A straddle buyer expects the market significant market moves but unsure about the direction of it. If market goes up, call generates money for him and vice versa. However, if a trader believes that although market move in either direction, there is a greater possibility of downward movement than upward and hence, he buys two puts and one call to advantage of the down side movement. Hence we can say that a strip is a modified, more bearish version of the common straddle and its construction is similar to the straddle except that the ratio of puts to calls purchased is 2:1.

Assume for instance, that the cash price of a Stock-X is Rs.200 and you are unsure about the direction of market price movement in X, but you believe that there will be substantial movement in prices. Moreover your belief is there will be higher chances of fall in the price than increase and hence you decided to construct a strip strategy. In order to form a long strip strategy, you need to purchase one call and two put option with a strike of Rs.200 on payment of a premium of Rs.10 each, resulting to an total outflow of Rs.30 (i.e. 1 call + 2 put premiums).

Your pay-offs under different scenarios of stock-X's prices, at maturity are given in following table.

Stock Price @Maturity	Premium Paid	Profit/loss on Call	Profit/loss on 2Puts	Net Payoff on Strip
150	-30	0	100	70
160	-30	0	80	50
170	-30	0	60	30
180	-30	0	40	10
185	-30	0	30	0
190	-30	0	20	-10
200	-30	0	0	-30
210	-30	10	0	-20
220	-30	20	0	-10
230	-30	30	0	0
240	-30	40	0	10
250	-30	50	0	20

The above table indicates that you will lose money between the levels of Rs.185 and 230 (break-even levels). Under strip strategy in the above example, you may end up losing maximum of Rs.30 (i.e., option premium) no matter what the price in future.

12.4.4 Straps

The strap is a more bullish variant of the straddle. Twice the number of call options are purchased to modify the straddle into a strap. Unlike the buyer of strip position, a strap buyer expects the stock to move significantly in either direction with a greater probability of an upward reaction than downward and therefore, he buys two calls and one put to construct his strategy. A strap is a specific option contract consisting of 1 put and 2 calls for the same stock, strike price, and expiration date.

Let us reconsider the example of Mr.A and will assume that he is expecting a price hike than fall. His pay off of Straps for possible ranges of stock price at the time of expiration is:

Stock Price @Maturity	Premium Paid	Profit/loss on 2Calls	Profit/loss on Put	Net Payoff on Strip
150	-30	0	50	20
160	-30	0	40	10
170	-30	0	30	30
180	-30	0	20	0
185	-30	0	15	-15
190	-30	0	10	-20
200	-30	0	0	-30
210	-30	20	0	-10
220	-30	40	0	10
230	-30	60	0	30
240	-30	80	0	50
250	-30	100	0	70

Under straps in the above example, Mr. A may end up losing maximum of Rs.30 (i.e., option premium) no matter what the price in future.

12.4.5 Box Spreads

A box spread consists of a bull call spread and a bear put spread. The calls and puts have the same expiration date. Consider two strike prices X_1 and X_2, such that $X_1 < X_2$. The strategy requires the investor to buy a call with an exercise price of X_1 and sell call with an exercise price of X_2. It requires him to simultaneously sell a put with an exercise price X_1 and buy a put with a strike X_2. The initial cash flow of cost of this strategy will be:

$$-C_{t,1} + C_{t,2} + P_{t,1} - P_{t,2} < 0$$

because $C_{t,1} > C_{t,2}$ and $P_{t,1} < P_{t,2}$.

Suppose XYZ stock is trading at Rs.45 in June, option contract size is 100 shares and the following prices are available:

- JUL 40 put - Rs.1.50
- JUL 50 put - Rs.6
- JUL 40 call - Rs.6
- JUL 50 call - Rs.1

Buying the bull call spread involves purchasing the JUL 40 call for Rs.600 and selling the JUL 50 call for Rs.100. The bull call spread costs: Rs.600 - Rs.100 = Rs.500

Buying the bear put spread involves purchasing the JUL 50 put for Rs.600 and selling the JUL 40 put for Rs.150. The bear put spread costs: Rs.600 - Rs.150 = Rs.450

The total cost of the box spread is: Rs.500 + Rs.450 = Rs.950

The expiration value of the box is computed to be: (Rs.50 - Rs.40) x 100 = Rs.1000.

Since the total cost of the box spread is less than its expiration value, a riskfree arbitrage is possible with the long box strategy. It can be observed that the expiration value of the box spread is indeed the difference between the strike prices of the options involved.

If XYZ remain unchanged at Rs.45, then the JUL 40 put and the JUL 50 call expire worthless while both the JUL 40 call and the JUL 50 put expires in-the-money with Rs.500 intrinsic value each. So the total value of the box at expiration is: Rs.500 + Rs.500 = Rs.1000.

Suppose, on expiration in July, XYZ stock rallies to Rs.50, then only the JUL 40 call expires in-the-money with Rs.1000 in intrinsic value. So the box is still worth Rs.1000 at expiration.

What happens when XYZ stock plummets to Rs.40? A similar situation happens but this time it is the JUL 50 put that expires in-the-money with Rs.1000 in intrinsic value while all the other options expire worthless. Still, the box is worth Rs.1000.

As the trader had paid only Rs.950 for the entire box, his profit comes to Rs.50.

Remember that the value of a box spread will always be $(X_2 - X_1)e^{-rt}$. If it has a different value there is an arbitrage opportunity and this process enable the value remain at $(X_2 - X_1)e^{-rt}$ level.

10.8 NOTES

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12.10 SUMMARY

Under this unit we discussed in detail about a variety of popular options spreads and combinations strategies which can used for hedging as well as speculative purposes. Options spreads are the basic building blocks of many options trading strategies. A spread position is entered by buying and selling equal number of options of the same class on the same underlying security but with different strike prices or expiration dates, whereas, combinations are an option trading strategy that involves the purchase and/or sale of both call and put options on the same asset. Option combinations are popular with experienced traders and investors because they can be tailored to provide specific risk-reward payoffs that suit the investor's individual risk tolerance and preferences. This unit also provided good overview on bull spreads, bear spreads, butterfly spreads, condors, straddles, strangles, strips, straps and box spreads strategies.

12.11 KEY WORDS

- **Bear Spread :** a bear spread is a combination of long call/put with higher strike and short call/put with lower strike.
- **Box Spread :** A special combination of options that result in riskless payoff in most cases.
- **Bull Spread :** a combination of long call/put with lower strike and short call/put with higher strike.
- **Condor :** is created by two long calls/puts at different strikes and two short calls/puts at the different strikes that is in between the strikes of two long positions.
- **Straddle :** combination of a long/short call and a long/short put on the same asset with same expiry.
- **Strangle :** a combination consisting of a long/short call at higher strike and a long/short put at lower strike on the same asset with same expiry.
- **Strips :** a combination two puts and one call.
- **Straps :**a combination of two calls and a put.

12.12 SELF-ASSESSMENT QUESTIONS

1. Compare and contrast Spreads with Combinations.

2. How would you construct a bull spread strategy using puts? Illustrate.

3. How Butterfly strategy different from Condor strategy?

4. What is straddle? When is it appropriate to use?

5. What is box spread? Explain with suitable example.

6. An investor has the following portfolio of calls on the same asset and with same expiration of dates:

Long 1 call at a strike price of Rs.190 at a premium of Rs.10

Short 2 call at strike price of Rs.200 at premium of Rs.14 each

Long 1 call at a strike price of Rs.210 at a premium of Rs.20

Find out his payoff for various ranges of price (*from Rs.150 to Rs.250 with multiples of 10*) and depict the same graphically and answer the following:

(a) The price of asset yielding maximum profit and how much?

(b) The price of asset yielding maximum loss and how much?

(c) The price of the asset yielding no profit/loss.

7. If you having bullish expectation about market, what are the strategy you can use to take advantage of the possible opportunities in future?

8. At NSE, following were the prices of 1-month call and put on its index Nifty50 on 15th September 2016 when the Nifty was at 8500.

Exercise Price	Call Option	Put Option
8450	265	175
8500	225	195
8550	200	225

(a) How would you construct straddle at index value of 8500?

(b) Find out its cost, payoff, break-even point and the maximum loss.

(c) What would be the profit/loss if after 1-month the index value were (i) 8100 (ii) 8750 or (iii) 9000?

9. "Call buyers and put writers exhibit bullish sentiments". Do you agree? Explain.

10. Use data used in question number -8, construct following strategy and find out the cost and payoff for 1-m future spot price of 8100, 8200, 8300, 8400, 8500, 8600, 8700, 8800 and 8900 for following strategies.

    (i) Short Strangle.

    (ii) Bull call Spreads

    (iii) Bear put Spread.

11. Compare Strips with Straps with suitable example.

12. What trading position is created from a long strangle and a short straddle when both have the same time to expiry? Assume that strike prices in the straddle is halfway between the two strike prices of the strangle.

13. Currently the value of Nifty50 is at 8250 and at-the-money call and put with three months to maturity are selling for Rs.240 and Rs.150 respectively. If an investor believes that the market is going to remain range bound for coming three months how can he benefit from options being traded in the market? What maximum profit or loss can be made or incurred?

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MODULE- IV
VALUATION MODELS

UNIT -13 : PRINCIPLES OF OPTIONS PRICING

Structure :

13.0 OBJECTIVES

After studying this units, you will be able to;

- The basic relationship between the call option premium and macro economic and stock specific factors,
- The basic relationship between the put option premium and macro economic and stock specific factors,
- The fundamental equations representing upper and lower bounds for call option prices, and
- The fundamental equations representing upper and lower bounds for put option prices .

13.1 INTRODUCTION

Option valuation is one of the most important developments in the field of finance in the recent past. Any course in options shall be incomplete without a discussion on pricing and valuation of these unique derivative instruments popularly traded in both OTC markets and exchanges. The objective of this unit is to lay the foundation for valuation of options focusing on the two important models that can be used to calculate option prices before the option expiration date. However, before those two specific models are presented it is important to realize that basic options value before expiration must obey a set of pricing restrictions. The upper and lower boundary prices for call and put options are presented. This unit begins with a brief description of factors impacting options prices.

13.2 FACTORS AFFECTING CALL PRICES

Options have value because option buyers can exercise the option to their advantage, should the opportunity to do so arise. A fundamental advantage of holding a call option is that it may be possible to obtain the underlying shares more cheaply by exercising the option than by direct share purchase. Intuitively, the price paid for the right to exercise should therefore reflect, among other factors, the probability that the share price will rise above the exercise price (or rise further above it, if it has already been exceeded). This probability should, in turn, be related to the following factors.

(i) The current share price

The higher the current share price, the greater is the probability that the share price will increase above the exercise price, and therefore the higher the call price, other things being equal. Ignoring market imperfections, a call whose underlying share price is already above the exercise price must be worth at least the difference between the two. This amount is the cash flow that will occur if the call is exercised immediately, and is referred to as the call's intrinsic value. However, even a call whose exercise price is above the current price of the underlying share must be worth something. It has value as long as there is some chance, however small, that at some point in the call's life the intrinsic value may become positive.

(ii) The exercise price

Clearly, the higher the exercise price, the lower is the probability that the share price will increase above the exercise price, and therefore, the lower the call price, other things being equal.

(iii) The term to expiry

The longer the term to expiry, the greater is the probability that the share price will increase above the exercise price. Therefore, the longer the term to expiry, the greater is the call price, other things being equal. To make the same point in a slightly different way, consider two American calls which are equivalent in every respect, except that one has a shorter term to expiry than the other. In the period before the expiry of the shorter-term call, both calls provide the option buyer with the same rights. However, the rights conferred by the longer-term call continue for a further period. Therefore, the longer-term call is more valuable. The amount of the call price over and above any intrinsic value is called the time value, since with all other factors constant it will be greater, the longer the term to expiry. Note, however, that the term to expiry is only one factor determining the time value. It should also be distinguished from the 'time value of money'.

(iv) The Volatility of the Share Price

The volatility of a share is the variability of its price over time. The effect of volatility on call price is illustrated in the following simple example. Consider a high volatility share, H, whose current price is Rs.5, and a low volatility share, L, whose current price is also Rs.5. Consider call options on H and L at a moment before expiry. The exercise price of both call options is Rs.5. As explained previously, calls at expiry are worth a positive amount if the difference between the share price and the exercise price is positive. Otherwise they are worth zero. Suppose further that the probabilities of various share prices at expiry are known to be those shown in Table 1. The call on the low-volatility share is less valuable than the call on the high-volatility share. This result is not peculiar to this particular example and it may be shown that, other things being equal, calls on high-volatility shares are worth more than calls on low-volatility shares.

Table 1: Probability distributions for shares H and L

Share H			SharreL		
Share Price (Rs.)	Probability	Value of calls(Rs.)	Share price	Probability	Value of calls
4.00	0.2	0	4.00	0.04	0
4.50	0.2	0	4.50	0.16	0
5.00	0.2	0	5.00	0.60	0
5.50	0.2	0.50	5.50	0.16	0.50
6.00	0.2	1.00	6.00	0.04	1.00

The expected values of the calls on shares H and L are:

E (call on H) = (0.2)(0.50) + (0.2)(1.00)

=Rs. 0.30

E (call on L) = (0.16)(0.50) + (0.04)(1.00)

= Rs. 0.12

(v) The risk-free interest rate

The buyer of a call option gets a right to buy the underlying stock on a future date which implies deferment of payment. Because interest rates are positive, money has a time value, so the right to defer payment is valuable. The higher the interest rate, the more valuable is this right. Therefore, it is plausible to suggest that the higher the risk-free interest rate, the higher is the price of a call, other things being equal.

(vi) Expected dividends

If a company pays a dividend to its ordinary shareholders the share price will fall on the ex-dividend date. The price of a call will decrease if the price of the underlying share decreases. It is to be expected, therefore, that a call on a share that will go ex-dividend before the expiry of the call is worth less than if the share either never pays dividends or, if it does pay dividends will not reach the next ex-dividend date until after the call has expired. In short, calls on shares that pay high dividends during the life of the call are worth less than calls on shares that pay low dividends during the life of the call, other things being equal.

To summarise, other things being equal, call prices should be higher and vice versa, given:

(i) the higher current share price;

(ii) the lower the exercise price;

(iii) the longer term to expiry;

(iv) the higher volatility of the underlying share;

(v) the higher the risk-free interest rate; and

(vi) the lower expected dividend to be paid following an ex-dividend date that occurs during the term of the call.

13.3 FACTORS AFFECTING PUT OPTION PRICES

The buyer of a put option obtains the right to sell shares at the exercise price. The higher the exercise price, the more the buyer of the put stands to gain. For example, the right to sell a share for Rs.100 is a more valuable right than the right to sell for only Rs.90, other things being equal. Therefore, for put options, the higher the exercise price, the higher is the price of the option. For call options, the opposite is true. Similarly, the right to sell a share at a fixed price is less valuable, the higher the current share price, other things being equal. For example, suppose that the holder of a put exercised his right to sell a share at the exercise price of Rs.100. If the current share price is Rs. 90 , the holder of the put gains Rs. 10 because he has been able to sell the share for Rs.10 more than it is currently worth. If the share price had been higher – say, Rs.95 – the gain would have been only Rs.5. Therefore higher share prices imply lower put prices, other things being equal. For call options the opposite is true. The relationship between price and term to expiry is straightforward in the case of american puts. Consider two american puts, equivalent in all respects except that one has a longer term to expiry. Both puts may be exercised at any time up to (and including) their respective expiry dates. Therefore, the long-term put permits exercise, at all times permitted by the short-term put, but in addition the long term put permits exercise after the expiry of the short-term put. Therefore, for american puts, a longer term to expiry increases the value of the put, other things being equal. This is also true of call options.

The buyer of a put option gains if share prices fall. Consequently, puts are especially attractive to shareholders who fear that the share price may decrease, but who nevertheless do not wish to sell their shares.

As with call options, higher share volatility implies a higher option price. Higher volatility implies a greater chance of large increases and large decreases in the share price. From the put holder's viewpoint, share price increases are bad news, while decreases are good news. But a put holder gains more from a share price decrease than is lost from an increase of the same amount. So, on balance, a put holder has a favourable view of share price volatility.

Because a put confers the right to receive a future cash inflow, it is expected that put prices should be negatively related to interest rates. A higher interest rate reduces the present value of whatever future cash inflow may be received. Finally, dividend payments reduce share prices, which benefits put holders, so higher expected dividend payments increase put prices.

13.4 MAXIMUM AND MINIMUM OPTION PRICES

To explain the models dealing with maximum and minimum possible prices of options, it is assumed that there are some market participants for whom:

(1) There are no transactions costs

(2) All trading profits (net of trading losses) are subject to the same tax rate

(3) Borrowing and lending at the risk-free interest rate is possible

(4) No arbitrage opportunities exist

The following notations will be used:

S_O = current stock price

S_T = stock price at time T

K = strike price of option

T = time of expiration of option

r = risk-free rate of interest for maturity T (continuously compounded)

C_A = value of American call option

P_A = value of American put option

C_E = value of European call option

P_E = value of European put option

An American or European call option gives the holder the right to buy one share of a stock for a certain price. No matter what happens, the option can never be worth more than the stock price. Hence, the stock price is an upper limit to the option price:

C_A £ S_O and C_E £ S_O

Similarly, an American or European put option gives the holder the right to sell one share of a stock for K. No matter how low the stock price becomes, the option can never be worth more than K. Hence,

P_A £ K and P_E £ K

For European put options, we know that at time T the option will not be worth more than K. It follows that its value today cannot be more than the present value of K:

P_E £ K e^{-rT}

(1) European Calls

(Non-Dividend-Paying Stocks)

A minimum limit for the price of European call option on a non-dividend-paying stock must be non-negative, as the worst can happen to a call is that it expires worthless. This means that C_E ³ 0, and,

C_E ³ $\max(S_O - Ke^{-rT}, 0)$ ....(1)

Example

Consider a European call option on a non-dividend paying stock where the stock price is Rs.140,strike price is Rs.132 and risk-free rate of interest is 10 percent per annum and the maturity is 3 months. In this case S_0 = Rs.140, K= Rs.132, r = 0.1 and T = 0.25.

$S_0 - Ke^{-rT} = 140 - 132e^{-0.1x0.25}$

= Rs.11.36

(2) European puts

(Non-Dividend Paying Stocks)

For a European put option on a non-dividend-paying stock, a lower limit for the price must be non-negative as the worst that can happen to a put option is that it expires worthless. This means that $P_E \geq O$ and, therefore,

$$P_E \geq \text{Max}\ (Ke^{-rT} - S_O, O) \qquad \text{..................(2)}$$

Example

Consider an European put option on a non-dividend-paying-stock where the stock price is Rs.210, the time to maturity is 3 months, the risk-free rate of interest is 10 percent per annum and the strike price is Rs.225. In this case S_O = Rs.210, K = Rs.225, T = 0.25, r = 0.1 From equation (9.2), a lower limit for the option price is $Ke^{-rT} - S_O$, or

$$\begin{aligned} P_E &= 225^{-0.1x0.25} - 210 \\ &= \text{Rs.}9.44 \end{aligned}$$

(3) The Effect of Dividends

The price relationships discussed so far have assumed that options are on a non-dividend-paying stock. In this section, the effect of dividends is examined. An exchange traded stock options generally have less than a year to maturity, the dividends payable during the life of the option can usually be predicted with reasonable accuracy. Let the present value of the dividends during the life of option denoted by D.

On the basis of equation (1), it can be shown that the lower bound for a call option becomes

$$C_E \geq \text{Max.}(S_O - D - Ke^{-rT}, 0) \qquad \text{——(3)}$$

Similarly, on the basis of equation (2), it can be shown that the lower bound for put option

$$P_E \geq \text{Max.}\ (D + Ke^{-rT} - S_O, 0) \qquad \text{———(4)}$$

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

$$C_E + D + Ke^{-rT} = P_E + S_O \qquad \text{————(5)}$$

13.5 NOTES

13.5 ILLUSTRATIONS

(1) What is the lower-limit for the price of a three-month European put option on a non-dividend–paying stock when the stock price is Rs.171, the strike price is Rs.189, and the risk-free interest rate is 10 percent per annum?

Solution:

A lower-limit for the price of a European put option on a non-dividend-paying stock is

= (present value of strike price) – (current price)

$= Ke^{-rT} - S_0$

$= 189^{-0.1x0.25} - 171$

$= 184 - 171$

$= 13$

(2) What is the lower-limit for the price of a three-month European call option on a dividend – paying stock when the stock price is Rs.710, the strike price is Rs.650, the expected dividend in two month is Rs.5, and the risk-free interest rate is 10% per annum?

Solution:

The lower-limit for the price of a European call option on a dividend-paying stock is:

= (Current price) - (present value of dividends) - (present value of strike price)

$= S_0 - De^{-rT} - Ke^{-rT}$

$= 710 - 5e^{-0.1x1/6} - 650e^{-0.1x0.25}$

$= 710 - 4.9155 - 634$

13.6 CASE STUDY

Tables below sets out the call and put options prices on the stocks of RPR Ltd. and SPS Ltd. and probability distribution for the prices of the respective stocks on February 5, 2016.

Table : Prices of call and put options on RPR and SPS stocks on February 5, 2016.

Expiry Month	Exercise price Rs.	Type of option	Option price Rs.
February	- RPR 920	American-call	59.90
	- SPS 460	American-call	28.60
February	- RPR 980	American-call	15.80
	- SPS 490	American-call	7.45
March	- RPR 1000	American-call	27.70
	- SPS 500	American-call	13.25
March	- RPR 1020	American-call	20.00
	- SPS 510	American-call	9.50
February	- RPR 920	American-put	1.05
	- SPS 460	American-put	0.40
February	- RPR 940	American-put	1.65
	- SPS 470	American-put	0.75
March	- RPR 980	American-put	8.00
	- SPS 490	American-put	3.85
February	- RPR 1080	American-put	6.50
	- SPS 540	American-put	3.10

Table : Probability distributions of prices of RPR and SPS stocks

Share RPR		Share SPS	
Share Price (Rs.)	**Probability**	**Share price (Rs.)**	**Probability**
920	0.2	460	0.05
960	0.2	480	0.10
1000	0.2	500	0.70
1040	0.2	520	0.10
1080	0.2	540	0.05

The RPR stock is currently selling in the market for Rs.965 and SPS stock is at Rs.475 per share.

On the basis of data presented in Tables above, prove the following conventions about the factors impacting call and put options prices:

(1) Higher the current share price, the higher the call price.

(2) Higher the exercise price, the lower the call price.

(3) The longer the term to expiry, the greater is the call price.

(4) Calls on high-volatility shares are worth more than calls on low-volatility shares.

(5) The longer the term to expiry, the greater is the put price.

13.8 SUMMARY

This chapter provided an overview of fundamentals of option prices. Various factors affect price of a stock option: the current stock price, the strike price, the expiration date, the stock price volatility, the risk-free interest rate, etc. The price of a call generally increases as the current stock price, the time to expiration, the volatility, and the risk-free interest rate increase. The price of a call decreases as the strike price and expected dividend increase. The price of a put generally increase as the strike price, the time to expiration, the volatility, and the expected dividends increase. The value of a put decreases as the current stock price and the risk free interest rate increase.

It is possible to reach some conclusion about the values of stock options without making any assumptions about the behaviour of stock prices. For example, the price of a call option on a stock must always be worth less than the price of the stock itself. Similarly, the price of a put option on a stock must always be worth less than the option's strike price.

13.9 KEY WORDS

Option price Volatility Upper bound Lower bound

13.10 SELF ASSESSMENT QUESTIONS

1. Explain the factors that would influence the price of a call option.
2. Explain the factors that would influence the price of a put option.
3. What is the minimum value of a call option on a share that does not pay dividends? Why?
4. The price of an American call on a non-dividend-paying stock is Rs.4. The stock price is Rs.31, the strike price is Rs.30, and the expiration date is in three months. The risk-free interest rate is 8%. Derive upper and lower bounds for the price of an American put on the same stock with the same strike price and expiration date.
5. What is the lower-limit for the price of a three-month European put option on a non-dividend–paying stock when the stock price is Rs.171, the strike price is Rs.189, and the risk-free interest rate is 10 percent per annum?
6. What is the lower bound for the price of a three-month European call option on a dividend–paying stock when the stock price is Rs.710, the strike price is Rs.650, the expected dividend in two months is Rs.5, and the risk-free interest rate is 10% per annum?

7. Calculate lower bound from the following data:

Stock price: Rs.300 (per share)	style of option: European
Type of option : Call	strike price: Rs.280
Interest rate : 8% p.a.	Time to expiration: 3 months
Dividend : Nil	

10. What is the lower bound for the price of a three-month European call option on a dividend–paying stock when the stock price is Rs.710, the strike price is Rs.650, the expected dividend in two months is Rs.5, and the risk-free interest rate is 10% per annum?

13.10 REFERENCES

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6. Derivatives – By D.A.Dubofsky and T.W.Miller (Oxford)

UNIT -14 : OPTIONS PRICING – PUT/CALL PARITY

Structure :

14.0 OBJECTIVES

After studying this units, you will be able to;

- Understand the basic principle of put-call parity
- Grasp the implications of put-call parity principle, and
- Clearly identify the scope for arbitrage opportunity, and
- Understand the relationship b/w put-call parity and price equilibrium.

14.1 INTRODUCTION

Option valuation is one of the most important developments in the field of finance in the recent past. Any course in options shall be incomplete without a discussion on pricing and valuation of these unique derivative instruments popularly traded in both OTC markets and exchanges. There are different models used to calculate option prices before the option expiration date. The basic assumption underlying these models is that capital markets are perfect i.e, non-existance of arbitrage opportunities. It is important to realize that basic options value before expiration must obey a set of pricing restrictions. The upper and lower boundary prices for call and put options are presented. The most important of these relationships is known as put-call parity. The objective of this unit is to present put – call parity principle which upholds assumption of 'no arbitrage'.

14.2 MEANING OF PUT – CALL PARITY

Put–call parity defines a relationship between the price of a European call option and European put option, both with the identical strike price and expiry. It establishes that a portfolio of a long call option and a short put option is equivalent to (and hence has the same value as) a single forward contract at this strike price and expiry. This is because if the price at expiry is above the strike price, the call will be exercised, while if it is below, the put will be exercised, and thus in either case one unit of the asset will be purchased for the strike price, exactly as in a forward contract. The validity of this relationship requires that certain assumptions be satisfied. In practice transaction costs and financing costs (leverage) makes this relationship away from reality, but in liquid markets the relationship is close and relevant.

If the prices of the put and call options diverge so that this relationship does not hold, an arbitrage opportunity exists, meaning that sophisticated traders can earn a theoretically risk-free profit. Such opportunities are uncommon and short-lived in liquid markets.

14.3 ASSUMPTIONS

Put–call parity assumes the existence of a forward contract. In the absence of traded forward contracts, the forward contract can be replaced by the ability to buy the underlying asset and finance this by borrowing for fixed term (e.g., borrowing bonds), or conversely to borrow and sell (short) the underlying asset and loan the received money for term, in both cases yielding a self-financing portfolio. These assumptions do not require any transactions between the initial date and expiry. The relationship thus only holds exactly in an ideal market with unlimited liquidity. However, real world markets may be sufficiently liquid that the relationship is close to exact, most significantly foreign exchange markets in major currencies or major stock indices, in the absence of market swings.

14.4 PUT– CALL PARITY

Put-call parity establishes that European call and put options values are identical. This means that:

$$C_E + Ke^{-rT} = P_E + S_O \qquad \text{...........(1)}$$

It shows that the value of European call (that pays no dividend) with a certain exercise price and exercise date is equal to the value of a European put with the same exercise price and date. Alternatively, the price of a European call option should be equal to the price of a put option with the same strike price and expiration date plus a sum equal to the current price of the underlying asset minus the present value of the option's strike price.

$$C_E = P_E + S_O - Ke^{-rT} \qquad \text{...........(2)}$$

If either of these relationships is violated, arbitrageurs can make a certain profit on a zero investment by selling the relatively overpriced option and using the proceeds to buy the relatively underpriced option together with the appropriate related positions in the underlying asset and debt instruments. Taken together, the latter positions create a synthetic option which completely hedges the risk associated with the short position in the overpriced option. For instance, if call prices are too high relative to put prices, an arbitrageur can lock in a riskless profit by selling a call and simultaneously buying a put, borrowing the amount equal to Ke^{-rT} at the risk-free rate, and buying the underlying asset.

Example

Suppose that stock price is Rs.310, the exercise price is Rs.300 (for both call and put options), the risk-free interest rate is 10% per annum, the price of a three-month European call option is Rs.30, and the price of a three–month European put option is Rs.22.5. In this case,

$$C_E + Ke^{-rT} = 30 + 300\, e^{-0.1 \times 3/12} = 322.26$$

$$P_E + S_O = 22.5 + 310 = 332.5$$

Portfolio consisting of $P_E + S_O$ is overpriced relative to portfolio consisting of $C_E + Ke^{-rT}$. This encourages arbitrage activity which involves buying the call and shorting both the put and the stock. The strategy generates a positive cash flow of Rs. 302.5 at the beginning.

$$-30 + 22.5 + 310 = 302.5$$

When invested at the risk-free interest rate, this grows to 302.5 $e^{0.1 \times 0.25}$ = Rs.310.2 in three months. If the stock price is greater than Rs.30, the call will be exercised. If it is less than Rs.300, the put will be exercised. In either case, the investor ends up buying one share of Rs.300. The net profit is therefore,

Rs.310.2 – Rs.300.0 = Rs.10.2

If, at the expiration date, the stock price (S_T) is Rs.290, the put will be worth Re.10 (300-290) and the call will expire worthless. If, on the other hand, at expiration the stock price (S_T) is Rs.310, the call writer will lose Rs.10(310-300), and the put will expire worthless. In both cases, however, the investor will own the stock at expiration, worth S_T, and will have to pay K. In addition, in both cases the cash flow at expiration will be zero. Thus, a no-arbitrate equilibrium pricing relationship requires that the initial investment necessary to set up these riskless positions must be zero, or that

$$C_E - P_E - S_O + Ke^{-rT} = 0$$

Which implies that

$$C_E = P_E + S_O - Ke^{-rT}$$

And $$P_E = C_E + Ke^{-rT} - S_O$$

This shows that if S_O is equal to K, the call option premium must nevertheless be greater than the put option premium, since the strike price is discounted.

14.5 ARBITRAGE OPPORTUNITIES

Arbitrage involves risk-less profit from market mispricing. The prices of both call and put options in the same series have to bear a parity relationship (see section 7.4), otherwise opportunities for arbitrage will arise. Put–call parity establishes that European call and put options values are identical. This means that

$$C_E + Ke^{-rT} = P_E + S_o$$

It shows that the value of European call (that pays no dividends) with a certain exercise price and exercise date is equal to the value of a European put with the same exercise price and date. Alternatively, the price of a European call option should be equal to the price of a put option with the same strike price and expiration dates plus a sum equal to the current price of the underlying asset minus the present value of the option's strike price.

$$C_E = P_E + S_o - Ke^{rT}$$

If this relationship is violated, arbitrageurs can make a profit on a zero investment by selling the relatively overpriced option and using the proceeds to buy the relatively underpriced option together with the appropriate related positions in the underlying asset and debt instruments. Consider, for example, index options contracts (European) on Oct.15, 2016 presented in Table 1.

Table 1 NIFTY option contracts on 15.10.2016

Contract	Type of Contract (European)	Strike Price (Rs.)	Premium (Rs.)
Oct. 2016	Call	1800	97.40
Oct. 2016	Call	1850	63.50
Oct. 2016	Call	1860	58.90
Oct. 2016	Call	1870	53.70
Oct. 2016	Put	1730	5.45
Oct. 2016	Put	1790	10.00
Oct. 2016	Put	1800	14.25
Oct. 2016	Put	1840	22.10

From the quotations shown on Table 1, it can be shown whether the arbitrage opportunity available on Oct.15, 2016, when the index closed at 1888.65 and the option contracts are expiring on Nov. 28, 2016. It is assumed that the risk-free rate is 10 percent per annum.

For a 43 days (15+28) call option, the call price is Rs.53.70 for a strike price of Rs.1870. In this case, for a minimum lot size of 200 contracts

Portfolio A = call price + p.v. of strike price

= 97.40(200) + [1800/(1.0118)] x 200

= 3,75,282

Portfolio B = put price + current index value

= 14.25(200) + 1888.65(200)

= 2850 + 3,77,730

= 3,80,580

Portfolio B is overpriced relative to portfolio A. The arbitrageur can buy portfolio A and short portfolio B. This involves buying the call and shorting both the put and the stock. The strategy generates a positive cash flow of

\- 97.40(200) + 14.25(200) + 1888.15(200)

= 3,61,100

upfront. When invested at the risk-free interest rate, this grows to 3,61,100 x (1.0118) = 3,65,361 in 43 days.

If the index value at expiration of the option is greater than Rs.1888.65, the call will be exercised, if it is less than Rs.1888.65, the put will be exercised. In either case, the investor ends up buying index for Rs.1800. This can be used to close out the short position. The net profit is therefore

Rs.3,65,361 – 1800(200)

= Rs.5,361

14.6 NOTES

14.7 ILLUSTRATION

An European call option is currently priced at Rs.170 and has an exercise price of Rs.1500 and a term to expiry of 3 months. The current price of the underlying share is Rs.1490. The share does not pay dividends. The risk-free interest rate is 10 percent per annum (continuously compounded). The price of the equivalent put option Rs.85. show that:

(a) the price of the call option exceeds its minimum theoretical price;

(b) an arbitrage profit would be earned by simultaneously buying the put, selling the call, buying the share and borrowing the present value of the exercise price.

Solution:

(a) put-call parity holds that

$C_E + Ke^{-rT} = P_E + S_0$

$C_E + Ke^{-rT} = 170 + 1500e^{0.1x0.25} = 1633$

$P_E + S_0 = 85 + 1490 = 1575$

As the combined value of call option price plus present value of strike price is greater than the combined value of put price and current price of stock, the price of call option exceeds its minimum theoretical price.

(b) An arbitrageur can short the call and buy both the put and the stock. This strategy involves an initial investment of

Rs.1490 + 85 – 170 = 1405

When financed at the risk-free interest rate, repayment of $1405e^{0.1x0.25}$ = Rs.1440 is required at the end of three months. At the end, either call or put will be exercised. The short call and long put option, therefore, leads to the stock being sold for Rs.1500.

<u>Initial cash flow</u>	Rs.	
Investment	- 1405	
Equivalent loan	<u>+ 1405</u>	
<u>Terminal cash flow</u>		
Repayment of loan		- 1440
Sale of stock		<u>+ 1500</u>
Arbitrage Profit		<u>+ 60</u>

14.8 CASE STUDY

Mr. Akhil, a post-graduate in Management with finance specialistion, is the the manager of Bharat Funds since last 4 years. He has been providing positive returns to the shareholders of the fund. He has mastered the art of using options when the market was highly volatile, through covered call writing and portfolio insurance strategies. He is convinced that better returns would not have been possible if he had not used the options.

The Nifty index had crossed 8000 from 6000, over previous year registering an increase of 33%. It was expected that the Indian market was likely to go up further, and Akhil was wondering how he could use options to generate higher returns. He was not sure whether the options were priced efficiently in the market and wanted to arbitrage, if such an opportunity was available. He collected information on index options as of October 2016 (as shown in tables 1 & 2). The risk-free rate was estimated to be 9%, and the contract multiplier was 50. The exercise date was October 27th , 2016.

Table 1: Nifty Index Options

Exercise price (INR)	Call Premium (INR)	Put Premium (INR)
8500	228.42	114.40
8400	211.51	88.50
8800	82.55	166.32
8600	181.25	146.05
9000	29.80	189.51

The major investment for Bharat Funds includes investment in the S & B stock. There are options available on this stock, and the details are provided here.

Table 2 : S&B Options

Exercise price (INR)	Call Premium (INR)	Put Premium (INR)
1850	279.42	54.40
1840	211.51	88.50
1880	182.55	146.32
1860	81.25	196.05
1900	29.80	229.51

Nifty Index on Oct 1 stood at 8855. S & B stock price on Oct 1 stood at Rs 1860 ; contract size 430.

Questions

1. Identify whether there are any opportunities for arbitrage to be made in these options.
2. Do you think Mr. Akhil will be able to enhance returns to fund investors by arbitraging ? Justify your answer.

14.9 SUMMARY

Put–call parity defines a relationship between the price of a European call option and European put option, both with the identical strike price and expiry. It establishes that a portfolio of a long call option and a short put option is equivalent to (and hence has the same value as) a single forward contract at this strike price and expiry. Put–call parity **assumes** the existence of a forward contract. In the absence of traded forward contracts, the forward contract can be replaced by the ability to buy the underlying asset and finance this by borrowing for fixed term (e.g., borrowing bonds), or conversely to borrow and sell (short) the underlying asset and loan the received money for term, in both cases yielding a self-financing portfolio. The relationship thus only holds exactly in an ideal **market with** unlimited liquidity.

14.10 KEY WORDS

Put–call parity   Portfolio   Arbitrage

14.11 SELF ASSESSMENT QUESTIONS

1. What is a put-call parity? Illustrate with a suitable example.
2. An European call option is currently priced at Rs.220 and has an exercise price of Rs.1260 and a term to expiry of 3 months. The current price of the underlying share is Rs.1300. The share does not pay dividends. The risk-free interest rate is 10 per annum (compound). The price of the equivalent put option Rs.45. show that:
   a) The price of the call option exceeds its minimum theoretical price;
   b) An arbitrage profit would be earned by simultaneously buying the put, selling the call, buying the share and borrowing the present value of the exercise price.

c) An European call option is currently priced at Rs.160 and has an exercise price of Rs.1700 and a term to expiry of 3 months. The current price of the underlying share is Rs.1500. The share does not pay dividends. The risk-free interest rate is 10 per annum (compound). The price of the equivalent put option Rs.45. Explore the arbitrage opportunity on the basis of put-call parity principle.

3. An European call option on SS Ltd stock is currently selling at a premium of Rs. 118 and has an exercise price of Rs.1250 and a term to expiry of 3 months. The current price of the underlying share is Rs.1310. The share does not pay dividends. The risk-free interest rate is 7 per cent p.a (continuous compounding). The price of the equivalent put option Rs.65. Explore the arbitrage opportunity based on put-call parity principle.

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6. Derivatives – By D.A.Dubofsky and T.W.Miller (Oxford)

UNIT - 15 : BINOMIAL MODEL

Structure :

15.0 OBJECTIVES

After studying this units, you will be able to;

- Understand the theory underlying Binomial option pricing model,
- Draw binomial tree,
- Apply the Binomial option pricing model to find the fair price of an option, and
- Comprehend the basic nature of a theoretical approach for option valuation.

15.1 INTRODUCTION

The two popular approaches to option valuation are binomial option pricing (BOP) model and Black-Scholes option pricing model (BSOP). The BOP was model developed by William sharpe, J.C. Cox, S.Ross, et all during late 1970s. It employs an approach to option pricing based on simple algebra. Black-Scholes model (BSOP), which revolutionized the theory of option pricing, was developed by Fischer Black and Myron Scholes in 1973. BSOP model is based on a complex stochastic calculus which is more difficult to comprehend by most of the business and economics students.

BOP model can be approximated to produce option values that are equivalent to Black-Scholes prices. As such, the BOP model provides a way to understand the key elements of modern option pricing theory without having to employ advanced methods of calculus. Besides, BOP model can be used to compute option prices for complex options that do not lend themselves to formalised solutions. For example, using BSOP model, it is difficult to estimate the price of an american put option. However, if the parameters of the binomial model can be used to estimate the prices of american puts and other complex options to any degree of accuracy. As such, the BOP model has become the model of choice for approximating values for many types of complex options.

15.2 A ONE–STEP BINOMIAL MODEL

Option valuation is one of the most important developments in the field of finance in the recent past. A useful and a very popular technique for pricing a stock option involves constructing a binomial tree. A binomial tree represents a set of different possible paths that might be followed by the stock price over the life of the option. It is based on the principle of *risk–neutral valuation**.

Assuming no arbitrage opportunities for an investor, a simplified binomial model can be developed to explain pricing of options. Suppose a stock price is currently Rs.100

and it is known that at the end of three months the stock price will be either Rs.90 or Rs.110. The objective is to value a European call option to buy the stock for Rs.105 in three months. This option will have one of two values at the end of three months. If the stock price is Rs.110, the value of the option will be Rs.5; if the stock price turns out to be Rs.90, the value of the option will be zero. The situation is illustrated in figure 1.

Fig.1**: Stock price movements**

Stock price=Rs.110

Option price=Rs.5

Stock price = Rs.100

Stock price=Rs.90

Option price=Rs.0

By setting up of a portfolio of the stock and the option in such a way that there is no uncertainty about the value of the portfolio at the end of the three months, it can be argued that the return earned on it must be equal to the risk–free interest rate. This enables to work out the cost of setting up the portfolio and therefore the option price. Since there are two securities (the stock and the stock option) and only two possible outcomes, it is always possible to set up the riskless portfolio.

Consider a portfolio consisting of a long position in D shares of the stock and a short position in one call option. It requires calculating the value of D that makes the portfolio riskless. If the stock price moves up to Rs.110, total value of the portfolio is given by

$$110\,D - 5$$

If the stock price falls to Rs.90, the value of the portfolio is given by

$$90\,D - 0 \quad \text{or} \quad 90D$$

The portfolio is riskless if the value of D is so chosen that the final value of the portfolio is the same for both of the alternative stock prices. This means

$$110\,D - 5 = 90\,D$$

or

$$D = 0.25$$

A riskless portfolio is, therefore:

Long : 0.25 shares

Short: 1 option

If the stock price moves upto Rs.110, the value of the portfolio is:

$$110 \times 0.25 - 5 = 22.5$$

If the stock price falls to Rs.90, the value of the portfolio is:

$$90 \times 0.25 = 22.5$$

Regardless of whether the stock price moves up or down, the value of the portfolio is always Rs.22.5 at the end of the life of the option.

Riskless portfolio should earn a return equal to risk-free rate of interest. Suppose that in this case the risk-free rate is 12 per cent per annum. It follows that the value of the portfolio today must be the present value of Rs.22.5 or $22.5\, e^{-0.12 \times 0.25} = 21.84$

The price of stock today is Rs.100. Supposing price of option is denoted by f, the value of the portfolio today is, therefore,

$$100 \times 0.25 - f$$

$= 25 - f$

It follows that

$$25 - f = 21.84$$

or

$$f = \text{Rs.}3.16$$

Suppose that the option lasts for time T and that during the life of the option the stock price (S) can move up to a new level S_u or down to S_d. If the stock price moves up to S_u, the payoff from the option is f_u; if the stock price falls to S_d, the payoff from the option is f_d.

Considering a portfolio consisting of a long position in D shares and a short position in one option, the value of D that makes the portfolio riskless can be calculated. If there is an up movement in the stock price, the value of the portfolio at the end of the life of the option is

$$S_u D - f_u$$

If there is a down movement in the stock price, this becomes

$$S_d D - f_d$$

The two are equal when

$$S_u D - f_u = S_d D - f_d$$

Or

$$D = \frac{f_u - f_d}{S_u - S_d} \qquad \text{.........(1)}$$

In this case the portfolio is riskless and must earn the risk-free interest rate. Equation (1) shows that the ratio of the change in the option price to the change in the stock price. The present value of the portfolio must be

$$[S_u\ D - f_u]\ e^{-rT}$$

The cost of setting up the portfolio is:

$$S\ D - f$$

It follows that

$$S\ D - f = [S_u D - f_u]\ e^{-rT}$$

Substituting from equation (1) for D and simplifying, the equation reduces to

$$f = e^{-rT}[Pf_u + (1 - P)f_d] \qquad \text{...............(2)}$$

Where P represents the probability. By manipulating the equation (2) , the value of P can be derived as follows:

$$e^{-rT}\ [\ Pf_u + (1 - P)f_d\ ] = f$$

or $$\underline{1}\quad [\ Pf_u + (1 - P)f_d\ ] = f$$

$$e^{-rT}$$

or $$\frac{1}{e^{-rT}} \left[Pf_u + f_d - Pf_d \right] = f$$

or $$[Pf\,(u - d)\,] + f_d\,] = e^{rT} f$$

or $$[Pf\,(u - d)\,] = e^{rT} f - f_d$$

or $$Pf = \frac{e^{rT} f - f_d}{u - d}$$

or $$p = \frac{e^{rT} f - f_d}{u - d} \; (f^{-1})$$

or $$P = \frac{e^{-rT} - d}{m - d} \qquad \text{..........(3)}$$

Equations (2) and (3) enable an option to be priced using a one-step binomial model.

From the numerical example considered previously (see figure 1), u= 1.1 (110/100), d=0.9 (90/100), r = 0.12, T=0.25, f_u = 5 and f_d =0. From equation (9.10),

$$P = \frac{e^{0.03} - 0.90}{1.10 - 0.90} = 0.6523$$

and from equation (9.9),

$$f = e^{-0.03}\,[0.6523 \text{ x } 5 + 0.3477 \text{ x } 0]$$

$$= \text{Rs.}3.16$$

This agrees with the answer obtained earlier in this section. This means that the option must sell for Rs.3.16. This value is independent of the probabilities associated with the two branches. It makes no difference what the probabilities are that the investor assigns to the two branches. Therefore, it is natural to interpret the variable P in equation (9) as the probability of up movement and the variable 1-P is then the probability of a down movement and the expression:

$$Pf_u + (1\text{-}P)\,f_d$$

is the expected payoff from the option. With this interpretation of P, equation (9) then states that the value of the option today is its expected future value discounted at the risk-free rate.

15.3 TWO–STEP BINOMIAL TREES

The one-step binomial tree analysis can be extended to a two-step binomial tree such as that shown in Fig. 2.

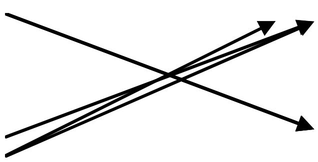
Fig:2 : Stock prices in a two-step tree

D 121

110 B

Rs.100 A

E 99



90 C

F 81

The stock price starts at 100 and in each of the two time-steps price may go up or down by 10 per cent. It is assumed that each time-step is three months in length, the risk-free rate is 12 per cent per annum and the strike price is Rs.105. The six node points are identified as A, B, C, D, E and F. The objective of the analysis is to calculate the option price at the initial nodes A, B and C. The option prices at the final nodes D, E and F are simply the payoffs from the option. At node D the stock price is Rs.121 and the option's price is Rs.121 – 105 = 16, at nodes E and F the option is out of the money and hence its value is zero.

At node C the option price is zero, since node C leads to either node E or node F and at both of these nodes the option price is zero. The option price at node B is calculated by using equation (2) with u = 1.1, d=0.90, r=0.12, T=0.25 so that P=0.6523.

$= e^{-0.03}$ [0.6523 x 16 + 0.3477 x 0]

= 10.13

The option price at node A depends on the option price at node B and node C. The value of option at node B is Rs.10.13 and at node C it is zero. Equation (2), therefore, gives the value at node A as

$$= e^{-0.03} [0.6523 \times 10.13 + 0.3477 \times 0]$$

$$= 6.48$$

These results are shown in Fig. 3

Fig.3: **Stock and option prices in a two-step tree**

D S_{uu} =121

f_{uu}=16

S_u=110

f_u=10.13 B

S=100

f=6.48 A

E S_{ud} =99

f_{ud} = 0

S_d =90

f_d =0 C

S_{dd} =81

F f_{dd}=0

By considering the situation shown in Fig.3, it can be observed that the stock price either move up to *u* times its initial value or down to *d* times its initial value. The notation for the value of the option is shown on the tree. For example, after two up movements the value of the option is f_{uu}. Assuming the risk-free interest rate is r and the length of time step is D T years, following generalisations are possible on the basis of application of equation 9.

$$f_u = e^{-rDT} [Pf_{uu} + (1-P)f_{ud}] \quad \text{.....................(4)}$$

$$f_d = e^{-rDT} [Pf_{ud} + (1-P)f_{dd}] \quad \text{.....................(5)}$$

$$f = e^{-rDT} [Pf_u + (1-P)f_d] \quad \text{.....................(6)}$$

The option price is equal to its expected payoff in a risk-neutral world discounted at the risk-free interest rate. This risk-neutral valuation principle continues to hold even when more steps are added to the tree.

The procedure described above for pricing a call option is equally applicable for pricing put options of a stock whose price changes are binomial.

15.4 VALUATION OF AMERICAN OPTIONS

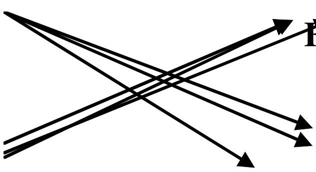
American options can be valued using a binomial tree. The procedure is to work back through the tree from the end to the beginning, testing at each node to see whether early exercise is optimal. The value of the option at the final nodes is the same as for the European option. At earlier nodes the value of the option is the greater of

(1) The value given by equation (2); and

(2) The payoff from earlier exercise.

As an illustration consider an American put with a strike price of Rs.105 on a stock whose current price is Rs.100. It is assumed that there are two time steps of three months each and in each time step the stock price either moves up by a proportional amount of 10 percent or down by a proportional amount of 10 percent. The risk-free interest rate is 12 percent. The tree is shown in Fig. 4. At node B, equation (9) gives the value of the option as 3.8, while the payoff from early exercise is negative (-5).

Fig. 4: Two-Step Tree for American Put Option



D 121

0

110 B

3.8

Rs.100 A

7.4672

E 99

6

90

C

15.00

F 81

24

As the early exercise is not optimal at node B, the value of the option at this node is 3.8. At node C, equation (2) gives the value of the option as Rs.11.9, while the payoff from the early exercise is 15.0. In this case early exercise is optimal and the value of the option is Rs.15. At the initial node A the value given by equation (2) is

$$e^{-0.03}[0.6523 \times 3.8 + 0.3477 \times 15] = 7.4672$$

As the payoff from early exercise is 5.0, the value of the option is, therefore, Rs.7.4672.

15.5 NOTES

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15.6 ILLUSTRATIONS

(1)Find the value of a European call option with a strike price of Rs.21 which is currently selling at Rs.20. Assume that there are two time steps of three months each and in each time step the stock price either move up by a proportional amount of 10pc or down by a proportional amount of 10 pc. Also assume that risk-free rate of interest is 12 pc.

Solution:

D
24.2
3.2

22
B

A
20
1.28

E
19.8
0.0

18
C
0.0

F
16.2
0.0

Payoff at node D (242-21) = Rs.3.2

Payoff at node E = (price < strike price)= 0

Payoff at node F = (price < strike price) = 0

At node C the option price = 0

(since node C leads to

either node E or node F

and at both of these nodes

the option price is zero)

The value of the option at node B is given by

$$f = e^{-rT}\ [Pf_u + (1-P)f_d]$$

The value of the risk-neutral probability, P, is given by

$$P = \frac{e^{0.12 \times 0.25} - 0.9}{1.1 - 0.9} = 0.6523$$

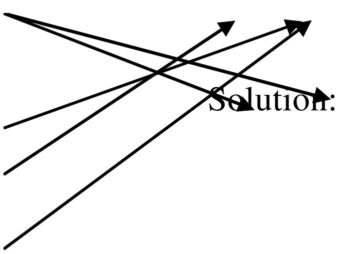
$$f = e^{-0.12x0.25}\,[0.6523x3.2 + 0.3477\ x0] = 2.03$$

The value of the option at initial node A is given by

$$e^{-0.12x0.25}\,[0.6523\ x\ 2.03 + 0.3477\ x\ 0] = 1.28$$

The price of the option is Rs.1.28

(2) Find the value of an American put option with a strike price of Rs.52 which is currently selling for Rs.50. Assume that there are two time steps of one year and in each time step the stock price either moves up by a proportional amount of 20 pc or down by a proportional amount of 20 pc. Also assume that the risk-free interest rate is 5 pc.



Solution:

D

72

0

B

60

1.41

E

48

4

A

50

5.09

C

40

12

F

32

20

The possible final stock prices are: 72, 48 and 32. In this case $f_{uu} = 0$, $f_{ud} = 4$, and $f_{dd} = 20$.

The value of option at node B is given by

$$F = e^{-0.05x1} [0.6282x0 + 0.3718x4] = Rs.1.41$$

Payoff from early exercise (52-60) = -8

\ the value of option at node B = 1.41

Similarly, value of option at node C is

$$f = e^{-0.05x1} [0.6282x4 + 0.3718x20] = Rs.9.46$$

Payoff from the early exercise (52-40) = Rs.12.00

\ The value of option at C = Rs.12.00

The value of option at initial node A is given by

$$e^{-0.05x1} [0.6282x1.41 + 0.3718x12] = Rs. 5.09$$

Payoff from early exercise (52-50) =Rs.2.00

\ The value of option =Rs.5.09

15.7 CASE STUDY

Mr. Yadav is the manager of a MAX Mutual funds. His strategy is to arbitrage on the basis of mispricing of stock option contracts traded on the NSE to boost returns. He would like to earn profits by identifying the underpriced and overpriced options so that he can make additional gains. He has identified the options on Nifty index, SBI, L&T and Tata motors. On Oct 1 , the Nifty index is at Rs 6010. The Nifty index has been trading in the range of 5600 to 6200 over the past 3 years. The contract multiplier is 250. The standard deviation of the index is 24%. Call and put options are with an exercise of 6000 are priced at Rs 153 and Rs 340 respectively. The individual stock option details on Oct 1 are as given below:

SL NO		Current price	standard deviation	Call option strike price	Call option premium	Put option Istrike price	Put option premium	Expiration
1	SBI	1758	15%	1700	40	1700	10	26th Dec
2	L&T	800	22%	860	90	860	100	26th Dec
3	Tata motors	335	30%	400	24	400	23	26th Dec

Mr. Yadav wants to know whether the call and put options are correctly priced . The risk-free rate is estimated as 8% per annum.

Questions:

1. Identify the underpriced and overpriced options on the basis of put-call parity principle
2. Identity the underpriced and overpriced options on the basis of BOP model
3. Explain whether BOP model or put-call principle to be used for arbitraging.

15.8 SUMMARY

Option valuation is one of the most important developments in the field of finance in the recent past. A useful and very popular technique for pricing a stock option involves constructing a binomial tree which explains relation to an important principle known as risk-neutral valuation. This principle states that it is permissible to assume that the world is risk-neutral when valuing an option in terms of the underlying stock.

15.9 KEY WORDS

Binomial Risk neutrality probability Upside price movement Downside price movement

15.10 SELF ASSESSMENT QUESTIONS

1. Explain the no-arbitrage and risk-neutral valuation approaches to valuing a European option using a one-step binomial tree.

2. Explain the no-arbitrage and risk-neutral valuation approaches to valuing a European option using a one-step binomial tree.

3. A stock price is currently Rs.150. It is known that at the end of one month it will be either Rs.165 or Rs.135. The risk-free interest rate is 8 percent per annum with continuous compounding. What is the value of a one-month European call option with a strike price of Rs.145.

4. A stock price is currently Rs.80. It is known that at the end of six months it will be either Rs.84 or Rs.76. The risk-free interest rate is 10 percent per annum with continuous compounding. What is the value of a six-month European put option with a strike price of Rs.80?

5. Draw binomial trees from the following data and show the stock prices:

Parameters	European	
	Call option	Put option
Stock price	300	300
Strike price	360	240
Time to expiration	1 year	1 year
Sub-periods	Two	Two
u factor	0.2	1.2
d factor	0.9	0.9

6. From the following data, calculate the value of a call option (European style):

Current price of the stock	= Rs.100
Option period	= 3 months
Up movement factor (u)	= 1.1
Down movement factor (d)	= 0.9
Exercise Price	= Rs. 105

Risk-free interest rae	= 12% p.a.

Use Binomial Option Pricing Method.

7. From the following data, calculate the value of a call option:

Style of option	= European
Current price of the stock	= Rs.100
Option period	= 6 months
Time intervals for change at each	= 3 months
Up movement factor (u)	= 1.1
Down movement factor (d)	= 0.9
Exercise Price	= Rs. 105
Risk-free interest rate	=12% p.a.

Draw a two-step binomial tree, show the stock prices at each node and

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UNIT-16 : BLACK-SCHOLES OPTION PRICING MODEL

Structure :

16.0 OBJECTIVES

After studying this units, you will be able to;

- Understand the theory underlying **Black–Scholes** option pricing model,
- Comprehend th e assumptions underlying **Black–Scholes** option pricing model,
- Apply the **Black–Scholes** option pricing model to find the fair price of an option, and
- Comprehend the superiority of **Black–Scholes** Model over Binomial Model.

16.1 INTRODUCTION

Black–Scholes model is a mathematical model of a financial market containing options (derivative) investment instruments. From the model, one can derive the **Black–Scholes formula**, which gives a theoretical estimate of the price of European-style options. lt is widely used by options market participants. Many empirical tests have shown that the Black–Scholes price is "fairly close" to the observed prices. The Black–Scholes model was first published by Fischer Black and Myron Scholes in their 1973 seminal paper, "The Pricing of Options and Corporate Liabilities", published in the *Journal of Political Economy*. They derived a partial differential equation, now called the Black–Scholes equation, which estimates the price of the option over time. The key idea behind the model is to hedge the option by buying and selling the underlying asset in just the right way and, as a consequence, to eliminate risk. The Black–Scholes formula has only one parameter that cannot be observed in the market: the average future volatility of the underlying asset.

16.2 BASIS OF BSOP MODEL

Moving to two-steps of a binomial tree when valuing the option probably added extra realism. But there is no reason to stop there. We could go on to take shorter and shorter intervals in each of which there are only two possible changes in the value of the stock. For example, we could divide the year into 12 subintervals of one month each. That would give 13 possible year-end values. We could still use the binomial method to work back from the final date to the present. Of course, it would be tedious to do such a calculation by hand, but with a computer you can whisk through options with many periods to run.

Since an asset can usually take on an almost limitless number of future values, the binomial method is likely to give a more realistic and accurate measure of the option's value if we work with a large number of subperiods. But that raises an important question: How do we pick sensible figures for the up and down changes in value? For example, why did we pick figures of 10 percent and –10 percent when we valued the options by using two subperiods? Fortunately there is a neat little formula that relates the up and down changes to the standard deviation of the returns on the asset.

$$1 + \text{upside change} = u = e^{sÖh}$$

$$1 + \text{downside change} = d = 1/u$$

where

e = base for natural logarithms = 2.7183

s = standard deviation of (continuously compounded) annual returns on asset

h = interval as a fraction of a year

When the price of a stock could either rise by 33 percent or fall by 25 percent over one year, these figures are consistent with a figure of 28.8 percent for the standard deviation of the annual returns:

$$1 + \text{upside change (1–year interval)} = u = e^{.288Ö1} = 1.33$$

$$1 + \text{downside change} = d = 1/u = 1/1.33 = .75$$

To work out the equivalent upside and downside changes when we chop the year into two 6-month intervals, we use the same formula:

$$1 + \text{upside change (6-month interval)} = u = e^{.288Ö.5} = 1.226$$

$$1 + \text{downside change} = d = 1/u = 1/1.226 = .816$$

As the number of intervals is increased, the values that one obtains from the binomial method should get closer and closer to the Black-Scholes value. In fact, you can think of the Black-Scholes formula as a shortcut alternative to the binomial method as the number of intervals gets very large. In the early 1970s, Fischer Black and Myron Scholes made a major breakthrough in the pricing of stock options. This has had a huge influence on the way in which market participants price and hedge options.

16.3 ASSUMPTIONS OF BSOP MODEL

The assumptions made by Black and Scholes when they derived their option pricing formula were as follows:

(1) Stock price behaviour follows random walk and corresponds to the lognormal model.

(2) There are no transactions costs or taxes.

(3) All securities are perfectly divisible.

(4) There are no dividends on the stock during the life of the option.

(5) There are no riskless arbitrage opportunities.

(6) Security trading is continuous.

(7) Investors can borrow or lend at the same risk-free rate of interest.

(8) The short-term risk-free rate of interest, r, is constant.

16.4 BLACK-SCHOLES FORMULA

The Black-Scholes formulas for the prices of European calls and puts on nondividend-paying stocks are

$$C_E = S_0 N(d_1) - Ke^{-rT} N(d_2) \quad \text{.....................(1)}$$

$$P_E = Ke^{-rT} N(-d_2) - S_0 N(-d_1) \quad \text{.....................(2)}$$

Where $d_1 = \dfrac{\ln(S_0/Ke^{-rT})}{s\text{Ö}\,T} + \dfrac{s\text{Ö}\,T}{2}$

$$d_2 = d_1 - s\,\text{Ö}\,T$$

S_0, K, r and T are as previously defined.

C_E = Call European

P_E = Put European

s = Annualised volatility of stock returns

l_n = Natural logarithm

N = is the cumulative probability distribution for a standardised normal variable*.

The Black-Scholes model requires only five inputs, four of which are easily obtainable the current price, the option's strike price, the riskless rate of interest, and the option's time to expiration. The only variable that is not directly observable is the expected volatility of the stock's return, which is customarily estimated using historical data. The volatility of stock's return is computed as annualised sigma and is discussed later.

Since the American call price, C_A, equals the European call price, C_E, for a nondividend-paying stock, equation (1) also gives the price of an American call. Unfortunately no exact analytic formula for the value of an American put on a nondividend-paying stock has been produced.

Example

Consider the situation where the stock price three months from the expiration of an option is Rs.245.78, the exercise price of the option is Rs.240.00, the risk-free interest rate is 10 percent per annum, and the volatility is 20 percent per annum. This means that $S_0 = 245.78$, $X = 240$, $r = 0.1$, $s = 0.2$, $T = 0.25$.

(1) Compute the present value of strike price

$$Ke^{-rT} = 240e^{-0.1x0.25}$$

$$= 234.07$$

(2) Compute d_1 and d_2:

$$d_1 = \frac{l_n(S_0/Ke^{-rT})}{s \ddot{O} T} + \frac{s \ddot{O} T}{2}$$

$$= \frac{l_n(1.05)}{0.2 \ddot{O}0.25} + \frac{0.2 \ddot{O}0.25}{2}$$

$$= 0.5380$$

$$d_2 = d_1 - s \ddot{O} T$$

$$= 0.5380 - 0.2 \ddot{O}0.25$$

$= 0.4380$

(3) Compute $N(d_1)$ and $N(d_2)$

$N(d_1)$ and $N(d_2)$ are the values in the cumulative standard normal distribution that correspond to $d_1 = 0.5380$ and $d_2 = 0.4380$. In other words, they are the probabilities that the the price at expiration will be 0.5380 and 0.4380 standard deviations above the mean, (i.e.,0). That is, from normal distribution table,

$N(d_1) = 0.7045$ $\quad\quad$ $N(-d_1) = 0.2955$

$N(d_2) = 0.6682$ $\quad\quad$ $N(-d_2) = 0.3318$

(4) Compute the fair value of the call option:

$C_E(C_A) = S_0 N(d_1) - Ke^{-rT} N(d_2)$

$= 245.78(0.7045) - 234.07(0.6682)$

$= 16.65$

(5) Value of Put option

$P_E = Ke^{-rT} N(-d_2) - S_0 N(-d_1)$

$= 234.07(0.3318) - 245.78(0.2955)$

$= 5.03$

Dividend Paying Stock

Up to now it was assumed that the stock upon which the option is written pays no dividends. In practice, this is not always the case. Extending these results it is assumed that the dividends paid on the stock during the life of an option can be predicted with certainty. As traded options usually last for less than three months, this is not an unreasonable assumption.

The model of stock price behaviour developed earlier is reasonable for a dividend-paying stock except when it goes ex-dividend. At this point, the stock's price goes down by an amount reflecting the dividend paid per share. The effect of this is to reduce the value of calls and to increase the value of puts. For tax reasons the stock price may go down by somewhat less than the cash amount of the dividend. To take account of this, the word dividend should be interpreted in the context of option pricing as the reduction in the stock price on the ex-dividend date caused by the dividend. Thus, if a dividend of Re.1 per share is anticipated and the share price normally goes down by 80 percent of the dividend on the ex-dividend date, the dividend should be assumed to be Re.0.80 for the purposes of the analysis.

(i) **European Options**

European options can be analysed by assuming that the stock price is the sum of two components: a riskless component that will be used to pay the known dividends during the life of the option and a risky component. The riskless component at any given time is the present value of all the dividends during the life of the option discounted from the ex-dividend dates to the present at the risk-free rate. The Black-Scholes formula is then correct if S is put equal to the risky component. Operationally, this means that the Black-Scholes formula can be used provided that the stock price is reduced by the present value of all the dividends during the life of the option, the discounting being done from the ex-dividend dates' at the risk-free rate. A dividend is included in calculations only if its ex-dividend date occurs during the life of the option.

Example

Consider a European call option on a stock when there is an ex-dividend date in two months. The dividend on ex-dividend date is expected to be Rs.2.00 The current share price is Rs.40, the exercise price is Rs.40, the stock price volatility is 30 percent per annum, the risk-free rate of interest is 10 percent per annum, and the time to maturity is three months. The present value of the dividends is

$$2e^{-0.1667 \times 0.10} = 1.9662$$

The option price can, therefore, be calculated from the Black-Scholes formula with S_0=38.0338, K=40, r=0.10, s=0.3, and T=0.25.

(1) $Ke^{-rT} = 40e^{-0.1x0.25} = 39.01$

(2) $d_1 = \underline{l_n\,(38.0338/39.01)} + \underline{.3Ö.25}$

0.3Ö.25 2

$= \underline{l_n\,(0.975)} + 0.0375$

0.075

$= -0.2998$

$d_2 = d_1$ - sÖT

$= -0.3748$

(3) $N(d_1) = N(-0.2998) = 0.3821$

$N(d_2) = N(-0.3748) = 0.3539$

(4) $C_E = (38.0338)(0.3821) - (39.01)(0.3539)$

= Re. 0.73

(ii) American Call Option

American call options are not exercised early when the underlying stock pays no dividends. When dividends are paid, it is sometimes optimal to exercise at a time immediately before the stock goes ex-dividend. The reason for this is easy to understand. The dividend will make both the stock and the call option less valuable. If the dividend is sufficiently large and the call option is sufficiently in-the-money, it may be worth forgoing the remaining time value of the option in order to avoid the adverse effects of the dividend on the stock price. In practice, call options are most likely to be exercised early immediately before the final ex-dividend date. Here an approximate procedure suggested by Fischer Black for valuing American calls on dividend-paying stocks is described.

(iii) Black's Approximation

Black's approximation involves calculating the prices of two European options:

1. An option that matures at the same time as the American option.
2. An option maturing just before the ex-dividend date occurring during the life of the option.

The strike price, initial stock price, risk-free interest rate, and volatility are the same as for the option under consideration. The American option price is set equal to the higher of these two European option prices.

Example

Consider the situation in our previous example but suppose that the option is American rather than European. The value of the option on the assumption that it expires just before the ex-dividend date can be calculated using the Black-Scholes formula with S_0 =40, K=40, r=0.10, s =0.30, and T=0.1667. It is Rs.2.21. Black's approximation involves taking the greater of this and the value of the option when it can only be exercised at the end of three months. From the previous example, we know that the latter is Re.0.73. Black's approximation, therefore, gives the value of the American call as Rs.2.21.

16.5 DETERMINING ANNUALISED SIGMA

Steps:

1. Take past data of closing price of the underlying (stock).
2. Determine daily return.
3. Calculate daily volatility or daily sigma.
4. Find annualised sigma = daily sigma *Öno. of trading days per year (i.e., 250 days)

Consider a stock's past 10 trading days' closing price

Trading Day	ONGC Closing Price	Daily Return
0	828.20	0
1	802.25	-3.14%
2	788.80	-1.675%
3	830.75	+5.32%
4	853.50	+2.70%
5	858.65	+0.65%
6	857.80	-0.099%
7	844.35	-1.57%
8	839.70	-0.55%
9	850.50	+1.285%
10	849.2	-0.153%
	Total	2.768%

$$\text{Daily Return} = \frac{\text{Today's price} - \text{Yesterday's Price}}{\text{Yesterday's Price}} * 100$$

Now, Calculation of Daily Volatility or Daily Sigma (s):

Days	Daily Return (%) X	$(x-\bar{X})$ $(x-0.2768)$	Square of Deviation $(x-\bar{X})^2$
1	-3.14	-3.4168	11.6745
2	-1,675	-1.9518	3.8095
3	+5.32	5.0432	25.433
4	+2.70	2.4232	5.8719
5	+0.65	0.3732	0.1393
6	-0.099	-0.3758	0.14122
7	-1.57	-1.8468	3.41067
8	-0.55	-0.8268	0.6836
9	+1.285	1.0082	1.01647
10	-0.153	-0.4298	0.18473
	$\sum X = 2.768$		$\sum(x-x^2)=$ 52.36489

$$\bar{X} = \frac{\sum x}{N} = \frac{2.768}{10}$$

$$\bar{X} = 0.2768$$

Daily volatility or Daily Sigma = $\sqrt{\sum(x-\bar{x})^2}$

N

= Ö52.36489

10

= Ö52.36489 = 2.288 or 2.29%

Daily Sigma = 2.29%

Now, Annualized Sigma of ONGC is:

Annualized Sigma=Daily Sigma xÖ No. of trading days per year

\ Annualized Sigma = 2.29 *Ö250 days

= 2.29 * 15.8113

= 36.2076 or 36.21%

Annualized Sigma = 36.21%

This Annualized Sigma figure may differ from those annualized sigma figures that are available on websites due to consideration of past trading day's closing prices.

16.6 NOTES

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16.7 ILLUSTRATIONS

Illustration 1

On the basis of following information find the value of a European call option

S_0 = Rs.92

K = Rs.95

T = 50 days or 50/365 (=0.137) of a year

r = 7.12%

s = 35%

Assume that the stock does not pay dividends.

Solution:

(1) Compute the present value of the strike price

Ke^{-rT} = Rs.$95e^{-0.0712x0.137}$ = Rs.94.08

(2) Compute d_1 and d_2:

$$d_1 = \frac{l_n (S/Ke^{-rT})}{sT} + \frac{s\text{Ö}T}{2}$$

$$d_1 = \frac{l_n (\text{Rs.}92/94.08)}{(0.35)\text{Ö}.137} + \frac{(0.35)\text{Ö}.137}{2}$$

= -0.1082

$d_2 = d_1 - s\text{Ö}T$

= -0.1082 – 0.35)Ö.1370 = -0.2377

(3) Compute $N(d_1)$ and $N(d_2)$:

$N(d_1)$ = 0.4570

$N(d_2)$ = 0.4061

(4) Compute the value of the call option:

C_E = (Rs.92.00) (0.4570) – (94.08)(0.4061)

= 3.83

Illustration 2

A stock is selling for Rs.330 with a strike price of Rs.340. At what price an investor can sell put option on the stock? Assume that the T= 2 months, r = 10 percent and s = 28%.

(1) Compute the present value of the strike price

$Ke^{-rT} = 340e^{-0.08x0.167}$

= 334.25

(2) Compact $d_1 = \frac{l_n (330/334.25)}{0.28Ö0.167} + \frac{0.28 Ö0.167}{2}$

= -0.0547

d_2 = -0.0547 – 0.1144

= -0.1691

(3) $N(d_1)$ = 0.4780

$N(-d_1)$ = 0.5220

$N(d_2)$ = 0.4545

$N(-d_2)$ = 0.5455

(4) Put price is

(334.25)((0.5455) – 330(0.5220)

= 10.07

He can sell the put at a maximum price of Rs.10.07.

16.8 CASE STUDY

On 1st July, a trader in the options market plans to write a call and put option on the stock of NPT Limited for the month of Sep. (i.e., expiring 3 months from now). For this purpose he has collected the following information.

a) The stock is currently selling in the market for Rs1800 each

b) The yield on treasury bills of an equivalent period is 7%

c) The volatility of the stock is 23%

d) The call option on the stock (expiring 3 months from now , strike price Rs 1900) is currently selling in the market for Rs. 140

e) The put option on the stock (expiring 3 months from now, strike price Rs 1700) is currently selling in the market for Rs. 65

f) The strike value of call option to be Rs.100 more than its current price and the put option Rs.100 less than the current price.

Questions

(a) Find the fair price of call option on the basis of Black-Scholes Option Model.

(b) Should he write a call option? If so, at what price?

(c) Find the fair price of put option on the basis of Black-Scholes Option Model.

(d) Should he write a put option? If so, at what price?

16.9 SUMMARY

BSOP model is a mathematical model of a financial market containing options (derivative) investment instruments. From the model, one can derive the **Black–Scholes formula**, which gives a theoretical estimate of the price of European-style options. lt is widely used by options market participants. Many empirical tests have shown that the Black–Scholes price is “fairly close” to the observed prices. In fact, one can think of the Black-Scholes formula as a shortcut alternative to the binomial method as the number of intervals gets very large. In the early 1970s, Fischer Black and Myron Scholes made a major breakthrough in the pricing of stock options. This has had a huge influence on the way in which market participants price and hedge options.

16.10 KEY WORDS

Lognormal distribution Annualised sigma Cumulative normal distribution value

16.11 SELF ASSESSMENT QUESTIONS

(1) What is the basis of BSOP Model?

(2) What are the assumptions underlying BSOP Model ?

(3) Define annualized sigma. How is it determined?

(4) What is the price of a European call option on a nondividend-paying stock when the stock price is Rs.270, the strike price is Rs.260, the risk-free interest rate is Rs.10 percent per annum, the volatility is 25 percent per annum, and the time to maturity is three months?

(5) What is the price of a European put option on a nondividend-paying stock when the stock price is Rs.80, the strike price is Rs.84, the risk-free interest rate is 5 percent per annum, the volatility is 35 percent per annum, and the time to maturity is two months?

(6) On 1st January, a trader in the options market plans to write a call and put option on the stock of SST Limited for the month of March (i.e., expiring 3 months from now). For this purpose he has collected the following information.

a) The stock is currently selling in the market for Rs.1,200 each

b) The yield on treasury bills of an equivalent period is 6.5%

c) The volatility of the stock is 30%

d) The strike value of call option to be Rs.100 more than its current price and the put option Rs.100 less than the current price.

On the basis of Black-Scholes Option Model, determine

i) The premium at which he should write a call option

ii) The premium at which he should write a put option.

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(Footnotes)

[*] A random variable has a log-normal distribution if the natural logarithm of the variable is log-normally distributed. The Black-Scholes option pricing model assumes that stock prices are log-normally distributed. If stock prices are normally distributed, this would imply that it is equally likely for a stock price to move up or down. But there are natural factors that impede price movements in the downward direction. For example, a stock's price cannot drop below zero. These considerations make a log-normal distribution assumption more reasonable.

MODULE – V
OTHER DERIVATIVES AND RISK MANAGEMENT

UNIT - 17 : MEASURES OF RISK

Structure :

17.0 Objectives

17.1 Introduction

17.2 Delta Risk

17.3 Gamma Risk

17.4 Theta Risk

17.5 Vega Risk

17.6 RHO Risk

17.7 Case study

17.8 Summary

17.9 Key Words

17.10 Self Assessment Questions and Problems

17.11 Reference

17.0 OBJECTIVES

This unit is so designed as to enable the reader to :

(1) Understand the concept of 'greeks' in the context of derivatives,

(2) Appreciate the need for greeks to hedge,

(3) Comprehend the mathematical expression of Greeks like delta, vega , etc, and

(4) Apply the Greeks for neutralizing the risk of investment in derivatives.

17.1 INTRODUCTION

The purpose of this unit is to define and measure risk in the context of derivatives trading and portfolio of derivative investments. A trader who sells (i.e., writes) an option or other derivative to a client in the over-the-counter market is faced with the problem of managing its risk. If the derivative happens to be the same as one that is traded on an exchange, the exposure can be neutralised by buying on the exchange the same derivative. But, when the option has been tailored to the needs of a client and does not correspond to the standardised products traded by exchanges, hedging the exposure is difficult. "Greek letters" or simply the "Greeks" measure a different dimension of the risk in a derivative position and the aim of the trader is to manage the Greeks so that all risks are acceptable.

17.2 DELTA RISK

As the underlying factors (such as the stock price, exchange rate, futures price, or spot exchange rate) change, the value of the derivative asset changes as well. This exposure is called the delta risk and is denoted by Ä. The first variable in the risk management of options is the option delta. It is formally defined as the change in option premium expected from a small change in the stock price. Symbolically, for a call option,

$$\Delta_C = \frac{\partial_C}{\partial_S} \qquad \text{.....................(1)}$$

where ∂_c/∂_s is the partial derivative of the call premium (c) with respect to the stock price (S). Similarly, the put delta is the partial derivative of the put premium (p) with respect to the stock price, or

$$Ä_P = \frac{\partial_P}{\partial_S} \qquad \text{..............................(2)}$$

Delta is useful because it indicates the number of shares of stock required to match the returns of the option. A call delta of 0.60, for instance, means it will act like 0.60 shares of stock. If the stock price rises by Re.1, the call option will advance by 60 paise. A put delta of –0.60 means that the put option will decline by about 60 paise if the stock rises by a rupee. For a European option, the absolute values of the put and call deltas will sum to one. That is,

$$|\Delta_c| + |\Delta_P| = 1.0 \qquad \text{..........................(3)}$$

This is not exactly true for an American option, but is still a reasonably accurate estimate. If, for instance, the call delta is 0.55, a good estimate of the put delta is 0.55 – 1.0 = -0.45 irrespective of whether the option is American or European.

In the Black-Scholes OPM, determination of the call delta is a simple task: it is equal to $N(d_1)$. For a call option,

$$\Delta_c = N(d_1) \qquad \text{........................(4)}$$

$$0 \leq \Delta_c \leq 1.0$$

because $N(d_1)$, the area under the normal curve, ranges from 0 to 100%. Similarly, for a put option,

$$\Delta_P = N(d_1) - 1 \qquad \text{........................(5)}$$

$$-1 \leq \Delta_P \leq 0$$

Example

Suppose a trader has sold 100 option contracts – that is option to buy 10,000 shares (with each contract size being 100 shares). The stock price Rs.250 and the option price is Rs.22, and the delta ratio is 0.40.

(a) How many shares to be bought to hedge the exposure?

(b) If the stock price increases to Rs.260 or falls to Rs.240, show the results.

Solution:

(a) Trader's exposure can be hedged by buying (0.40x10,000)	4000 shares

(b) If stock price rise by Rs.10:		Rs.
Gain on shares purchased [4000 x 10]		+ 40,000
Loss on options written as Option price tend to go up by 0.4 [0.4 x 10,000]	- 40,000	
		0

If stock price falls by Rs.10:	
Gain on option written [0.4 x 10,000]	+ 40,000
Loss on shares purchased [4000 x 10]	- 40,000
	0

In example 10.1, the delta of investor's option position is 0.4(-10,000)= -4000. In other words, the investor losses 4000 $Ä_S$ on the short option position when the stock price increases by $Ä_S$. The delta of the stock is 1.0 and the long position in 4000 shares has a delta of +4000. The delta of the trader's overall position is, therefore, zero. The delta of the stock position offsets the delta of the option position. A position with a delta of zero is referred to being **delta neutral** as indicated by example .

Dynamic Hedging

As the value of delta keeps changing on account of market fluctuations, trader's hedged delta remains neutral only for a relatively short period of time. The hedge has to be adjusted periodically. Dynamic hedging requires the hedge position to be adjusted periodically.

Dynamic hedging can be contrasted with static hedging, where the hedge, once set up, is never adjusted.

In the above example, if the stock price at the end of the week increases to, say, Rs.270, resulting in increase in delta from 0.40 to 0.45. An extra 0.05 x 10,000 = 500 shares would then have to be purchased to maintain the hedge.

Delta is closely related to Black Scholes analysis. They showed that it is possible to set up a riskless portfolio consisting of a position in a derivative on a stock and a position in the stock itself.

17.3 GAMMA RISK

The delta risk of a derivative securities change as the market conditions in the underlying factors change. The rate of change of delta with respect to the price of the underlying asset is known as **gamma risk** of the derivative product. This is denoted by the symbol G. It is the second derivative of the option premium with respect to the stock price:

$$\Gamma_C = \frac{\partial \Delta_C}{\partial_S}$$

$$\Gamma_P = \frac{\partial \Delta_P}{\partial_S}$$

The $\ddot{A}_S$ of the derivative assets change constantly. The larger the G, the more dramatic will be the movements in the Ä of the derivative asset for a given change in the market conditions of the underlying factor.

As with the delta risk, some derivative positions will have a positive gamma risk, and others will have a negative gamma risk. If an upward movement in the underlying factor causes the delta (with respect to that factor) of the derivative asset to increase and a downward movement causes the delta of the derivative asset to decrease, then such a position has a position gamma. On the other hand, if an upward movement in underlying factor causes the delta (with respect to that factor) of the derivative asset to decrease and a downward movement causes the delta of the derivative asset to increase, then such a position has a negative gamma.

One use of gamma is a measure of how often option portfolios need to be adjusted as stock prices change and time passes. Options with gammas near zero have deltas that are not particularly sensitive to changes in the stock price, and consequently more robust. Gamma is at a maximum when an option is at-the-money and near expiration.

A positive gamma comes from long option positions. A portfolio with a positive gamma becomes more bullish as the underlying price rises (i.e., delta increases) or more bearish as the price declines (delta declines). Negative gammas, conversely, come from short positions. Equation (6) shows how to calculate gamma.

$$\Gamma_C = \Gamma_P = \frac{e^{-0.5(d_1)^2}}{S_o \sigma \sqrt{\pi T}} \qquad \text{.......................} (6)$$

Where So = current stock price

ó = Annualised volatility of stock returns

T = expiry duration

17.4 THETA RISK

The rate of change in the value of a derivative asset as the time passes is known as the theta risk of the asset and is denoted by q. Formally,

$$\theta_C = \frac{\partial_C}{\partial_t}$$

$$\theta_C = \frac{\partial_P}{\partial_t}$$

The theta of an option measures the change in the option value due to the passage of time. It indicates the sensitivity of a call option to the time remaining until its expiration.

Mathematically, a theta is greater than zero because more time until expiration means more option time value. Options become less valuable, ceteris paribus, as they approach expiration day. However, because time until expiration can only get shorter, option traders usually think of theta as a negative number. The holder of a long option position loses with the passage of time, so holding a long call or long put means theta declines in premium due solely to the passage of time. Conversely, the passage time is to the benefit of the option writer, so theta is positive for a short call or short put and represents a gain to the option writer. Equations (7) and (8) show how to calculate theta for a call and a put.

$$\theta_C = - \frac{S_o \sigma e^{-0.5(d_1)^2}}{2\sqrt{2\pi T}} - rke^{-rT} N(d_2) \qquad \text{.........(7)}$$

$$\theta_C = - \frac{S_o \sigma e^{-0.5(d_1)^2}}{2\sqrt{2\pi T}} + rke^{-rT} N(d_2) \qquad \text{.........(8)}$$

These equations determine theta per year. It is desirable to know theta per day, as this value indicates how the option price changes with the passage of a single day and is easier to interpret.

A theta value of –73 means that the holder will lose Rs.73 in time value over the course of a year. This is not especially helpful information. Dividing the Rs.73 by 365 gives about Rs.0.2, and this result is meaningful. This means that at present the option will lose about 20 paise in time value holding it for a day. Hold it for 10 days and it will lose Rs.2.

17.5 VEGA RISK

The vega risk of a derivative, n is the rate of change in the value of the derivative with respect to the volatility (s) of the underlying asset. It is the first partial derivative of the Black-Scholes Model with respect to the volatility of the underlying asset.

$$\nu = = \frac{\partial c}{\partial \sigma}$$

$$\nu = = \frac{\partial P}{\partial \sigma}$$

Vega is positive for both long calls and long puts. If a vega is high in absolute terms, the portfolio's value is very sensitive to small changes in volatility. If vega is low, volatility changes have relatively little impact on the value of the portfolio. For example, if an option has a vega of 0.25, it will gain 0.25 percent in value for each percentage point increase in the anticipated volatility of the underlying asset. Vega is the same for puts and calls and is given by:

$$\nu = \frac{S_o \sqrt{T}\, e^{-0.5(d_1)^2}}{\sqrt{2\pi}} \qquad \text{.....................(9)}$$

17.6 RHO RISK

The *rho* risk of a derivative measures its sensitivity with respect to the interest rate and is denoted by r. It is the first partial derivative of the Black-Scholes Model with respect to the risk-free interest rate and is given by:

$$\rho_C = K\, T\, e^{-rT} N(d_2) \qquad \text{.....................(10)}$$

$$\rho_\rho = -\, K\, T\, e^{-rT} N(-d_2) \qquad \text{..................(11)}$$

Rho is positive for call options and negative for put options. Unless an option has an exceptionally long life, changes in interest rates affect the premium only modestly.

17.7 CASE STUDY

Mr. Jadav is the manager of Golden Hedge funds. He is basically a business management post-graduate with Financial Derivative as specialization. He is keen to use financial options contracts to design hedging strategies with the objective of improving the yield and reduce risk. His portfolio is currently worth Rs.150 crore, of which 90% is invested in stocks. The return on stock portfolio is highly corrected to BSE sensex (with r value being 0.92). on august 1st, the sensex is at 27,890 and traded on BSE with an exercise price in the range of 26,500 to 28,500 with expiry on Sept. 29. The price of these options are as follows:

Exercise price(Rs.)	Call Premium (Rs.)	Put Premium (Rs.)
27,500	720	510
27,700	680	570
27,900	560	660
28,100	440	780
28,300	310	840
28,500	180	910

September futures on sensex are currently selling at 28,150 expiring on 29th September. The volatility of the sensex is estimated at 23% and the risk-free rate is 6%. Mr.Jadav is concerned about a possible downside risk and wants to hedge the value of the portfolio.

Questions:

1. Explain the risks associated with the use of options for hedging.
2. Explain how Mr.Jadav can delta-hedge the portfolio.
3. How can portfolio be made gamma-neutral?

4. How can portfolio be made vega-neutral?
5. Show how to create put option synthetically in order to hedge the portfolio.

17.8 SUMMARY

The concept of risk is central to players in capital markets, particularly derivatives market. The traders in derivatives market are faced with the problem of hedging their exposure. Delta hedging involves creating a position with zero delta (sometimes referred to as a delta-neutral position). The delta of a derivative changes over time. This means the position in the underlying asset has to be frequently adjusted.

The gamma of an option is the rate of change of its delta with respect to the price of the underlying asset. Options with gammas near zero have deltas that are not particularly sensitive to changes in the stock price, and consequently are more robust.

Theta is a measure of the sensitivity of an option to the time remaining until its expiration. It is greater than zero because more time until expiration means more option time value.

Two other measures of the risk of an option position are vega and rho. The vega of an option measures the rate of change of its value with respect to volatility. Rho measures the rate of change of the position's value with respect to the risk-free interest rate.

17.9 KEY WORDS

Delta risk Gamma risk Theta risk Vega risk Rho risk

17.10 SELF ASSESSMENT QUESTIONS AND PROBLEMS

1. What is meant by the delta of an option?
2. Calculate the delta of a call option given that:

$T = 100$ days

$R = 6\%$

$S_o =$ Rs.125

$s = 0.29$

3. How can a short position in 600 call options be made delta neutral when the delta of each option is 0.5?
4. What is theta risk? How is it computed?

5. What does theta of – 0.8 mean when time is measured in years?

6. What is meant by the gamma of an option position? How is it computed?

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UNIT – 18 : EURODOLLAR DERIVATIVES (FUTURES)

Structure :

18.0 OBJECTIVES

This unit is so designed as to enable the reader to :

- Understand the concept of 'eurodollar',
- Appreciate the need for eurodollar derivatives
- Comprehend the basics of eurodollar derivatives, and
- Analyse FRAs, caps , etc., based on Eurodollars.

18.1 INTRODUCTION

The name eurodollars was derived from the fact that initially dollar-denominated deposits were largely held in European banks. At first these deposits were known as eurobank dollars. However, U.S. dollar-denominated deposits are now held in financial centers across the globe and referred to as eurodollars. The eurodollar futures contract was launched in 1981 by the Chicago Mercantile Exchange (CME), marking the first cash-settled futures contract. On expiration, the seller of cash settled futures contracts can transfer the associated cash position rather than making a delivery of the underlying asset. Eurodollar futures were initially traded on the upper floor of the Chicago Mercantile Exchange in its largest pit, which accommodated as many as 1,500 traders and clerks. However, the majority of eurodollar futures trading now takes place electronically.

18.2 WHAT ARE EURODOLLARS?

Eurodollars are time deposits denominated in U.S.dollars at banks outside the United States, and thus are not under the jurisdiction of the Federal Reserve system of U.S.A. Consequently, such deposits are subject to much less regulation than similar deposits within the U.S.. The term was originally coined for U.S. dollars in European banks, but it expanded over the years to its present definition—a U.S. dollar-denominated deposit in Hong Kong or Tokyo or Beijing would be likewise deemed a Eurodollar deposit. The eurodollar market traces its origins to the Cold War era of the 1950s. During this period, the Soviet Union started to move its dollar-denominated revenue, derived from selling commodities such as crude oil, out of U.S. banks. This was done to prevent the U.S. from being able to freeze its assets. Since then, eurodollars have become one of the largest short-term money markets in the world and their interest rates have emerged as a benchmark for corporate funding.

"eurodollars" as deposits were at first held mostly by European banks and financial institutions. In the mid-1950s, Eurodollar trading and its development into a dominant world currency began when the Soviet Union wanted better interest rates on their Eurodollars and convinced an Italian banking cartel to give them more interest than what could have been earned if the dollars were deposited in the U.S. The Italian bankers then had to find customers ready to borrow the Soviet dollars and pay above the U.S. legal interest-rate caps for their use, and were able to do so; thus, Eurodollars began to be used increasingly in global finance.

18.3 EURODOLLAR FUTURES

The Eurodollar futures contract refers to the financial futures contract based upon eurodollar deposits, traded at the Chicago Mercantile Exchange (CME). More specifically, EuroDollar futures contracts are derivatives on the interest rate paid on those deposits. Eurodollars are cash settled futures contract whose price moves in response to the interest rate offered on US Dollar denominated deposits held in European banks.[Eurodollar futures are a way for companies and banks to lock in an interest rate today, for money it intends to borrow or lend in the future. Each CME Eurodollar futures contract has a notional or "face value" of $1,000,000, though the leverage used in futures allows one contract to be traded with a margin of about one thousand dollars.

The London Interbank Offered Rate (LIBOR) is a benchmark for short-term interest rates at which banks can borrow funds in the London interbank market. Eurodollar futures are a LIBOR based derivative, reflecting the London Interbank Offered Rate for a 3-month $1,000,000 offshore deposit. (See "An Introduction to LIBOR")

Eurodollar futures prices are expressed numerically using 100 minus the implied 3-month U.S. Dollar LIBOR interest rate. In this way, a eurodollar futures price of $96.00 reflects an implied settlement interest rate of 4%.

For example, if an investor buys 1 eurodollar futures contract at $96.00 and price rises to $96.02, this corresponds to a lower implied settlement of LIBOR at 3.98%. The buyer of the futures contract will have made $50. (1 basis point, 0.01, is equal to $25 per contract, therefore a move of 0.02 equals a change of $50 per contract.)

18.4 HEDGING WITH EURODOLLAR FUTURES

Eurodollar futures provide an effective means for companies and banks to secure an interest rate for money it plans to borrow or lend in the future. The Eurodollar contract is used to hedge against yield curve changes over multiple years into the future.

For example: Suppose a company knows in September that it will need to borrow $10 million in December to make a purchase. As each eurodollar futures contract represents a $1,000,000 time deposit with a three month maturity, the company can hedge against an adverse move in interest rates during that three month period by short selling 10 December Eurodollar futures contracts, representing the $10 million needed for the purchase.

The price of eurodollar futures reflect the anticipated London Interbank Offered Rate (LIBOR) at the time of settlement, in this case, December. By short selling the December contract, the company profits from upward movement in interest rates, reflected in correspondingly lower December eurodollar futures prices.

Let's assume that on September 1, the December eurodollar futures contract price was exactly $95.00, implying an interest rate of 5.0%, and that at the expiry in December the final closing price is $94.00, reflecting a higher interest rate of 6.0%. If the company had sold 10 December Eurodollar contracts at $95.00 in September, it would have profited by 100 basis points (100 x $25 = $2,500) on 10 contracts, equaling $25,000 ($2,500 x10) when it covered the short position.

In this way, the company was able to offset the rise in interest rates, effectively locking in the anticipated LIBOR for December as it was reflected in the price of the December Eurodollar contract at the time it made the short sale in September.

18.5 SPECULATING WITH EURODOLLAR FUTURES

The policy decisions of the U.S. Federal Reserve have a major impact on the price of eurodollar futures. A change in Federal Reserve policy towards lowering or raising interest rates can take place over a period of years. Eurodollar futures are impacted by these major trends in monetary policy.

The high levels of liquidity along with relatively low levels of intraday volatility create an opportunity for traders using a 'market making' style of trading. Traders using this non-directional strategy place orders on the bid and offer simultaneously, attempting to capture the spread. More sophisticated strategies such as arbitrage and spreading against other contracts are also used by traders in the eurodollar futures market.

The TED spread is the price difference between interest rates on three-month futures contracts for U.S. Treasuries and three-month contracts for Eurodollars with the same expiration months. TED is an acronym using T-Bill and ED, the symbol for the eurodollar futures contract. This spread is an indicator of credit risk; an increase or decrease in the TED spread reflects sentiment on the default risk level of interbank loans.

18.6 PRICING AND QUOTATION

Eurodollar futures are based on a $1 million facevalue, 3-month maturity Eurodollar Time Deposit.They are settled in cash on the 2nd London Bank business day prior to the 3rd Wednesday of the contract month by reference to the ICE Benchmark Administration Limited (ICE) Interest Settlement Rate for three-month Eurodollar Interbank Time Deposits. These contracts mature during the months of March, June, September, or December, extending outward 10 years into the future. However, the exchange also offers "serial" contract months in the four nearby months that do not fall into the March quarterly cycle. See Table 1 below for contract specifications. Where once trading was largely conducted on the floor of the exchange using traditional open outcry methods during regular daylight hours – today, trading activity is largely conducted on the CME GlobexR electronic trading platform on nearly an around the clock basis. These contracts are quoted in terms of the "IMM index." The IMM index is equal to 100 less the yield on the security. If for example, the yield equals 0.750%, the IMM index is quoted as 99.250 (100.000 " 0.750% = 99.250) . If the value of the futures contract should fluctuate by one basis point (0.01%), this equates to a $25.00 movement in the contract value. The minimum allowable price fluctuation, or "tick" size, is generally established at one-half of one basis point, or 0.005%. Based on a $1 million face-value 90-day instrument, this equates to $12.50. However, in the nearby expiring contract month, the minimum price fluctuation is set at one-quarter basis point, or 0.0025%, equating to $6.25 per contract.

18.7 FORWARD RATE AGREEMENTS

The FRA is a legally binding agreement between two parties to borrow or lend at a rate that will be applied to a notional loan or deposit of an agreed amount to be drawn, on an agreed future date for a specified term. One of the parties is a 'buyer' of the FRA, the other a 'seller'. The buyer agrees notionally to borrow the money at the FRA rate, and the seller agrees notionally to lend the money at the FRA rate. On the settlement date, the difference between the agreed FRA rate and the prevailing MIBOR rate will be settled by one party to the other in cash. Usually, one of the parties is a bank, and other a corporate organization. The settlement date commences on some future date which needs to be specified. The significant characteristics of an FRA are:

(a) It is an OTC product, and FRAs are quoted by many banks around the world.

(b) It is predominantly used as an inter-bank tool for hedging of short-term interest rate risk.

(c) Simpler to administer than futures since there is no margining requirement.

(d) The underlying principal amount is purely notional and no actual exchange takes place. The notional principal amount (NPA) is used for calculation of settlement amount to be exchanged between parties. The difference between the agreed FRA rate and the ruling market rate (MIBOR) will be cash-settled by the parties.

(e) Most liquid and frequently traded FRAs are for 3 to 6 months.

(f) FRAs are available for periods extending to 2 years.

(g) It is like insurance. The bank will guarantee (or insure) a rate of interest for a transaction which starts on a future date.

(h) FRAs are flexible. If the FRA is no longer required, a reversing contract may be transacted to close out the position.

(i) FRAs involve zero cost. There are no costs incurred by the hedger.

Many leading banks around the world quote and trade FRAs and the market is liquid. The bid-ask spreads are usually quite low – as small as 3 to 4 basis points. For a 6x12 FRA (Borrowing for 6 months, beginning six months from now), a bank may be willing to borrow at a rate of 5.05% for a 6-month period, 6 months hence, and lend at a rate of 5.08%; this is a spread of 3 basis points.

a) The settlement date which is also known as the delivery date of the forward contract, is given by t_1.

b) The end of exposure period, also known as the end of the forward period, given by t2.

c) The length of the loan period is $t_2 - t_1$, which is the length of time for which the money is borrowed.

d) The payment is made on the settlement date, t_1, which is the start of the loan period

e) The forward rate according to the FRA is known and is denoted as Fr.

f) On t_1 the spot interest rate – denoted by r is ascertained on the basis of MIBOR or any other benchmark rate for the same period, i,e $t_2 - t_1$.

g) Since Fr and r are calculated in annual terms, the rates are converted to the rates applicable for the loan period. For example, if the r is 6% and the Fr is 8%, the difference is 2% on an annual basis, if the loan period is six months; the rate for six-month period is 1%.

h) The difference in interest rate, which is (r-Fr), is multiplied by the principal to find the amount of interest differential. This amount is discounted at the spot rate as indicated by the following formula.

$$\text{Settlement amount} = \frac{P \ \Delta (r, Fr) \ [D/B]}{1 + [\, r \times (D / B) \,]}$$

Where,

P = principal amount

" = (r, Fr) = interest rate differential.

D = no of days in the loan period

B = No of days in the year (360/365 as specified in the FRA)

Example

NDH bank sells a 2x5 FRA with a principal amount of INR 15 million at an Fr of 8% .The reference rate on the FRA is the MIBOR, and the cost of the loan is MIBOR + 100. On the settlement date, which is two months ahead, the MIBOR is 6.4 % and the r is MIBOR + 100. A year is specified to have 360 days. What will be the settlement payment?

(1) Calculate the difference between Fr and r.

Fr =8%

r = 7.4 %[MIBOR +100 , or 6.4% + 1% =7.4%]

Fr – r = 0.6%

(Fr - r) (D/B) = 0.15% OR 0.0015

(2)

$$\text{Settlement amount} = \frac{P \text{ `` } (r, Fr) \ [D/B]}{1 + [\, r \times (D / B)]}$$

Settlement amount = $\frac{15,000,000 \text{ x } 0.0015}{1 + [0.074\text{x}90/360]}$

= $\frac{22500}{1.0185}$

= 22,091

In this example, NDH bank will receive INR 22,091 as the settlement amount.

18.8 INTEREST RATE CAPS & FLOORS

An interest rate cap is a derivative in which the buyer receives payments at the end of each period in which the interest rate exceeds the agreed strike price. An example of a cap would be an agreement to receive a payment for each month the LIBOR rate exceeds 2.5%. They are most frequently taken out for periods of between 2 and 5 years, although this can vary considerably. Since the strike price reflects the maximum interest rate payable by the purchaser of the cap, it is frequently a whole number integer, for example 5% or 7%. By comparison the underlying index for a cap is frequently a LIBOR rate, or a national interest rate. The extent of the cap is known as its notional profile and can change over the lifetime of a cap, for example, to reflect amounts borrowed under an amortizing loan. The purchase price of a cap is a one-off cost and is known as the premium. The purchaser of a cap will continue to benefit from any fall in interest rates below the strike price, which makes the cap a popular means of hedging a floating rate loan. The interest rate cap can be analyzed as a series of European call options, known as caplets, which exist for each period the cap agreement is in existence. Unlike other types of option, it is generally not necessary for the purchaser of a cap to notify the seller in order to exercise it, as this will happen automatically if the interest rate exceeds the strike price. Each caplet is settled in cash at the end of the period to which it relates. In mathematical terms, a caplet payoff on a rate *L* struck at *K* is : N * *a*{\displaystyle N\cdot \alpha \max(L-K,0)} max(L – K , 0)

where *N* is the notional value exchanged and *{\displaystyle \alpha }* a is the day count fraction corresponding to the period to which L applies. For example, suppose you own a caplet on the six month USD LIBOR rate with an expiry of 1 Sept. 2016 struck at 2.5% with a notional of 1 million dollars. Then if the USD LIBOR rate sets at 3% on 1 Sept. you receive

$ 1M * 0.5.max (0.03-0.025,0) = $ 2500

Customarily the payment is made at the end of the rate period, in this case on 1 August.

An **interest rate floor** is a series of European put options or **floorlets** on a specified reference rate, usually LIBOR. The buyer of the floor receives money if on the maturity of any of the floorlets, the reference rate is below the agreed strike price of the floor. An **interest rate collar** is the simultaneous purchase of an interest rate cap and sale of an interest rate floor on the same index for the same maturity and notional principal amount.

- The cap rate is set above the floor rate.
- The objective of the buyer of a collar is to protect against rising interest rates (while agreeing to give up some of the benefit from lower interest rates).
- The purchase of the cap protects against rising rates while the sale of the floor generates premium income.
- A collar creates a band within which the buyer's effective interest rate fluctuates

A **reverse interest rate collar** is the simultaneous purchase of buying an interest rate floor and simultaneously selling an interest rate cap.

- The objective is to protect the bank from falling interest rates.
- The buyer selects the index rate and matches the maturity and notional principal amounts for the floor and cap.
- Buyers can construct zero cost reverse collars when it is possible to find floor and cap rates with the same premiums that provide an acceptable band.

18.9 EURODOLLAR SPREADS

It is Known as the **TED spread.** TED spread is the difference between the interest rates on interbank loans and on short-term U.S. government debt ("T-bills"). TED is an acronym formed from *T-Bill* and *ED*, the ticker symbol for the Eurodollar futures contract. Initially, the TED spread was the difference between the interest rates for three-month U.S. Treasuries contracts and the three-month Eurodollars contract as represented by the London Interbank Offered Rate (LIBOR). However, since the Chicago Mercantile Exchangedropped T-bill futures after the 1987 crash,[1] the TED spread is now calculated as the difference between the three-month LIBOR and the three-month T-bill interest rate.

TED spread = (3-month LIBOR) - (3-month T-bill int. rate)

The size of the spread is usually denominated in basis points (bps). For example, if the T-bill rate is 5.10% and ED trades at 5.50%, the TED spread is 40 bps. The TED spread fluctuates over time but generally has remained within the range of 10 and 50 bps (0.1% and 0.5%) except in times of financial crisis. A rising TED spread often presages a downturn in the U.S. stock market, as it indicates that liquidity is being withdrawn.

Treasury/Eurodollar (TED) spreads have been studied and traded since 1981 concurrent with the introduction of Eurodollar futures. Spreads were originally constructed with use of CME (Chicago Mercantile Exchange) 90-day Treasury bill futures vs. CME 90-day Eurodollar futures contracts. As such, the spread was a very direct measure of marketplace perception of the credit risk implied by a private investment (in Eurodollars) vs. the so-called "risk-free rate" implied by a Treasury bill. The popularity of the TED spread was enhanced by various credit events affecting the marketplace over the years like Continental Illinois Bank crisis of 1984, the savings and loan failures and subsequent bailout of the early 1980s. While CME's T-bill futures contract has fallen into disuse as the popularity of Eurodollar futures has transcended all other domestic short-term interest rate contracts, the TED lives on as a popular device for trading credit risks. The TED is sometimes referred to as a "swap spread" or a spread between interest rate swap (IRS) rates and a riskfree government rate. Noting the close relationship between IRSs and Eurodollar futures as a pricing mechanism and hedging tool, one may readily substitute Eurodollar futures as a proxy for a swap. Thus, TED spreads are often constructed with the use of Eurodollar futures vs. cash Treasury notes. Or, one may facilitate the trade with use of 2-year, 5-year, 10-year Treasury note futures as traded on the Chicago Board of Trade (CBOT) vs. Eurodollar futures. All yields are not going to be uniform. The yield quoted on a money market instrument such as LIBOR is calculated using somewhat different assumptions than the yield quoted on a TED spreads or Treasury vs. Eurodollar spreads have been traded in a variety of forms over the years. A TED spread does reflect credit quality. Yields quoted on money market instruments such as Eurodollars are not strictly comparable to yields quoted on coupon bearing items such as Treasury notes. Fixed income traders need be careful to assure that they are comparing "oranges with oranges." Yields associated with Eurodollar or LIBOR quotes are known as money market yields (MMY). Eurodollars are so-called "add-on" instruments where one invests the stated face value and received the original investment plus interest at term. Thus, one's interest may be calculated as a simple function of the face value (FV), rate (r) and days to maturity (D) :

Interest = FV [r x (D/360)]

Example: If one were to purchase a $1 million face value unit of 270- day Euros with MMY(Money Market Yield) =3.00%, one would receive the original $1 million face value (FV) investment plus interest (i) of $7,833 at the conclusion of 94 days. Interest = $1,000,000

[0.03 x (270/360)] = $22,500. The MMYs suffer from the mistaken assumption that there are but 360 days in a year . As such, MMYs are not completely comparable to the bond equivalent yield (BEY) quoted on Treasury notes that imply periodic coupon payments. The following adjustment may be made to render the two quotes comparable :

BEY = MMY x (365/360)

where BEY= bond equivalent yield

Example: Assume an investor has a 90-day money market instrument yielding 3.00%. The BEY of the instrument is 3.0417% which slightly exceeds the MMY.

18.10 CASE STUDY

Victoria (India) Ltd. is a foreign subsidiary engaged in the business of Pearls and Diamonds. On January 2, the company plans to borrow $ 10 million and Rs.10 crores in March for three months. HSB Bank agrees to provide required funds at 1 pc above whatever the 3-month LIBOR on March 20 for dollar loan, and 1 pc above whatever the 3-month MIBOR on March 20 for rupee loan.

The management of the firm is concerned that in the interim the LIBOR and MIBOR may rise causing increase in borrowing cost.

On January 2, the March Eurodollar futures price is 91.72, and the implied 3-month Eurodollar rate is 8.28 pc. The 3-month LIBOR on January 2 is 8.375.

The 3-month benchmark MIBOR rate (ask) is 8.1 pc on January 2 .

MIBOR Rates (%)

Duration	Bid	Ask
1 month	7.80	8.30
2 months	7.90	8.30
3 months	8.00	8.10
6 months	7.75	7.80
12 months	7.63	7.65

The 3-3 FRA is being quoted by the Bank of Baroda at 7.70 – 7.80 pc.

Discussion Questions:

(1) What strategy the management of the firm should put in place to protect itself against possible rise in LIBOR?

(2) What strategy the management of the firm should put in place to protect itself against possible rise in MIBOR?

(3) If it can lock in the 3-month Eurodollar futures rate of 8.28 pc on January 2, what will be its guaranteed dollar borrowing cost?

(4) If it can lock in the 3-month FRA rate of 7.80 pc on January 2, what will be its guaranteed rupee borrowing cost?

(5) If the 3-month LIBOR rises to 9.00 pc by March 20 (March futures are $ 91), demonstrate how the dollar borrowing cost will still be equal to the amount computed in part (3) above.

(6) If the 3-month MIBOR rises to 8.25 pc on March 20, demonstrate how the rupee borrowing cost will still be equal to the amount computed in part (4) above.

18.11 SUMMARY

Eurodollars are time deposits denominated in U.S.dollars at banks outside the United States, and thus are not under the jurisdiction of the Federal Reserve system of U.S.A. Consequently, such deposits are subject to much less regulation than similar deposits within the U.S.. The term was originally coined for U.S. dollars in European banks, but it expanded over the years to its present definition—a U.S. dollar-denominated deposit in Hong Kong or Tokyo or Beijing would be likewise deemed a Eurodollar deposit. The eurodollar market traces its origins to the Cold War era of the 1950s.

The Eurodollar futures contract refers to the financial futures contract based upon eurodollar deposits, traded at the Chicago Mercantile Exchange (CME). More specifically, EuroDollar futures contracts are derivatives on the interest rate paid on those deposits. Eurodollar futures provide an effective means for companies and banks to secure an interest rate for money it plans to borrow or lend in the future. The Eurodollar contract is used to hedge against yield curve changes over multiple years into the future. The FRA is a legally binding agreement between two parties to borrow or lend at a rate that will be applied to a notional loan or deposit of an agreed amount to be drawn, on an agreed future date for a specified term. An interest rate cap is a derivative in which the buyer receives payments at the end of each period in which the interest rate exceeds the agreed strike price. An **interest rate floor** is a series of European put options or **floorlets** on a specified reference rate, usually LIBOR. A **reverse interest rate collar** is the simultaneous purchase of buying an interest rate floor and simultaneously selling an interest rate cap. TED spread is the difference between the interest rates on interbank loans and on short-term U.S. government debt ("T-bills").

18.12 KEY WORDS

Eorodollar   Eurodollar futures   FRAs   Caps   Floors   Collars   Eorodollar spreads

18.13 SELF ASSESSMENT QUESTIONS AND PROBLEMS

1. What do you mean by 'Eurodollar'? why did Eurodollars evolved?
2. Define an Eurodollar futures contract. What are its salient features?
3. How Eurodollars are useful for hedging? Explain with an example.
4. Briefly explain the pricing mechanism of Eurodollar futures.
5. What are forward rates? Explain, with a suitable example, the procedure *for* determining forward rates.
6. Discuss the mechanics of trading FRAs
7. What are interest rate caps?
8. What do you mean by interest rate floors and collars?

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UNIT – 19 : ACCOUNTING ISSUES IN DERIVATIVES

Structure :

19.0 OBJECTIVES

This unit is so designed as to enable the reader to :

- Understand the basics of accounting for derivatives,
- Grasp the concept of hedge accounting,
- Comprehend the derivative accounting practices , and
- Analyse accounting standards applied for derivative accounting in India.

19.2 INTRODUCTION

The trading volume in financial derivatives has increased tremendously over the last three decades. But the accounting framework has not kept pace with the growth and complexity of these instruments. It is still in the process of evolution. Though some accounting standards have been framed by various accounting bodies on the basis of International Accounting Standards (IAS) 39, but still there is no uniform standard accounting practice for derivative instruments as a whole. International Accounting Standards Board (IASB) has an on going project to revise IAS 39. This chapter focuses on the current version of accounting treatment of derivative deals, followed by brief note on accounting for derivatives in India.

19.3 'FAIR VALUE' ACCOUNTING

Conventional accounting principles do not specifically describe the accounting treatment of derivative financial instruments and their risk reducing effects of a hedge. For example, as per accounting convention of conservatism or prudence, inventory is to be valued at the lower of cost or market value (net realizable value). A firm may hold inventory of a particular material (say raw coffee) and the price of the raw coffee might have fallen in the market. Assume that the firm has simultaneously have hedged against the fall in price by selling raw coffee in the futures market in a particular exchange. In conventional accounting the unrealized loss on such raw coffee will have to be reflected in terms of lower stock valuation in both profit and loss account as well as in balance sheet of the firm. As a result, the profit figure of the company will be lesser. On the other hand, the gain (unrealized) on futures transaction on raw coffee will not be shown, because as per above accounting convention, the unrealized gain cannot be shown. Hence, in these circumstances, the conventional accounting may not show the fair financial position of the firm.

The big change that accounting standards on financial instruments bring about is clearly the fair value accounting, also called *mark-to-market* accounting, is taking over the age-old historical cost accounting. 'Mark-to-market' is a stock market term; 'fair value' is more preferable. Assets are stated at their historical cost under conventional accounting. Gain or loss cannot be booked until they are actually realized. However it is generally felt that historical costs are less relevant than prevailing values. There is a general consensus that fair values provide more current and relevant information.

19.4 ACCOUNTING FOR DERIVATIVE INSTRUMENTS

In the regular course of business operations, organizations are exposed to market risks such as interest rate risk, foreign exchange risk, commodity price risk, etc., that give rise to income volatility. As a result, organizations often will take some action to mitigate or economically hedge against such exposures using derivative financial instruments. In addition, some organizations may enter into derivative contracts for speculative or trading purposes.

Under current Indian and International accounting standards, an entity is required to measure derivative instruments at fair value, or mark-to-market (MTM), with changes in fair value or MTM to be recognized through the income statement.

(1) Hedge Accounting

Hedge accounting means designating a hedging instrument, normally a derivative, as an offset to changes in the fair value or cash flows of a hedged item. Non-derivative financial instruments may be used as hedging instruments only in respect of foreign exchange risk. A hedged item can be an asset, liability, firm commitment or forecast future transaction that is exposed to a risk of change in value or changes in future cash flows. Hedge accounting attempts to match the off-setting effects of the fair value changes in hedged items and hedging instruments and recognize them in net profit or loss at the same time.

The normal rules for financial instruments call for all derivatives to be carried at fair value with gains and losses in the income statement. Hedge accounting allows departures from the normal recognition rules in order to reflect the economics of hedging relationships in reporting performance. An entity using hedge accounting can alter the timing of recognition of gains and losses from fair value changes in hedged items and hedging instruments and avoid the significant volatility that might arise if the gains and losses were recognized in the income statement under normal accounting rules. There are three types of hedge accounting recognized by IFRS; *fair value hedges*, *cash flow hedges* and *hedges of the net investment* in a foreign entity.

(2) Criteria for Hedge Accounting

Hedge accounting is an exception to the usual rules for financial instruments. There are strict criteria that must be met before accounting can be used. The requirements are:

a) The hedged item and the hedging instrument are specifically identified.

b) The hedging relationship is formally documented – at the outset.

c) The documentation of the hedged relationship must identify the hedged risk and how effectiveness of the hedge will be assessed.

d) At the inception of the hedge, it must be expected to be highly effective; that is, the gains and losses on the hedged item and the hedging instrument should almost fully offset over the life of the hedge.

e) Effectiveness of the hedge must be tested regularly throughout the life of the hedge. Retrospective effectiveness should fall within a range of 80% to 125%.

f) One to one designation is normally required between a single external asset, liability or forecast transaction and a single external derivative instrument.

g) Hedges of forecast transactions are allowed if the forecast transaction is 'highly probable'.

(3) Hedged Items

Hedge accounting can be applied to qualifying hedged items. A hedged item must create an exposure to risk that could affect the income statement, currently or in future periods. The usual types of risks that are hedged include foreign currency risk, interest rate risk, equity price risk, commodity price risk and credit risk. Portfolio hedging, that is hedging the open position arising from a number of similar hedged items, is difficult to achieve.

Any financial asset or liability which creates exposure to risk can be hedged item, with two specific exclusions. Held-to-maturity investments cannot be hedged items for interest rate risk nor can investments in subsidiaries or associates that are consolidated or measured using the equity method. However, the net investment in a foreign entity can be hedged. Some examples of risks that can be hedged are:

a) Foreign currency monetary items (risk or changes in foreign exchange rate).

b) Fixed interest debt security classified as available for sale (risk of changes in interest rates or credit risk).

c) Highly probable forecast sale or purchase in a foreign currency.

d) Originated loans (risk of changes in interest rates).

An exposure to general business risks cannot be hedged, nor can risk of obsolescence of computer equipment or risk of unseasonable weather because these risks cannot be reliably measured. For similar reasons, a commitment to acquire another entity in a business combination cannot be a hedged item, other than for foreign exchange risk.

(4) Qualifying for Hedge Accounting

There are three basic requirements that must be satisfied in order for hedge accounting to be applied to any eligible hedge relationship: (1) Documentation, (2) Assessment of Effectiveness and (3) Measurement of Ineffectiveness

Formal documentation of the hedge relationship needs to exist at the date of designation those details:

a) The entity's risk management objective and strategy for undertaking the hedge;

b) The nature of the risk being hedged

c) Clear identification of the hedged item and hedging derivative including the key terms; and

d) The methods through which the effectiveness of the relationship will be assessed on both a prospective and retrospective basis, and how any ineffectiveness will be measured.

A critical requirement before one can apply hedge accounting is the analysis that supports the assessment of hedge effectiveness by analyzing the relationship between the changes in fair value or cash flows of the hedging derivative instrument versus those of the hedged item. At the inception of each hedge, an organization is required to demonstrate that the hedge is expected to be highly effective throughout the designated term in achieving offsetting changes in the fair value or cash flows attributable to the hedge risk through a prospective test. At each subsequent period , the prospective test should be rerun to demonstrate that the relationship is still expected to be highly effective for the remainder of the term of the hedge. At each period end, a retrospective test also has to be conducted to demonstrate that the hedge has been highly effective since inception of the hedge. Hedge accounting must be discontinued prospectively from the current assessment date should there be a failure of the prospective test, or discontinued prospectively from the previous assessment date should there be a failure of the retrospective test.

When applying hedge accounting an entity is also required to measure any ineffectiveness that may exist in the relationship (that is, the extent to which the change in the fair value or cash flows of the derivative instrument does not offset the change in fair value or cash flows of the hedged item). For a cash flow hedge ineffectiveness is currently recognized in profit or loss only when there is an over hedge and accordingly entities require processes and information to calculate the ineffectiveness accurately and in the appropriate instances. For a fair value hedge, ineffectiveness is naturally recognized in profit or loss as it is simply the extent to which a perfect offset does not exist and can occur in an over hedge or under hedge situation.

19.5 ACCOUNTING PRACTICE

International Accounting Standards get modified and rewritten very frequently. For instance, IASB seeks to replace IAS 39 by IFRS 9 in three phases. The first phase was completed with the issue of the portion of IFRS 9 which deals with the classification and measurement of financial assets and financial liabilities. The second and third phase are in the area of Impairment and Hedge Accounting, the supplementary document of these was published in Jan. 2011 and the comment period closed on 1st April 2011.

Any derivative instrument used as a trading transaction should be recorded in accounting records on marked-to-market basis. It means that it has to be valued at market value, and resultant capital gains or losses must be taken into the profit and loss account for the current period as part of earnings. In other words, not only realized gains and losses but also unrealized gains and losses will be accounted for at the end of each accounting period. The treatment of specific hedge transaction in accounting records should be the same as the treatment used for the underlying asset. For example, if the underlying asset is valued at cost then the hedge too will be at the cost. Further, if the underlying asset will affect profit or loss for more than one year, the effect of the hedge should be spread over a matching number of accounting years. If the underlying asset is marked-to-market, the same treatment should be with the hedge.

If the underlying asset in a specific hedge transaction is carried at lower of cost or market value, the market value should include the market value (i.e. net open or loss) on the hedge instrument. The market value of the asset and the hedge are aggregated and treated as one composite market value. Then this composite market value is compared with the cost (book value) and the lower of the two is adopted. This valuation process has explained by an example.

Example

A jewelery design company holds stock of 14 kilos of gold bars with a book value of 42 lakhs at the rate of Rs.3000 per gram. Its accounting year ends on December 31. It hedges the same by selling January gold futures contract. It wants to know the correct stock valuation for balance sheet purposes in each of the following scenarios:

1. Sale of futures at Rs.2700 per gram, market price on balance sheet date is Rs.2600 per gram.
2. Sale of futures at Rs.3200 per gram, market price on balance sheet date is Rs.2600 per gram.
3. Sale of futures at Rs.3200 per gram, market price on balance sheet date is Rs.3300 per gram.

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	Rs. in lakh		
.	Scenario		
	I	II	III
1. Book value	420	420	420
2. Market value	364	364	462
+ (-) Gain (loss) on futures contract	14[1]	84[2]	-14[3]
Composite Market value	378	448	448
3. Balance Sheet value [lower of (1) ad (2)]	**378**	**420**	**420**

Notes:

1. (Rs.2700/gm – Rs.2600/gm) x 14000 gms = Rs. 14 lakhs gain
2. (Rs.3200/gm – Rs.2600/gm) x 14000 gms = Rs. 84 lakhs gain
3. (Rs.3300/gm – Rs.3200/gm) x 14000 gms = Rs.14 lakhs loss

19.6 ACCOUNTING TREATMENT OF DERIVATIVES IN INDIA

The Institute of Chartered Accountants of India (ICAI), 2006 issued, a new draft accounting standard for recognition and measurement of financial instruments. It has also modified its earlier draft standard on presentation of financial instruments. The Code came at a time when corporate organisations had undertaken a large number of currency and interest rate swaps to reduce their liability on loans. But the firms often abstain from disclosing these off-balance sheet items. In the proposed rule, these derivative positions will not only have to be disclosed, but also provided for, depending on the nature of the transaction.

The standards cover all financial instruments including various derivatives, equity, debt, preference capital, bonds, convertible debentures and their combinations that corporate design for specific needs. The standards will also make it easier for investors to find the net worth of a company without making complex calculations. The idea is to infuse transparency and enable a clearer picture of a company's financial health and. The standard on recognition and measurement of these instruments (AS 30) is based on the International Accounting Standard (IAS) 39.

AS 30 requires that all derivatives are accounted for on the balance sheet at fair value, irrespective of whether they are used as part of a hedging relationship. Changes in fair value are recognized in the statement of profit and loss unless the contract is part of an effective cash flow or net investment hedging relationship. As the definition of a derivative is so broad, many contracts are likely to be with in its ambit, and therefore will have to be accounted for at fair value.

(1) Definition of Derivative

According to Para 8 of AS 30, A derivative is a financial instrument or other contract within the scope of this Standard with all three of the following characteristics:

(a) Its value changes in response to the change in a specified interest rate, financial instrument price, commodity price, foreign exchange rate, index of prices or rates, credit rating or credit index or other variable provided in the case of a non-financial variable that the variable is not specific to a party to the contract (sometimes called the 'underlying')

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

(c) It is settled at a future date.

(2) Hedge Accounting

Hedge accounting is a method of presentation that may be voluntarily applied to hedging transactions. The objective of hedge accounting is to ensure that the gain or loss on the hedging instrument is recognized in the statement of profit and loss in the same period when the item that is being hedged affects profit or loss. In other words, applying hedge accounting results in the 'matched' timing of recognition of gains and losses in the statement of profit and loss. Where an entity is perfectly hedged, the gains and losses on the hedging instrument and the hedged item perfectly offset in the statement of profit and loss in the same period.

AS 30 allows an entity to apply hedge accounting if an entity specifically designates the hedging instrument and the hedged item at inception of the hedge accounting relationship. Generally, there are two ways in which hedge accounting achieves the matching of gains and losses on the hedging instrument and the hedged item.

a) Changes in the fair value of the hedging instrument are recognized in the statement of profit and loss at the same time that a recognized asset and liability that is being hedged is adjusted for movements in the hedged risk and that adjustment is also recognized in the statement of profit and loss in the same period. This is referred to as a fair value hedge because it is the exposure to changes in the fair value of the hedged item due to the designated risk that is being hedged ; or

b) Changes in the fair value of the hedging instrument are recognized initially in equity and 'recycled' into the statement of profit and loss when the hedged item affects profit or loss. This is known as a cash flow hedge because it is the exposure to the variability in future cash flow that is being hedged.

A third and final category of hedge accounting is hedging a net investment in a foreign operation. This is accounted for similarly to cash flow hedges.

When an entity wishes to apply hedge accounting, it must formally document in writing its intention to apply hedge accounting prospectively. Hedge accounting cannot be applied retrospectively. Additionally, hedge accounting must be consistent with the entity's established risk management strategy for that hedge relationship. The hedge documentation must identify the hedging instrument, the hedged item or transaction, the nature or the risk being hedged and specify how the 'effectiveness' of the hedge relationship will be assessed and ineffectiveness measured.

AS 30 does not mandate the use of hedge accounting. Hedge accounting is voluntary. If an entity does not wish to use hedge accounting it does not need to designate and document its hedging relationships.

Definitions of hedge accounting

AS 30 recognises three types of hedge accounting depending on the nature of the risk exposure:

(a) Fair value hedge: Fair value hedge is a hedge of the exposure to changes in fair value of a recognized asset or liability or an unrecognized firm commitment, or an identified portion of such an asset, liability or firm commitment, that is attributable to a particular risk and could affect profit or loss.

The following assets and liabilities are commonly fair value hedged:

(i) Fixed rate liabilities like loans;

(ii) Fixed rate assets like investments in bonds;

(iii) Investments in equity securities; and

(iv) Firm commitments to buy/sell non-financial items at a fixed price

A firm commitment is a binding agreement for the exchange of a specified quantity of resources at a specified price on a specified future date or dates.

(b) Cash flow hedge: Cash flow hedge is a hedge of the exposure to variability in cash flows that (i) is attributable to a particular risk associated with a recognized asset or liability (such as all or some future interest payments on variable rate debt) or a highly probable forecast transaction and (ii) could affect profit or loss.

Common assets and liabilities and forecast transactions that are cash flow hedged include:

(i) Variable rate liabilities like loans;

(ii) Variable rate assets like investments in bonds;

(iii) Highly probable future issuance of fixed rate debt;

(iv) Forecast reinvestment of interest and principal received on fixed rate assets; and

(v) Highly probable forecast sales and purchases

An example of a cash flow hedge is a hedge of variable rate debt with a floating to fixed interest rate swap. The cash flow hedge reduces future variability of interest cash flows on the debt.

(c) Hedge of a net investment in a foreign operation ('net investment hedge'): A hedging relationship qualifies for hedge accounting under AS 30 if, and only if, all of the following conditions are met.

(i) At the inception of the hedge there is formal designation and documentation of the hedging relationship and the entity's risk management objective and strategy for undertaking the hedge. The documentation should include identification of the hedging instrument, the hedged item or transaction, the nature of the risk being hedged and how the entity will assess the hedging instrument's effectiveness in offsetting the exposure to changes in the hedged item's fair value or cash flows attributable to the hedged risk.

(ii) The hedge is expected to be highly effective in achieving offsetting changes in fair value or cash flows attributable to the hedged risk, consistently with the originally documented risk management strategy for that particular hedging relationship.

(iii) For cash flow hedges, a forecast transaction that is the subject of the hedge must be highly probable and must present an exposure to variations in cash flows that could ultimately affect profit or loss.

(iv) The effectiveness of the hedge can be reliably measured, i.e., the fair value or cash flows of the hedged item that are attributable to the hedged risk and the fair value of the hedging instrument can be reliably measured.

(v) The hedge is assessed on an ongoing basis and determined actually to have been highly effective throughout the financial reporting periods for which the hedge was designated.

Forwards and Options: A forward contract is basically a contractual arrangement in which one party buys and other party sells designated currency at a forward rate mutually agreed upon the date of contract for delivery at designated future date. Accordingly, 'An enterprise may enter into a forward contract or other financial instrument that is in substance a forward exchange contract to establish the amount of reporting currency required or available at settlement date of a transaction. The difference between the forward rate and the exchange rate at the date of transaction should be recognized as income or expense over the life of the contract, excect in respect of liabilities incurred for acquiring fixed assets, in which case, such difference should be adjusted in carrying amount of the respective fixed assets.

(3) Embedded Derivatives

AS 30 describes embedded derivative as a component of a hybrid (combined) instrument that also includes a non-derivative host contract – with the effect that some of the cash flows of the combined instrument vary in a way similar to a stand-alone derivative. An embedded derivative causes some or all of the cash flows that otherwise would be required by the contract to be modified according to a specified interest rate, financial instrument price, commodity price, foreign exchange rate, index of prices or rates, credit rating or credit index, or other variable, provided in the case of a non-financial variable that the variable is not specific to a party to the contract.

The hybrid contract is the entire contract, within which there may be an embedded derivative. The host contract is the main body of the contract, excluding the embedded derivative. Company X holds a bond which is convertible into the equity shares of company Y. The hybrid contract is the convertible bond; the host contract is the bond asset, and the embedded derivative is the conversion option.

A derivative that is attached to a financial instrument but is contractually transferable independently of that instrument, or has a different counterparty from that instrument, is not an embedded derivative, but a separate financial instrument.

An embedded derivative should be separated from the host contract and accounted for as a derivative under this Standard if, and only if:

(a) The economic characteristics and risks of the embedded derivative are not closely related to the economic characteristics and risks of the host contract (see Appendix A paragraphs A50 and A53 of AS 30);

(b) A separate instrument with the same terms as the embedded derivative would meet the definition of a derivative; and

(c) The hybrid (combined) instrument is not measured at fair value with changes in fair value recognized in the statement of profit and loss (i.e., a derivative that is embedded in a financial asset or financial liability at fair value through profit or loss is not separated)

If an embedded derivative is separated, the host contract should be accounted for under this Standard if it is a financial instrument, and in accordance with other appropriate Standards if it is not a financial instrument. This Standard does not address whether an embedded derivative should be presented separately on the face of the financial statements.

Notwithstanding paragraph 10 of AS 30, if a contract contains one or more embedded derivatives, an entity may designate the entire hybrid (combined) contract as a financial asset or financial liability at fair value through profit or loss unless:

(a) The embedded derivative(s) does not significantly modify the cash flows that otherwise would be required by the contract: or

(b) It is clear with little or no analysis when a similar hybrid (combined) instrument is first considered that separation of the embedded derivative(s) is prohibited, such as a prepayment option embedded in a loan that permits the holder to prepay the loan for approximately its amortised cost.

Example

At the beginning of year 1, an enterprise issued 20,000 convertible debentures with face value Rs.100 per debenture at par. The debentures have six-year term. The interest at annual rate of 9% is paid half-yearly. The bondholders have an option to convert half of the face value of debentures into 2 ordinary shares at the end of year 3. The bondholders not exercising the conversion option will be repaid at par to the extent of Rs.50 per debenture at the end of year 3. The non-convertible portion will be repaid at 10% premium at the end of year 6. At the time of issue, the prevailing market interest rate for similar debt without conversion option was 10%. Compute value of embedded derivative.

Solution

Half – year	Cash Flow	DF[1]	PV[2]
	Rs. 000	(5%)	Rs.000
1-6	90	5.076	456.84
7 – 12	45	3.787	170.41
12	1,100	0.557	612.70
Value of host (liability component)			1,239.95
Value of embedded derivative (Equity component)			760.05
Issue proceeds			2,000.00

1. Discount factor

2. Present Values

The ICAI issued a reminder in Feb. 2008 that companies should endeavour to follow as quickly as possible the Accounting Standard (AS) 30: Financial Instruments: Recognition and Measurement. AS 30 prescribes detailed rules to account for derivatives in balance sheets. The clarification issued also ruled that companies not yet ready to comply with AS 30 must, in the interim, " mark-to-market (MTM) all outstanding derivative contracts on the balance sheet date". This is to be done as per AS 1: Disclosure of Accounting Policies, which requires companies to reveal in balance sheets known losses or liabilities they might suffer later. AS 1, which is binding on companies, is rooted in the conservative accounting style of prudence and seeks to keep stakeholders informed of the financial risks to companies even before the threats play out fully.

19.7 CASE STUDY

MNP Tyres Ltd. is a leading tyres company with more than 50% of sales representing exports to Dubai. The company is extensively making use of derivatives contracts for the purpose of hedging its exposure to various risks, mainly exchange risk and price risk of rubber. The specific derivatives contracts the company has taken during current financial year ending on 31.03.14 are:

(1) Forward currency contract in Australian dollar (A$) maturing in April to guard against the possible depreciation of Dinar amounting to A$ 4 million to be received from a dealer in Dubai.

(2) Forward contract in Eurocurrency maturing in May to guard against possible appreciation of Euro currency. The company has taken this contract to meet its commitment regarding Eurobonds amounting to • 5 million maturing in May.

(3) The company has also taken long position in May rubber futures market as insurance against the possible rise in market price of rubber.

Questions:

1. Does forward contract in A$ to hedge against depreciation of Dinar comes under the purview of IAS 39 as a derivative?
2. Does the forward contract in Euro currency come under the purview of IAS 39 as a derivative?
3. Is the rubber futures contract covered under IAS 39 as derivative?
4. Is there any possibility that definition of derivative under IAS 39 is likely to be different from the definition of derivative under FASB 133 in each of the above situations?
5. Explain the deficiencies of conventional accounting in reflecting true value of its assets and liabilities in view of fluctuations in the currency market as well as rubber market.
6. Is hedge accounting mandatory in each of the above situations?
7.. Write a note on the accounting entries of the above derivative transactions.
8. What problems are generally encountered in accounting for derivatives?

19.8 SUMMARY

The accounting treatment of derivatives is still in the process of evolution. Various accounting bodies, both at national and international level, particularly IASB, are busy developing suitable standards for fair valuation of complex derivative instruments.

Under Indian and International Accounting Standards, business firms are required to measure a derivative instrument at fair value, or mark-to-market (MTM) with changes in fair value or MTM to be recognized through the income statement.

Hedge accounting provides for eliminating mismatch between the derivative instrument which is measured at fair value, and the underlying asset which is typically valued a cost or an amortised cost basis, through one of three ways: (1) 'fair value hedge' (2) 'cash flow hedge' and (3) 'net investment hedge'.

AS 30, AS 31 and AS 32 are Indian accounting standards that correspond respectively to IAS 39, IAS 32 and IFRS 7. The ICAI has issued a reminder in Feb. 2008 that companies should endeavour to follow as quickly as possible the accounting standard (AS 30). AS 30 prescribes detailed rules to account for derivatives in balance sheets and it mandates the companies to carry the unrealized MTM gains to profit and loss statements. The new norms are a codification of the best international practices.

19.9 KEY WORDS

Hedge accg   Fair value hedge   Cash flow hedge   Investment hedge

19.10 SELF ASSESSMENT QUESTIONS AND PROBLEMS

1. Define the following terms:
   a) Fair value accounting
   b) Financial instrument
   c) Derivative
   d) Embedded derivative
2. What do you mean by hedge accounting? Discuss the important guiding standards on which the hedge accounting is done.
3. Define fair value hedge. When it is used?
4. Define cash flow hedge. When it is used?
5. Discuss the classification of financial instruments for accounting purposes.
6. What are the various issues relating to derivative financial instruments with respect to accounting?
7. Discuss the progress of accounting standards for derivatives in India.

19.11 REFERENCES

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UNIT – 20 : OTHER (WEATHER) DERIVATIVES

Structure :

20.0 Objectives

On reading this unit the learner should be able to :

- Understand the concept of Alternative Risk Transfer (ART) ,
- Grasp the basic features of energy derivatives,
- Comprehend the emergence of catastrophe derivatives , and
- Understand the scope and importance of carbon derivatives.

20.1 INTRODUCTION

Alternative Risk Transfer (ART) is a new concept that describes a range of solutions other than traditional insurance and reinsurance that can assist companies in the financial management of their businesses . The ART market is the "combined risk management marketplace for innovative insurance and capital market solutions", while Alternative Risk Transfer is "a product, channel or solution that transfers risk exposures between the insurance and capital markets to achieve stated risk management goals". As a result, ART is used to absorb the effects of a hard market or to manage complex risk exposures which are often uninsurable in the traditional insurance market. This unit introduces innovations in the capital market through ART instruments for managing weather related risks i,e ; energy, catastrophe and carbon risks.

20.2 ENERGY DERIVATIVE

An energy derivative is a derivative contract based on (derived from) an underlying energy asset, such as natural gas, crude oil, or electricity. Energy derivatives are exotic derivatives and include exchange-traded contracts such as futures and options, and over-the-counter (i.e., privately negotiated) derivatives such as forwards, swaps and options. Major players in the energy derivative markets include major trading houses, oil companies, utilities, and financial institutions.

Electricity derivatives are the popular energy derivatives traded today – both in organised and unorganized markets. Electricity spot prices are volatile due to the unique physical attributes of electricity such as non-storability, uncertain and inelastic demand and a steep supply function. Uncontrolled exposure to market price risks could lead to devastating consequences. For this reason market participants find the importance and necessity of risk management practices in competitive electricity market. Hedging of risk by a corporation should in principle be motivated by the goal of maximizing firm's value. Hedging achieves value enhancement by reducing the likelihood of financial distress and its ensuing costs. On the supply side, managing risk associated with long-term investment in generation and transmission requires methods and tools for planning under uncertainty and for asset valuation.

The plainest forms of electricity derivatives are forwards, futures and swaps. Being traded either on the exchanges or over the counters, these power contracts play the primary roles in offering future price discovery and price certainty to power generators .

Electricity forwards:

Electricity forward contracts represent the obligation to buy or sell a fixed amount of electricity at a pre-specified contract price, known as the forward price, at certain time in the future (called maturity or expiration time). In other words, electricity forwards are custom tailored supply contracts between a buyer and a seller, where the buyer is obligated to take power and the seller is obligated to supply. Electricity forwards differ from other financial and commodity forward contracts in that the underlying electricity is a different commodity at different times. The settlement price is usually calculated based on the average price of electricity over the delivery period at the maturity time T. Consider a forward contract for the on-peak electricity on day T. "On-peak electricity" refers to the electricity delivered over the daily peak-period, traditionally defined by the industry as 06:00 - 22:00. The daily "off-peak" period is the remaining hours of the day. In this case, the settlement price is obtained by averaging the 16 hourly prices from 06:00 to 22:00 on day T. Based on the delivery period during a day, electricity forwards can be categorized as forwards on on-peak electricity, off-peak electricity, or "around-the-clock" (24 hours per day) 6 electricity. As almost all electricity derivatives have such categorization based on the delivery time of a day, we will not repeat this point. Generators such as independent power producers (IPPs) are the natural sellers (or, shortside) of electricity forwards while utility companies often appear as the buyers (or, long-side). The maturity of an electricity forward contract ranges from hours to years although contracts with maturity beyond two years are not liquidly traded. Some electricity forwards are purely financial contracts, which are settled through financial payments based on certain market price index at maturity, while the rest are physical contracts as they are settled through physical delivery of underlying electricity. Electricity forwards with short maturity like one hour or one day are often physical contracts, traded in the physical electricity markets. Those with maturity of weeks or months can be either physical contracts or financial contracts and they are mostly traded through brokers or directly among market participants (namely, traded in the OTC markets). Electricity forward contracts are the primary instruments used in electricity price risk management.

Electricity futures:

First traded on the NYMEX in March 1996, electricity futures are highly standardized in contract specifications, trading locations, transaction requirements, and settlement procedures. The most notable difference between the specifications of electricity futures and those of forwards is the quantity of power to be delivered. The delivery quantity specified in electricity futures contracts is often significantly smaller than that in forward contracts. Electricity futures are exclusively traded on the organized exchanges while electricity forwards are usually traded over-the-counter in the form of bilateral transactions. This fact makes the futures prices more reflective of higher market consensus and transparency than the forward prices. The majority of electricity futures contracts are settled by financial payments rather than physical delivery, which lower the transaction costs. In addition, credit risks and monitoring costs in trading futures are much lower than those in trading forwards since exchanges implement strict margin requirements to ensure financial performance of all trading parties. The OTC transactions are vulnerable to financial non-performance due to counterparty defaults. The fact that the gains and losses of electricity futures are paid out daily on *mark-to -market* basis, as opposed to being cumulated and paid out in a lump sum at maturity time, as in trading forwards, also reduces the credit risks in futures trading. In summary, as compared to electricity forwards, the advantages of electricity futures lie in market consensus, price transparency, trading liquidity, and reduced transaction and monitoring costs while the limitations stem from the various basis risks associated with the rigidity in futures specification and the limited transaction quantities specified in the contracts.

Electricity swaps:

Electricity swaps are financial contracts that enable their holders to pay a fixed price for underlying electricity, regardless of the floating electricity price, or vise versa, over the contracted time period. They are typically established for a fixed quantity of power referenced to a variable spot price at either a generator's or a consumer's location. Electricity swaps are widely used in providing short- to medium-term price certainty up to a couple of years. They can be viewed as a strip of electricity forwards with multiple settlement dates and identical forward price for each settlement. These swaps are effective financial instruments for hedging the basis risk on the price difference between power prices at two different physical locations.

Electricity options:

An electricity option is a contract wherein the holder has a right to buy or sell a specified quantum of electricity at a specified rate on some future date.The emergence of the electricity wholesale markets and the dissemination of option pricing and risk management techniques have created electricity options not only based on the underlying price attribute (as in the case with plain vanilla electricity call and put options), but also other attributes like volume, delivery location and timing, quality, and fuel type. Basically, a counterpart of each financial option can be created in the domain of electricity options by replacing the underlying of a financial option with electricity.

20.3 CATASTROPHE DERIVATIVES (BONDS)

Catastrophe bonds (or **cat bonds**) are also known as Act of God bonds . Cat bonds came into existence due to the lack of capacity in the catastrophe reinsurance market. Although the catastrophe bond market is still relatively small compared with the traditional insurance and reinsurance markets, it is expected to continue to grow and exert an important check and balance upon pricing and underwriting practices in traditional insurance and reinsurance markets. Catastrophe bonds have become an increasingly important part of the loss financing market for insurance corporations. Cat bonds were first launched in 1994. Over 85% of these catastrophe-linked securities are sold in the US.

The catastrophe bonds are so structured that if a pre-specified event such as a hurricane occurs prior to the maturity of the bonds, then investors risk losing accrued interest and/or the principal value of the bonds. Specifically, a catastrophe bond offering is made through a special purpose reinsurer (SPR), an issuance vehicle that may be an insurance or a reinsurance company. The SPR provides reinsurance to a sponsoring insurance or reinsurance company and sells in particular notes to investors, passes the proceeds to the trustee for further reinvestment, and provides an indemnity contract to the issuing company. The return generated through reinvestment and the premium payment from the issuing company form the investor coupon that becomes due and payable on a periodic basis. The invested proceeds held in the trust account are used to repay principal at maturity. If a pre-specified catastrophic event occurs the trustee withholds interest and/or principal payments temporarily or permanently. Principal that otherwise would be returned to the investors is then used to fund the SPR's payments to the insurer. The investor's reward for taking catastrophe risk is a relatively high interest rate paid by the bonds. Since the issuing company will be exposed to losses on its underlying catastrophe risk but will not longer need to provide payments to investors, it has effectively used the capital markets investor base to hedge its risk. Catastrophe bonds serve an extremely useful role in their overall approach to manage natural catastrophe risk exposures and are therefore a constitute a basic ART instrument.They help to raise more equity capital by selling more company stock, they limit risks through the underwriting and asset management process, and they allow a reinsurance company to transfer a portion of its natural catastrophe exposures to the capital markets rather than retaining the exposure on its books of business or retroceding the risks to other reinsurers. Cat bonds have a moderating effect on reinsurance . Furthermore, these have emerged as a distinct asset class since cat bonds have presumably low or zero correlation with other currently traded assets and are therefore a promising instrument for portfolio management .

Investments in catastrophe risk indeed are proven to over-perform domestic bonds and returns on catastrophe bonds are proven to be less volatile than either stocks or bonds. However,catastrophe bonds are struggling with significantly high costs, especially compared to the costs of buying traditional reinsurance coverage. One of the costs associated with catastrophe bonds are the interest costs that insurers must pay to compensate investors for purchasing securities that involve a substantial risk of loss of principal. Administrative and transaction costs are cited as another reason for the relatively high costs associated with catastrophe bonds. Transaction costs include underwriting fees charged by investment banks, fees charged by modeling firms to develop models to predict the frequency and severity of the event that is covered by the security, fees charged by the rating agencies to assign a rating to the securities, and legal fees associated with preparing the provisions of the security and preparing disclosures for investors. Indeed, catastrophe bonds may be cost-competitive with traditional reinsurance for high-severity and low-probability risks, for retrocessional coverage, and for larger-sized transactions. Therefore it can be concluded that cat bond constitute a mixed bag.

Cat Bonds in India

GIC Re, the sole Indian reinsurer, has sought government's permission in 2014 for issuing cat bonds. GIC Re is attempting to establish itself as a bigger player in the international reinsurance business. It has been underwriting many global events in the past. For the company, it is a natural progression to launch what is popularly known as 'cat bonds'. The 'cat bond' market size is more than $20 billion. The bonds, popular in the US, are generally priced 200 basis points above the 10-year US treasury yield. The price offered on 'cat bonds' is higher than corporate bonds as they carry junk status and investors run the risk of losing their entire sum. GIC will raise funds for a particular catastrophic risk like either earthquake or a tsunami or a cyclone with the condition that if the event happens, there will be no payout of interest or principal. But if the event does not happen, investors will get a higher yield than in other top-rated bonds. GIC saw a claim of Rs2,000 crore in Uttarakhand floods. It has not announced last fiscal's result. In 2012-13, it had posted a profit of Rs2,345 crore against a loss of Rs2,469 crore in the previous year. GIC will be the first company to issue 'cat bonds' in India and is likely to benchmark them against the 10-year government securities. According to the Swiss Re Cat Bond Price Return Index, 'cat bonds' have returned 9.09 per cent in the nine months till September last. Large global reinsurance companies like Swiss Re sell 'cat bonds' to reinsure against catastrophes. Also, companies package various catastrophic risks and some even design products based on specific perils like storm, earthquake and flood.

20.4 CARBON CREDIT DERIVATIVES

A **carbon credit** is a generic term for any tradable certificate or permit representing the right to emit one tonne of carbon dioxide or the mass of another greenhouse gas with a carbon dioxide equivalent (tCO_2e) equivalent to one tonne of carbon dioxide. Carbon credits and carbon markets are a component of national and international attempts to mitigate the growth in concentrations of greenhouse gases (GHGs). One carbon credit is equal to one tonne of carbon dioxide, or in some markets, carbon dioxide equivalent gases. Carbon trading is an application of an emissions trading approach. Greenhouse gas emissions are capped and then markets are used to allocate the emissions among the group of regulated sources.

The goal is to allow market mechanisms to drive industrial and commercial processes in the direction of low emissions or less carbon intensive approaches than those used when there is no cost to emitting carbon dioxide and other GHGs into the atmosphere. Since GHG mitigation projects generate credits, this approach can be used to finance carbon reduction schemes between trading partners and around the world.

Carbon Credits Trading or Emission Trading refers to trading in Greenhouse gas emission certificates within the legal framework. It is a market-based scheme for environmental improvement that allows parties to buy and sell permits for emissions or credits for reductions. Emissions trading allow established emission goals to be met in the most cost-effective way by letting the market determine the lowest-cost pollution abatement opportunities. Under such schemes, the environmental regulator first determines the total acceptable emissions and then divides this total into tradable units (often referred to as credits or permits). These units are then allocated to scheme participants with dual purpose while allowing the flexibility to meet their emission targets according to their own strategy. Participants who emit pollutants must obtain sufficient tradable units to compensate for their emissions Participants who reduce emissions may have surplus units that they can sell to others, who find emission reduction more expensive or difficult . Emissions trading schemes were first developed in the 1960s and 1970s in the United States, motivated partly by dissatisfaction with the cost of the regulatory approaches to pollution control, they were first used to price, with a view to reduce nitrogen and sulphur oxides (NOx and SOx) emissions in the United States electricity industry. The Kyoto Protocol is an amendment to the international treaty of United Nations Framework Convention on Climate Changes (UNFCCC) which is a legally binding agreement under which more than 169 industrialized countries have agreed to reduce greenhouse gas emissions to a level of 5.4% by 2012 keeping 1990 as the base. The objective of the protocol is the "stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system. Under this protocol, about 38 industrialized countries and the European Union forms a part of Annex-1 list, the remaining are part of Non–Annex 1 list of countries.

Carbon Market is the outcome of the Kyoto Protocol for controlling greenhouse gas emissions. Green house gases are emitted mainly by burning oil, gas, and coal that are resulting in perilous climate change. Each carbon credit represents one ton of carbon dioxide either removed from the atmosphere or saved from being emitted. Countries buy and sell green house gas emission in the form of "Units" and "Credits". Credits issued for emission reductions or removals achieved by a project under the clean development mechanism (CDM) involving certification requirements. The certification requirements are as follows: Base line to be drawn up – a scenario in which one provides supporting evidence about the emission of greenhouse gases till 2012 without investment and compare this baseline with lower emission that will be achieved through investment. A validation or certification organization, acting as an independent third party validates the baseline. This organization works according to the "Accreditation Guidelines for the Validation and Verification of Joint Implementation (JI) projects" or according to the guidelines of the UNFCCC Executive Board accreditation Panel for Clean Development Mechanism (CDM) projects. The host country's government must provide approval for the transaction in carbon credits through a Letter of Approval. However, even if there is an MoU with the country in which one wants to invest, this letter has to be obtained from the country's government.

Simple transactions account only for a very small percentage of the carbon market today. The carbon market has moved away from its beginnings, where carbon trading was about a simple trade between two parties: one needing a permit or offset credit for compliance, and the other having one to spare. At financial conferences, carbon is now being marketed as a new asset class for investors such as pension funds. The carbon market has grown into a 'matured' market.As a consequence, the nature of the trading has changed significantly.

Market for Carbon Credits

Both OTC traders and organised exchanges trade in carbon derivatives such as carbon forwards (OTC), carbon futures (exchanges) or carbon swaps. They can also both trade in offset credits or emission permits directly. In 2009, 53 per cent of all European Union Emission Trading System (EUETS) trading took place over the counter, while the remaining

47 per cent was made on exchanges. Some 85 per cent of exchange trades were made through the European Climate Exchange (ECX) in 2009. Other active exchanges include Bluenext, the Chicago Climate Exchange (CCX), Climex, EEX, EXAA, Green Exchange, GME/PEX, MCX and Norpool. In the OTC offset market, purchases are typically arranged through an Emission Reduction Purchase Agreements (ERPA). These can take a variety of forms, but usually stipulate the price of the reductions, the volumes expected, and delivery schedule. Most trading in CDM carbon offset credits occurs on the OTC markets (71 per cent by value or US$ 7.1 billion in 2008). Trading in secondary offset credits (i.e. credits generally purchased from a financial institution or other entity that has previously purchased the credits directly from the carbon project owner) more than doubled between the first three quarters of 2007 (US$ 4 billion) and the same period in 2008 (US$ 10 billion). The primary CDM offset market, where offset credits are purchased directly from project developers, by contrast, decreased by more than half from 2008 to 2009 (see table below). The secondary market for offset credits has continued to grow exponentially.

Options represent a small but growing percentage of carbon market activity, although there may be OTC trading of options not reported. A market for options on CDM offset credits started to emerge in the second half of 2008, with hedging, profit-taking, raising cash and arbitrage (the simultaneous purchase and sale of an asset in order to profit from price differences on different markets or in different forms) as the main drivers. In 2009, $ 91.1million worth of options for CDM offset credits were traded against $ 67.8 million in 2008, a rise of 34 per cent.The first full year of options trading in EUETS allowances was 2009. Continuing global financial uncertainty and reduced access to cheap lending are cited as additional factors for the continued growth of options trading in ETS permits; options can provide a source of financing when other alternative financing is not available or more expensive. This is another example of how EUETS permits become an asset with a value beyond the original objective of the asset: companies covered by the EUETS, and who received free allowances, thereby gain an extra financial advantage over other industry sectors like the renewable energy or energy efficiency industries that do not have these alternative ways of accessing capital.

Innovations in Carbon Market

The carbon market is expanding, powered by innovation. In November 2008, Credit Suisse, in a joint venture with EcoSecurities, was the first bank to launch a 'carbon structured product'. It bundled together carbon credits from 25 different offset projects that were at various stages of CDM approval, were located in three countries, and had been developed by five project developers. The package of project credits was then split into three tranches representing different risk levels. This arrangement allows investors to choose the level of risk they would like to take on. Although the Credit Suisse deal was relatively small, future deals could become bigger and more complex, bundling carbon credits from many more projects of mixed types and origins, perhaps combined with agreements to swap more risky carbon credits for safer assets such as EUETS allowances as 'insurance' against 'junk' carbon. By diluting (or hiding) risk, this bundling would help make dubious offset projects more acceptable to buyers. The World Bank's Prototype Carbon Fund (PCF) has already performed a similar service, by bundling controversial projects such as the Plantar tree plantation project in Brazil together with less controversial projects. The problem is that it is just as difficult to analyse the quality of the individual underlying carbon offset projects as it was to analyse the quality of the US sub-prime mortgages whose 'bundling' in structured financial products nearly brought down the world economy. Trading in complicated carbon derivatives poses a threat to economic as well as climatic stability. In another development reflecting the expanding economic role and exchangeability of carbon commodities, in September 2009 companies covered by the EUETS began moving toward using their surplus European Union Allowances (EUAs) as collateral when trading oil. ICE Clear Europe for example, the clearing-house for the Intercontinental Exchange (ICE), has started to accept both EUETS allowances and CDM offset credits as partial payment of margin fees in the trade of energy contracts.

Carbon Offsets

The World Resources Institute defines a carbon offset as "a unit of carbon dioxide-equivalent (CO_2e) that is reduced, avoided, or sequestered to compensate for emissions occurring elsewhere". The Collins English Dictionary defines a carbon offset as "a compensatory measure made by an individual or company for carbon emissions, usually through sponsoring activities or projects which increase carbon dioxide absorption, such as tree planting". Offsets are typically achieved through financial support of projects that reduce the emission of greenhouse gases in the short- or long-term. The most common project type is renewable energy, such as wind farms, biomass energy, or hydroelectric dams. Others include energy efficiency projects, the destruction of industrial pollutants or agricultural byproducts, destruction of landfill methane, and forestry projects.[11] Some of the most popular carbon offset projects from a corporate perspective are energy efficiency and wind turbine projects.

Sources of carbon offsets :

The CDM identifies over 200 types of projects suitable for generating carbon offsets, which are grouped into broad categories like renewable energy, afforestation, etc. Renewable energy offsets commonly include wind power, solar power, hydroelectric power and biofuel.

Some of these offsets are used to reduce the cost differential between renewable and conventional energy production, increasing the commercial viability of a choice to use renewable energy sources.

Indian Scenario

India now has two Commodity exchanges trading in Carbon Credits. With the initiative of Multi Commodity Exchange (MCX), India's largest commodity exchange,of launching futures trading in carbon credits, it has become Asia's first-ever commodity exchange and among the select few along with the Chicago Climate Exchange (CCE) and the European Climate Exchange to offer trades in carbon credits. The Indian exchange also expects its tie-up with CCX which will enable Indian firms to get better prices for their carbon credits and better integrate the Indian market with the global markets to foster best practices in emissions trading. From April 2008 National Commodity and Derivatives Exchange (NCDEX) also has started futures contract in Carbon Trading for delivery in December 2008.The Indian government has not fixed any norms nor has it made it compulsory to reduce carbon emissions to a certain level. So, buyers of carbon credit, who are actually financial investors, anticipate an increase in the demand of carbon credits by 2009, 2010 or 2012 which will result in huge profits. So investors are willing to buy now to sell later. There is a huge requirement of carbon credits in Europe before 2012. Only those Indian companies that meet the UNFCCC norms and take up new technologies will be entitled to sell carbon credits. There are parameters set and detailed audit is done before you get the entitlement to sell the credit. This means that Indian Companies can now get a better trading platform and price for CERs generated. Carbon Credits projects requires huge capital investment. Realizing the importance of carbon credits in India, The World Bank has entered into an agreement with Infrastructure Development Finance Company (IDFC), wherein IDFC will handle carbon finance operations in the country for various carbon finance facilities. The agreement initially earmarks a \$10-million aid in World Bank-managed carbon finance to IDFC-financed projects that meet all the required eligibility and due diligence standards. IDBI has set up a dedicated Carbon Credit desk, which provides all the services in the area of Clean Development Mechanism/Carbon Credit (CDM). In order to achieve this objective, IDBI has entered into formal arrangements with multi-lateral agencies and buyers of carbon credits like IFC, Washington, KfW, Germany and Sumitomo Corporation, Japan and reputed domestic technical experts like MITCON. HDFC Bank has signed an agreement with Cantor CO2E India Pvt. Ltd. and MITCON Consultancy Services Limited (MITCON) for providing carbon credit services. As part of the agreement, HDFC Bank will work with the two companies on awareness building, identifying and registering Clean Development Mechanism (CDM) and facilitating the buy or sell of carbon credits in the global market.

20.5 CASE STUDY

Carbon offset schemes allow individuals and companies to invest in environmental projects around the world in order to balance out their own carbon footprints. The projects are usually based in developing countries and most commonly are designed to reduce future emissions. This might involve rolling out clean energy technologies or purchasing and ripping up carbon credits from an emissions trading scheme. Other schemes work by soaking up CO_2 directly from the air through the planting of trees.

Some people and organisations offset their entire carbon footprint while others aim to neutralise the impact of a specific activity, such as taking a flight. To do this, the holidaymaker or business person visits an offset website, uses the online tools to calculate the emissions of their trip, and then pays the offset company to reduce emissions elsewhere in the world by the same amount – thus making the flight "carbon neutral".

Offset schemes vary widely in terms of the cost, though a fairly typical fee would be around £8/$12 for each tonne of CO_2 offset. At this price, a typical British family would pay around £45 to neutralise a year's worth of gas and electricity use, while a return flight from London to San Francisco would clock in at around £20 per ticket.

Increasingly, many products are also available with carbon neutrality included as part of the price. These range from books about environmental topics through to high-emission cars (new Land Rovers include offsets for the production of the vehicle and the first 45,000 miles of use).

Over the past decade, carbon offsetting has become increasingly popular, but it has also become – for a mixed reasons – increasingly controversial.Traditionally, much of the criticism of offsetting relates to the planting of trees. Some of these concerns are valid, but in truth most of the best-known carbon offset schemes have long-since switched from tree planting to clean-energy projects – anything from distributing efficient cooking stoves through to capturing methane gas at landfill sites. Energy-based projects such as these are designed to make quicker and more permanent savings than planting trees, and, as a bonus, to offer social benefits. Efficient cooking stoves, for instance, can help poor families save money on fuel and improve their household air quality – a very real benefit in many developing countries. Even in the case of energy-based schemes, however, many people argue that offsetting is unhelpful – or even counterproductive – in the fight against climate change. For example, writer George Monbiot famously compared carbon offsets with the ancient Catholic Church's practice of selling indulgences: absolution from sins and reduced time in purgatory in return for financial donations to the church. Just as indulgences allowed the rich to feel better about sinful behaviour without actually changing their ways, carbon offsets allow us to "buy complacency, political apathy and self-satisfaction", Monbiot claimed. "Our guilty consciences appeased, we continue to fill up our SUVs and fly round the world without the least concern about our impact on the planet … it's like pushing the food around on your plate to create the impression that you have eaten it.

Questions

1. Do Carbon offset schemes help present or future generation?
2. What is the range of products available for achieving carbon neutrality?
3. Is the whole concept of offsetting a scam?
4. " A carbon offset scheme just allows companies to indulge and feel better about sinful behaviour without actually changing their ways" . Do you agree ?

20.6 SUMMARY

Innovations in the capital market through ART instruments for managing weather related risks i,e ; energy, catastrophe and carbon risks has opened a new chapter in risk management. An energy derivative is a derivative contract based on (derived from) an underlying energy asset, such as natural gas, crude oil, or electricity. Energy derivatives are exotic derivatives and include exchange-traded contracts such as futures and options, and over-the-counter (i.e., privately negotiated) derivatives such as forwards, swaps and options. Major players in the energy derivative markets include major trading houses, oil companies, utilities, and financial institutions.

Catastrophe bonds (or **cat bonds**) are also known as Act of God bonds . Cat bonds came into existence due to the lack of capacity in the catastrophe reinsurance market. Although the catastrophe bond market is still relatively small compared with the traditional insurance and reinsurance markets, it is expected to continue to grow and exert an important check and balance upon pricing and underwriting practices in traditional insurance and reinsurance markets. Catastrophe bonds have become an increasingly important part of the loss financing market for insurance corporations. Cat bonds were first launched in 1994. Over 85% of these catastrophe-linked securities are sold in the US.

A carbon credit is a generic term for any tradable certificate or permit representing the right to emit one tonne of carbon dioxide or the mass of another greenhouse gas with a carbon dioxide equivalent (tCO_2e) equivalent to one tonne of carbon dioxide. Carbon credits and carbon markets are a component of national and international attempts to mitigate the growth in concentrations of greenhouse gases (GHGs). One carbon credit is equal to one tonne of carbon dioxide, or in some markets, carbon dioxide equivalent gases. Carbon trading is an application of an emissions trading approach. Greenhouse gas emissions are capped and then markets are used to allocate the emissions among the group of regulated sources.

20.7 KEY WORDS

Alternative Risk Transfer (ART) Energy derivative Catastrophe bonds Carbon credits Carbon offsets

20.8 SELF ASSESSMENT QUESTIONS

1. Define the concept of 'alternative risk transfer'.

2. What are energy derivatives? Why are they needed?

3. Briefly explain the evolution of electricity derivatives.

4. What are the different types of electricity derivatives traded?

5. What are cat bonds?

6. Discuss the merits and limitations of cat bonds.

7. What is the status of cat bonds in India ?

8. Define the concept of 'carbon credit'.

9. Discuss the market for carbon credits.

10. What are carbon offsets?

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