UNIVERSITY OF CALICUT

SCHOOL OF DISTANCE EDUCATION

M.COM

(IV SEMESTER)

FINANCIAL DERIVATIVES AND RISK MANAGEMENT

2036

2015 ADMISSION ONWARDS

CUP 1221I/17/3050 - 2036 - SDE — 1

MASTER OF COMMERCE

STUDY MATERIAL

IV SEMESTER

FINANCIAL DERIVATIVES AND RISK MANAGEMENT

(2015 Admn. Onwards)

UNIVERSITY OF CALICUT

SCHOOL OF DISTANCE EDUCATION

Calicut University, P.O. Malappuram, Kerala, India-673 635

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Master of Commerce

Study material

IV SEMESTER

FINANCIAL DERIVATIVES AND RISK MANAGEMENT

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Layout:

Computer Section, SDE

80 Hours **Marks: 80**

Course Objectives:

1. To make the students efficient in the area of derivatives, by giving them the knowledge of basics in options, futures, swaps etc.

Module 1: Introduction to risk management – Meaning and need – importance – Types of market risk – Risk management issues in business – Financial derivatives – Meaning – Need – Growth of financial derivatives markets in India – Derivative markets – Exchange traded financial derivatives for risk management in India – Participants – Functions – Types of risk management instruments – Forwards – Futures – Options – Swaps – The regulatory framework of derivative trading in India. **16 hours**

Module 2: Future's growth and development t- Difference between forwards and futures - financial future - Future trading – currency futures – Interest rate futures Pricing and valuation – of future contacts – Value at risk-Hedging risk – Hedging with stock index future – types of members and margin system in India-Future trading in stock exchange for risk management. **20 hours**

Module 3: Options – meaning – needs and importance-options and futures-fundamental option strategies-type of option-put-call-trading strategies of risk instruments-positions in options-stock indices-options in Indian stock market. **16 hours**

Module 4 : Risk pricing of options-intrinsic value and time value-pricing at the expiry of contact-factors affecting option pricing-put-call-parity pricing-models of pricing-binomial option-pricing models-Black Schole's pricing methods. **16 hours**

Module 5: Swaps-meaning and definition-development-structure of swap dealing for risk management-interest rate swaps-forward swaps and swap option contractscancellable
and extendable swaps-no generic swaps transactions. Currency swaps -
Valuation and pricing of swaps - risk management function of swap transaction. **12 hours**

(Only theory, No problems expected)

UNIT-1

RISK MANAGEMENT

Introduction

We live in increasingly interesting and risky times. It is going to become more complex and risky in the future. Corporations (and all of us as leaders or managers) must adapt to this increasingly peculiar environment to survive potentially large risks. When people think of large risks confronting corporations they are used to thinking in terms of natural hazards such as hurricanes, earthquakes, floods or tornados, or even man-made disaster such as the terrorists attacks, the British Petroleum gulf oil spill, internet security breaches causing huge financial losses, the Tokyo earthquake (natural) and resulting nuclear disaster (man-made), or sometimes products liability lawsuits with attached punitive damages. People often overlook man made financial disasters which could be even more devastating globally, such as the credit crisis happened in 2008-2009. This disaster is already considered the worst global financial calamity ever with unprecedented world-wide consequences that have hit country after country and company after company.

Definition of the term

1. A probability or threat of damage, injury, liability, loss, or any other negative occurrence that is caused by external or internal vulnerabilities, and that may be avoided through pre emptive action.

2. Finance: The probability that an actual return on an investment will be lower than the expected return. Financial risk is divided into the following categories: Basic risk, Capital risk, Country risk, Default risk, Delivery risk, Economic risk, Exchange rate risk, Interest rate risk, Liquidity risk, Operations risk, Payment system risk, Political risk, Refinancing risk, Reinvestment risk, Settlement risk, Sovereign risk, and Underwriting risk.

3. Food industry: The possibility that due to a certain hazard in food there will be a negative effect to a certain magnitude.

4. Insurance: A situation where the probability of a variable (such as burning down of a building) is known but when a mode of occurrence or the actual value of the occurrence (whether the fire will occur at a particular property) is not. A risk is not an uncertainty (where neither the probability nor the mode of occurrence is known), a peril (cause of loss), or a hazard (something that makes the occurrence of a peril more likely or more severe).

5. Securities trading: The probability of a loss or drop in value. Trading risk is divided into two general categories: (1) Systemic risk affects all securities in the same class and is linked to the overall capital-market system and therefore cannot be eliminated by diversification. (2) Non systematic risk is any risk that isn't market-related or is not systemic. Also called non market risk, extra-market risk, or un systemic risk.

'Risk is a condition in which there exists a quantifiable dispersion in the possible outcomes from any activity. It can be classified in a number of ways.'

Risk has also been defined as: 'Uncertain future events which could influence the achievement of the organisation's strategic, operational and financial objectives'- International Federation of Accountants, 2009.

Risk management is: 'A process of understanding and managing the risks that the entity is inevitably subject to in attempting to achieve its corporate objectives. For management purposes, risks are usually divided into categories such as operational, financial, legal compliance, information and personnel. One example of an integrated solution to risk management is enterprise risk management.'- CIMA Official Terminology, 2015.

Importance of Risk Management

A basic lack of corporate and governmental risk management were at the heart of the global credit crisis. Probably no other risk-related event has had, and will continue to have, as profound an impact world wide as this risk management failure (and this includes the terrorist attacks many parts of the world, hurricane Katrina and the BP oil spill). The ramifications of risk management failures can potentially change the very structure of American government, and possibly governments and corporations throughout the world. Not understanding risks and how to mitigate them is simply no longer an option. How was risk in this situation so badly managed? What could firms and individuals have done to protect themselves from the consequences of this risk taking? How can government measure (beforehand) such risks in order to regulate and control them? These and other questions come immediately to mind when one contemplates the fateful consequences of this failure in risk management.

These will be among the topics of this book. From a corporate perspective, one can expect the cost of risk management to rise even further with increasing corporate responsibility for products liability, employment liability, directors and officers' liability, and health care costs for their employees. The actuarial studies unit of the Health Care Financing Administration states that overall health care costs will

increase at more than double the rate of inflation for the next five to seven years, so considerations of employee benefits can be expected to influence top level CEO/CFO decision making even more in the future. General Motors, for example, has an annual $2.8 Billion liability in health and pension benefits for their retired and active workers, which adds over $1500 to the cost of each automobile sold. The effect of the Obama nationalized health care plan will also change corporate risk profiles and competitiveness.

Supply chain risk management is getting increasing attention as well, since companies now often don't keep big stockpiles of parts the way they did two decades ago. Instead, to hold down warehouse and inventory costs, they rely on a "just in time" system in which parts are delivered just days or hours ahead of when they are needed. This, of course, makes their financial viability vulnerable to supply chain disruptions. We shall consider issues related to supply chain risk management particularly in this book. Increasingly there has been recognition of the enterprise wide nature of risk management and the realization that there should be a coordinated and integrated approach to handling risks of the corporation which entails a holistic view of risk and its management in a framework which views risk management as a value enhancing strategic process and goal of the corporation. It was just one division of the giant AIG Corporation (the financial products division) which brought down the entire giant company, a previously unthinkable event. Just as the Markowitz approach to portfolio theory revolutionized investment conceptualization in finance by considering the correlation of assets and the market, so too has the "portfolio" paradigm towards risk revolutionized the field of risk management for corporations.

We are currently are the forefront of this revolution, but the unfolding financial crisis will fasten this process. Such an approach is currently being introduced into the corporate governance structure and is known as enterprise risk management. This enterprise risk approach is in contrast to the old (now dramatically failed) model of handling risks in a silo approach, wherein the finance department handled the financial risks, the marketing department handled the marketing risks, the insurance and risk management group handled the physical risks, the legal department handled the liability risks, etc. The global, holistic, or integrated management of risk for an enterprise will be a major focus of this class, as well as the detailed examination of the more traditional areas of corporate risk (e.g., products liability, product recalls and reputation risk, financial hedging of risk, employee liability risk, etc.). We shall apply ERM techniques to supply chain risk management as a particular example. This

approach is encapsulated in the advice from Peter Cox, Chief Financial Officer of United Grain Growers (UGG) of Canada in the statement "Don't try to operate your business risk free. Just tip the scale to your advantage, so risk management becomes strategic rather than just defensive."

After a quick overview of the risk management process, this text will cover the various primary aspects of risk faced by corporations and the alternative methods (traditional and non traditional) available to them for managing these risks. These risks will include managing the usual physical risks of property damage and loss, but also will include liability costs and management, crisis management, and communication with the public in times of crisis to mitigate risk to brand value. Each of these risks will be also considered in a supply chain context. We shall take the stance throughout of integrating risk assessment through the evolving perspective of enterprise risk management for understanding the next wave of risk management. An important aspect of managing risk is the identification and choice of mitigation techniques to use.

The Risk Management Process

Risk Management is "the systematic application of management policies, procedures and practices to the tasks of establishing the context, identifying, analysing, assessing, treating, monitoring and communicating" .It is an iterative process that, with each cycle, can contribute progressively to organisational improvement by providing management with a greater insight into risks and their impact. Risk management should be applied to all levels of the University, in both the strategic and operational contexts, to specific projects, decisions and recognised risk areas. Risk is 'the chance of something happening that will have an impact on objectives'. It is, therefore, important to understand the objectives of the University, work unit, project or your position, prior to attempting to analyse the risks.

Risk analysis is often best done in a group with each member of the group having a good understanding of the objectives being considered.

1. **Identify the Risks:** What might inhibit the ability to meet objectives? E.g. loss of a key team member; prolonged IT network outage; delayed provision of important information by another work unit/individual; failure to seize a commercial opportunity, etc.Consider also things that might enhance the ability to meet objectives e.g. a fund-raising commercial opportunity.
2. **Identify the Causes:** What might cause these things to occur e.g. the key team member might be disillusioned with their position, might be head hunted to go

elsewhere; the person upon whom you are relying for information might be very busy, going on leave or notoriously slow in supplying such data; the supervisor required to approve the commercial undertaking might be risk averse and need extra convincing before taking the risk, etc.

3. **Identify the Controls**: Identify all the things (Controls) that you have in place that are aimed at reducing the Likelihood of your risks from happening in the first place and, if they do happen, what you have in place to reduce their impact (Consequence). Examples include: providing a friendly work environment for your team; multi-skilling across the team to reduce the reliance on one person; stressing the need for the required information to be supplied in a timely manner; sending a reminder before the deadline; and provide additional information to the supervisor before he/she asks for it, etc.
4. **Establish your Likelihood and Consequence Descriptors:** The likelihood descriptors are fairly generic however the consequence descriptors may depend upon the context of your analysis. I.e. if your analysis relates to your work unit, any financial loss or loss of a key staff member (for example) will have a greater impact on that work unit than it will have on the University as a whole so those descriptors used for the whole-of-University (strategic) context will generally not be appropriate for the Faculty, other work unit or the individual. The idea is analogous to how a loss of $300,000 would have less impact on the University than it would for an individual work unit. You will need to establish these parameters in consultation with the head of the work unit.
5. **Establish your Risk Rating Descriptors:** I.e. what is meant by a Low, Moderate, High or Extreme Risk needs to be decided upon from the outset.
6. **Add Other Controls:** Generally, any risk rated High or Extreme should have additional controls applied to it to reduce the rating to an acceptable level. What the additional controls might be, whether they are affordable, what priority might be placed on them etc is something for the group to determine in consultation with the Head of the work unit.
7. **Make a Decision:** Once the above process is complete, if there are still some risks that are rated as High or Extreme, a decision has to be made as to whether the activity will go ahead. Sometimes risks are higher than preferred but there may be nothing more that can be done to mitigate the risk i.e. they are out of the control of the work unit but the activity must still be carried out. In such situations, monitoring and regular review is essential.

8. **Monitor and Review:** Monitoring of all risks and regular review of the risk profile is a key part of effective risk management.

Types of Risks

Risk is of paramount importance to organisations. Businesses must identify, evaluate, manage and report many types of risk for improved external decision making. Risk can be classified in a number of ways. Here it is classified according to the CIMA Official Terminology. Business or operational: relating to activities carried out within an entity, arising from structure, systems, people, products or processes. Country: associated with undertaking transactions with, or holding assets in, a particular country. Risk might be political, economic or stem from regulatory instability. The latter might be caused by overseas taxation, repatriation of profits, nationalisation or currency instability.

Environmental: these risks may occur due to political, economic, socio-cultural, technological, environmental and legal changes.

Reputational: this is damage to an entity's reputation as a result of failure to manage other risks.

Strategic: these are risks stemming from the entity's strategy and pose the greatest threat to the achievement of the strategy.

Financial: relating to the financial operations of an entity and includes:

- Credit risk: a loss may occur from the failure of another party to perform according to the terms of a contract.
- Currency risk: the value of a financial instrument could fluctuate due to changes in foreign exchange rates (IAS 32).
- Interest rate risk: interest rate changes could affect the financial well being of an entity.
- Liquidity (or funding) risk: an entity may encounter difficulty in realising assets or otherwise raising funds to meet financial commitments.
- Market risk: Market risk refers to the sensitivity of an asset or portfolio to overall market price movements such as interest rates, inflation, equities, currency and property.

UNIT 2

MARKET RISK

The different types of risks associated with derivative instruments are as follows:

- Credit Risk: These are the usual risks associated with counterparty default and which must be assessed as part of any financial transaction. However, in India the two major stock exchanges that offer equity derivative products have Settlement / Trade Guarantee Funds that address this risk
- Market Risk: These are associated with all market variables that may affect the value of the contract, for e.g. A change in price of the underlying instrument.
- Operational Risk: These are the risks associated with the general course of business operations. It includes
  - Settlement Risk arises as a result of the timing differences between when an institution either pays out funds or deliverables assets before receiving assets or payments from a counterparty and it occurs at a specific point in the life of the contract.
  - Legal Risk arises when a contract is not legally enforceable, reason being the different laws that may be applicable in different jurisdictions - relevant in case of cross border trades.
  - Deficiencies in information, monitoring and control systems, which result in fraud, human error, system failures, management failures etc. Famous examples of these risks are the Nick Lesson case, Barings' losses in derivatives, Society General's debacle etc.
  - Strategic Risk: These risks arise from activities such as: Entrepreneurial behavior of traders in financial institutions
    - Misreading client requests
    - Costs getting out of control
    - Trading with inappropriate counterparties
- Systemic Risk: This risk manifests itself when there is a large and complex organization of financial positions in the economy. "Systemic risk" is said to arise when the failure of one big player or of one clearing corporation somehow puts all other clearing corporations in the economy at risk. At the simplest, suppose that an index arbitrageur is long the index on one exchange and short the futures on another exchange. Such a position generates a mechanism for transmission of failure - the failure of one of the exchanges could possibly influence the other. Systemic risk also appears when very large

positions are taken on the OTC derivatives market by any one player. Neither of these scenarios is in the offing in India. Hence it is hard to visualize how exchange traded derivatives could generate systemic risk in India.

Market risk

Market risk refers to the sensitivity of an asset or portfolio to overall market price movements such as interest rates, inflation, equities, currency and property. Pension funds are heavily exposed to interest and inflation rate risks as these determine the present value of the scheme's liabilities; typically these risks are referred to as 'unrewarded' risks as these are intrinsic to the liabilities. While market risk cannot be completely removed by diversification, it can be reduced by hedging. The use of interest and inflation rate swaps can produce offsetting positions whereby the risks are hedged.

Market risk is the possibility for an investor to experience losses due to factors that affect the overall performance of the financial markets in which he is involved. Market risk, also called "systematic risk," cannot be eliminated through diversification, though it can be hedged against. Sources of market risk include recessions, political turmoil, changes in interest rates, natural disasters and terrorist attacks.

Types of market risk

Under these categories are different classifications that involve unique aspects of financial markets. The most common types of market risks include interest rate risk, equity risk, currency risk and commodity risk, inflation risk,. Depending on the nature of the investment, relevant market risks may involve international as well as domestic factors. Key market risks to be aware of include:

Interest Rate Risk: It relates to the risk of reduction in the value of a security due to changes in interest rates. Interest rate changes directly affect bonds—as interest rates rise, the price of a previously issued bond falls; conversely, when interest rates fall, bond prices increase. The rationale is that a bond is a promise of a future stream of payments; an investor will offer less for a bond that pays-out at a rate lower than the rates offered in the current market. The opposite also is true. An investor will pay a premium for a bond that pays interest at a rate higher than those offered in the current market. It covers the volatility that happens with changing interest rates due to fundamental factors, such as Libor and other central bank announcements related to changes in monetary policies. Equity risk is the risk involved in the changing stock prices. An investor is exposed to currency risk if he is holding particular currencies facing volatile movements, because of fundamental factors such as interest rate changes or unemployment claims. Commodity risk covers the changing prices of

commodities such as crude oil and corn. Market risk exists because of price changes. The standard deviation of changes in prices of stocks, currencies or commodities is referred to as price volatility. Volatility is rated in annualized terms. It may be expressed as an absolute number, such as $10, or a percentage of the initial value, such as 10%. To measure market risk, investors and analysts use the value at risk method. The value at risk method is a well known and established risk management method, but it comes with some assumptions that limit its correctness. For example, it assumes that the makeup and content of the portfolio being measured is unchanged over a provided period. Though this may be acceptable for short-term horizons, it may provide less accurate measurements for long-term horizons of investments, because it is more exposed to changes in interest rates and monetary policies. Interest rate risk is the risk that the value of a security will fall as a result of increase in interest rates. However, in complex portfolios, many different types of exposures can arise.

Equity Risk:

Equity price risk refers to the risk arising from the volatility in the stock prices. While talking about equity risk, it is important to differentiate between systematic risk and unsystematic risk. Systematic risk refers to the risk due to general market factors and affects the entire industry. It cannot be diversified away. Unsystematic risk is the risk specific to a company that arises due to the company specific characteristics. According to portfolio theory, this risk can be eliminated through diversification.

Currency Risk:

Foreign exchange risk arises because of the fluctuations in the currency exchange rates. Companies may be exposed to the foreign exchange risk in their normal course of business because of the un hedged positions or because on imperfect hedges. **Currency Risk** comes into play if money needs to be converted to a different currency to purchase or sell an investment. In such instances, any change in the exchange rate between that currency and U.S. dollars can increase or reduce your investment return. This risk usually only impacts you if you invest in stocks or bonds issued by companies based outside India or funds that invest in international securities

Commodity Price Risk:

Commodity Price Risk refers to the risk of unexpected changes in a commodity price, such as the price of oil. These commodities may be grains, metals, gas, electricity etc. Commodity risk affects various sections of people:

- Producers (Farmers, plantation companies, and mining companies)
- Buyers (Cooperatives, commercial traders, etc)
- Exporters
- Governments

Most investors know that investing involves risks as well as rewards and that, generally speaking, the higher the risk, the greater the potential reward. While it is important to consider the risks in the context of a specific investment or asset class, it is equally critical that investors consider market risk.

Inflation Risk: It is the risk that general increases in prices of goods and services will reduce the value of money, and likely negatively impact the value of investments. Inflation reduces the purchasing power of money and therefore has a negative impact on investments by reducing their value. This risk is also referred to as Purchasing Power Risk. Inflation and Interest Rate risks are closely related as interest rates generally go up with inflation. To keep pace with inflation and compensate for loss of purchasing power, lenders will demand increased interest rates. However, you should note that inflation can be cyclical. During periods of low inflation, new bonds will likely offer lower interest rates. During such times, investors looking only at coupon rates may be attracted to investing in low-grade junk bonds carrying coupon rates similar to the ones that were offered by ordinary bonds during inflation period. Investors should be aware that such low-grade bonds, while they may to a certain extent compensate for the low inflation, bear much higher risks.

Liquidity Risk: It relates to the risk of not being able to buy or sell investments quickly for a price that tracks the true underlying value of the asset. Sometimes you may not be able to sell the investment at all—there may be no buyers for it, resulting in the possibility of your investment being worth little to nothing until there is a buyer for it in the market. The risk is usually higher in over-the-counter markets and small-capitalization stocks. Foreign investments pose varying liquidity risks as well. The size of foreign markets, the number of companies listed and hours of trading may be much different from those in the U.S. Additionally, certain countries may have restrictions on investments purchased by foreign nationals or repatriating them. Thus, you may: (1) have to purchase securities at a premium; (2) have difficulty selling your securities; (3) have to sell them at a discount; or (4) not be able to bring your money back home.

Socio political Risk: This involves the impact on the market in response to political and social events such as a terrorist attack, war, pandemic, or elections. Such events, whether actual or anticipated, affect investor attitudes toward the market in general, resulting in system-wide fluctuations in stock prices. Furthermore, some events can lead to wide-scale disruptions of financial markets, further exposing investments to risks.

Country Risk: It is is tied probably to the foreign country in which investment is made. It could involve, for example, an overhaul of the country's government, a

change in its policies (e.g., economic, health, retirement), social unrest, or war. Any of these factors can strongly affect investments made in that country. For example, a country may nationalize an industry or a company may find itself in the middle of a nationwide labour strike.

Legal Remedies Risk: This is the risk that if you have a problem with your investment, you may not have adequate legal means to resolve it. When investing in an international market, you often have to rely on the legal measures available in that country to resolve problems. These measures may be different from the ones you may be used to in the US. Further, seeking redress can prove to be expensive and time-consuming if you are required to hire counsel in another country and travel internationally.

Difference between Business Risk and Market Risk

Risks associated with investing in a particular product, company, or industry sector are called business or "non-systematic" risks. Common business risks include:

- **Management Risk**—also called company risk, encompasses a wide array of factors than can impact the value of a specific company. For example, the managers who run the company might make a bad decision or get embroiled in a scandal, causing a drop in the value of the company's stocks or bonds. Alternatively, a key competitor might release a better product or service.
- **Credit Risk**—also called default risk, is the chance that a bond issuer will fail to make interest payments or to pay back your principal when your bond matures.

By contrast, market risk, sometimes referred to as systematic risk, involves factors that affect the overall economy or securities markets. It is the risk that an overall market will decline, bringing down the value of an individual investment in a company regardless of that company's growth, revenues, earnings, management, and capital structure.

Here's an illustration of the concept of market risk: Let's say you decide to buy a car. You can buy a brand-new car under full warranty. Or you can buy a used car with no warranty. Your choice will depend on a variety of factors, like how much money you want to spend, which features you want, how mechanical you are, and, of course, your risk tolerance. As you research different vehicles, you'll find that some makes and models have better performance .

But whichever car you chose, you will face certain risks on the road which have nothing to do with the car itself, but which can significantly impact your driving experience—including the weather, road conditions, even animals crossing the highway at night. While these factors may be out of your control, being aware of them can help prepare you to navigate them successfully.

Management of Market Risk

While you cannot completely avoid market risks, you can take a number of steps to manage and minimize them.

1. **Diversify:** As in the case of business risks, market risks can be mitigated to a certain extent by diversification—not just at the product or sector level, but also in terms of region (domestic and foreign) and length of holdings (short- and long-term). You can spread your international risk by diversifying your investment over several different countries or regions.
2. **Do Your Homework:** Learn about the forces that can impact your investment. Stay abreast of global economic trends and developments. If you are considering investing in a particular sector, for example, aerospace, read about the future of the aerospace industry. If you are thinking about investing in foreign securities, learn as much as you can about the market history and volatility, socio-political stability, trading practices, market and regulatory structure, arbitration and mediation forums, restrictions on international investing and repatriation of investment.
3. Learn more about the various types of investments options available to you and their risk levels. Inflation risk can be managed by holding products that provide purchasing power protection, such as inflation-linked bonds. Interest rate risk can be managed by holding the instrument to maturity. Alternatively, holding shorter term bonds and CDs provide the flexibility to take advantage of higher paying instruments if interest rates go up.
4. Some investments are more volatile and vulnerable to market risks than others. Selecting investments that are less likely to fluctuate with changes in the market can help minimize risks to a certain extent.

UNIT 3

FINANCIAL DERIVATIVES

Business Snapshot- The Lehman Bankruptcy On September 15, 2008, Lehman Brothers filed for Chapter 11 bankruptcy protection. This was the largest bankruptcy filing in US history and its ramifications were felt throughout derivatives markets. Almost until the end, it seemed as though there was a good chance that Lehman would survive. A number of companies (e.g., the Korean Development Bank, Barclays Bank in the UK, and Bank of America) expressed interest in buying it, but none of these was able to close a deal. Many people thought that Lehman was ''too big to fail'' and that the US government would have to bail it out if no purchaser could be found. This proved not to be the case. How did this happen? It was a combination of high leverage, risky investments, and liquidity problems. Commercial banks that take deposits are subject to regulations on the amount of capital they must keep. Lehman was an investment bank and not subject to these regulations. By 2007, its leverage ratio had increased to 31:1, which means that a 3–4% decline in the value of its assets would wipe out its capital. Dick Fuld, Lehman's Chairman and Chief Executive Officer, encouraged an aggressive deal-making, risk-taking culture. He is reported to have told his executives: ''Every day is a battle. You have to kill the enemy.'' The Chief Risk Officer at Lehman was competent, but did not have much influence and was even removed from the executive committee in 2007. The risks taken by Lehman included large positions in the instruments created from subprime mortgages, which will be described in Chapter 8. Lehman funded much of its operations with short-term debt. When there was a loss of confidence in the company, lenders refused to roll over this funding, forcing it into bankruptcy. Lehman was very active in the over-the-counter derivatives markets. It had hundreds of thousands of transactions outstanding with about 8,000 different counterparties. Lehman's counterparties were often required to post collateral and this collateral had in many cases been used by Lehman for various purposes. It is easy to see that sorting out who owes what to whom in this type of situation is a nightmare!

Introduction

In the last 45 years, derivatives have become increasingly important in Business and finance. Futures, options and other related instruments are actively traded on many exchanges throughout the world. Many different types of forward contracts, swaps, options, and other derivatives are entered into by financial institutions, fund managers, and corporate treasurers in the over-the counter market. Derivatives are added to bond issues, used in executive compensation plans, embedded in capital investment opportunities, used to transfer risks in mortgages from the original lenders to investors, and so on. We have now reached the stage where those who work in finance, and many who work outside finance, need to understand how derivatives work, how they are used, and how they are priced. Whether you love derivatives or hate them, you cannot ignore them! The derivatives market is huge—much bigger than the stock market when measured in terms of underlying assets. The value of the assets underlying outstanding derivatives transactions is several times the world gross domestic product.

Derivatives can be used for hedging or speculation or arbitrage. They play a key role in transferring a wide range of risks in the economy from one entity to another. A derivative can be defined as a financial instrument whose value depends on (or derives from) the values of other, more basic, underlying variables. Very often the variables underlying derivatives are the prices of traded assets. A stock option, for example, is a derivative whose value is dependent on the price of a stock. However, derivatives can be dependent on almost any variable, from the price of hogs to the amount of snow falling at a certain ski resort.

The past decade has witnessed the multiple growths in the volume of international trade and business due to the wave of globalization and liberalization all over the world. As a result, the demand for the international money and financial instruments increased significantly at the global level. In this respect, changes in the interest rates, exchange rates and stock market prices at the different financial markets have increased the financial risks to the corporate world. Adverse changes have even threatened the very survival of the business world. It is, therefore, to manage such risks; the new financial instruments have been developed in the financial markets, which are also popularly known as financial derivatives.

Derivatives are specific types of instruments that derive their value over time from the performance of an underlying asset: eg equities, bonds, commodities. A derivative is traded between two parties – who are referred to as the counterparties.

These counterparties are subject to a pre-agreed set of terms and conditions that determine their rights and obligations. Derivatives can be traded on or off an exchange and are known as:

1. Exchange-Traded Derivatives (ETDs): Standardised contracts traded on a recognised exchange, with the counterparties being the holder and the exchange. The contract terms are non-negotiable and their prices are publicly available.
2. Over-the-Counter Derivatives (OTCs): Bespoke contracts traded off-exchange with specific terms and conditions determined and agreed by the buyer and seller (counterparties). As a result OTC derivatives are more illiquid, eg forward contracts and swaps.

Definition of Financial Derivatives

Before explaining the term financial derivative, let us see the dictionary meaning of 'derivative'. Webster's Ninth New Collegiate Dictionary states **Derivatives** as: A word formed by derivation. It means, this word has been arisen by derivation.

- Something derived; it means that some things have to be derived or arisen out of the underlying variables. For example, financial derivative is an instrument indeed derived from the financial market.
- The limit of the ratio of the change is a function to the corresponding change in its independent variable. This explains that the value of financial derivative will change as per the change in the value of the underlying financial instrument.
- A chemical substance related structurally to another substance, and theoretically derivable from it. In other words, derivatives are structurally related to other substances.
- A substance that can be made from another substance in one or more steps. In case of financial derivatives, they are derived from a combination of cash market instruments or other derivative instruments.

For example, you have purchased gold futures on May 2016 for delivery in August 2016. The price of gold on May 2016 in the spot market is Rs 4500 per 10 grams and for futures delivery in August 2016 is Rs 4800 per 10 grams. Suppose in July 2016 the spot price of the gold changes and increased to Rs 4800 per 10 grams. In the same line value of financial derivatives or gold futures will also change.

From the above, the term derivatives may be termed as follows: The term "Derivative" indicates that it has no independent value, i.e., its value is entirely derived from the value of the underlying asset. The underlying asset can be securities, commodities, bullion, currency, livestock or anything else. In other words, derivative means forward, futures, option or any other hybrid contract of predetermined fixed duration, linked for the purpose of contract fulfillment to the value of a specified real or financial asset or to an index of securities.

The Securities Contracts (Regulation) Act 1956 defines "derivative" as under: "Derivative" includes Security derived from a debt instrument, share, loan whether secured or unsecured, risk instrument or contract for differences or any other form of security.

Accounting Standard SFAS133 defines a derivative as, 'a derivative instrument is a financial derivative or other contract with all three of the following characteristics:
(i) It has (1) one or more underlings, and (2) one or more notional amount or payments provisions or both. Those terms determine the amount of the settlement or settlements.
(ii) It requires no initial net investment or an initial net investment that is smaller than would be required for other types of contract that would be expected to have a similar response to changes in market factors.
(iii) Its terms require or permit net settlement. It can be readily settled net by a means outside the contract or it provides for delivery of an asset that puts the recipients in a position not substantially different from net settlement.

In general, from the aforementioned, derivatives refer to securities or to contracts that derive from another—whose value depends on another contract or assets. As such the financial derivatives are financial instruments whose prices or values are derived from the prices of other underlying financial instruments or financial assets. The underlying instruments may be a equity share, stock, bond, debenture, treasury bill, foreign currency or even another derivative asset. For example, a stock option's value depends upon the value of a stock on which the option is written. Similarly, the value of a treasury bill of futures contracts or foreign currency forward contract will depend upon the price or value of the underlying assets, such as Treasury bill or foreign currency. In other words, the price of the derivative is not arbitrary rather it is linked or affected to the price of the underlying asset that will automatically affect the price of the financial derivative. Due to this

reason, transactions in derivative markets are used to offset the risk of price changes in the underlying assets.

In fact, the derivatives can be formed on almost any variable, for example, from the price of hogs to the amount of snow falling at a certain ski resort. The term financial derivative relates with a variety of financial instruments which include stocks, bonds, treasury bills, interest rate, foreign currencies and other hybrid securities. Financial derivatives include futures, forwards, options, swaps, etc. Futures contracts are the most important form of derivatives, which are in existence long before the term 'derivative' was coined. Financial derivatives can also be derived from a combination of cash market instruments or other financial derivative instruments. In fact, most of the financial derivatives are not revolutionary new instruments rather they are merely combinations of older generation derivatives and/or standard cash market instruments.

In the 1980s, the financial derivatives were also known as off-balance sheet instruments because no asset or liability underlying the contract was put on the balance sheet as such. Since the value of such derivatives depend upon the movement of market prices of the underlying assets, hence, they were treated as contingent asset or liabilities and such transactions and positions in derivatives were not recorded on the balance sheet. However, it is a matter of considerable debate whether off-balance sheet instruments should be included in the definition of derivatives. Which item or product given in the balance sheet should be considered for derivative is a debatable issue.

Features of Financial Derivatives

As observed earlier, a financial derivative is a financial instrument whose value is derived from the value of an underlying asset; hence, the name 'derivative' came into existence. There are a variety of such instruments which are extensively traded in the financial markets all over the world, such as forward contracts, futures contracts, call and put options, swaps, etc. A more detailed discussion of the properties of these contracts will be given later part of this lesson. Since each financial derivative has its own unique features, in this section, we will discuss some of the general features of simple financial derivative instrument.

The basic features of the derivative instrument can be drawn from the general definition of a derivative irrespective of its type. Derivatives or derivative securities are future contracts which are written between two parties (counter parties) and whose value are derived from the value of underlying widely held and easily marketable

assets such as agricultural and other physical (tangible) commodities, or short term and long term financial instruments, or intangible things like weather, commodities price index (inflation rate), equity price index, bond price index, stock market index, etc. Usually, the counter parties to such contracts are those other than the original issuer (holder) of the underlying asset. From this definition, the basic features of a derivative may be stated as follows:

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

2. Normally, the derivative instruments have the value which derived from the values of other underlying assets, such as agricultural commodities, metals, financial assets, intangible assets, etc. Value of derivatives depends upon the value of underlying instrument and which changes as per the changes in the underlying assets, and sometimes, it may be nil or zero. Hence, they are closely related.

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

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

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

6. Usually, in derivatives trading, the taking or making of delivery of underlying assets is not involved; rather underlying transactions are mostly settled by

taking offsetting positions in the derivatives themselves. There is, therefore, no effective limit on the quantity of claims, which can be traded in respect of underlying assets.

7. Derivatives are also known as deferred delivery or deferred payment instrument. It means that it is easier to take short or long position in derivatives in comparison to other assets or securities. Further, it is possible to combine them to match specific, i.e., they are more easily amenable to financial engineering.

8. Derivatives are mostly secondary market instruments and have little usefulness in mobilizing fresh capital by the corporate world; however, warrants and convertibles are exception in this respect.

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

Forwards: Forwards are non-standardised contracts between two parties to buy or sell an asset at a specified future time at a price agreed today. For example, pension funds commonly use foreign exchange forwards to reduce FX risk when overseas currency positions are required at known future dates. As the contracts are bespoke they can be for non standardised amounts and dates, eg delivery of EUR 23,967 against payment of USD 32,372 on 16 January 2014. Swaps: Swaps are agreements to exchange one series of future cash flows for another. Although the underlying reference assets can be different, eg equity or interest rate, the value of the underlying asset will characteristically be taken from a publicly available price source. For example, under an equity swap the amount that is paid or received will be the difference between the equity price at the start and end date of the contract.

Futures: Futures are exchange-traded standard contracts for a pre-determined asset to be delivered at a pre-agreed point in the future at a price agreed today. The buyer makes margin payments reflecting the value of the transaction. The buyer is said to have gone long and the seller to have gone short. Counterparties can exit a commitment by taking an equal but offsetting position with the exchange, so that the net position is nil and the only delivery will be a cash flow for profit or loss. Futures coverage includes currencies, bonds, agricultural and other commodities such as silver.

Options: Exchange-traded options are standardised contracts whereby one party has a right to purchase something at a pre agreed strike price at some point in the future. The right, however, is not an obligation as the buyer can allow the contract to expire and walk away. The cost of buying an option is the seller's premium which the

buyer must pay to obtain the option right. There are two types of option contracts that can be either bought or sold:

- Call – A buyer of a call option has the right but not the obligation to buy the asset at the strike price (price paid) at a future date. A seller has the obligation to sell the asset at the strike price if the buyer exercises the option.
- Put – A buyer of a put option has the right, but not the obligation, to sell the asset at the strike price at a future date. A seller has the obligation to repurchase the asset at the strike price if the buyer exercises the option.

Swaps: These are non-standard contracts giving the owner the right but not the obligation to enter into an underlying swap. The most common swaptions traded are those dependent on interest rates which allow funds to create bespoke protection. Contracts can be preconfigured to provide both upside and downside protection if an event occurs. For example, a party can purchase a swaption to protect itself from the 10-year interest rate swap rate going below 1% in three months time.

Example – Interest rate swap: Ordinarily when interest rates rise, the discount rate used in calculating the net present value (NPV) of liabilities rises, so the NPV of those liabilities is reduced and the fund's funding ratio is improved. However, the opposite is also true of a decrease in rates, whereby the NPV of liabilities increases and the pension scheme's funding deteriorates. Swaps can involve a scheme swapping either a fixed or variable rate payment. In the following example, Scheme A wishes to reduce its exposure to interest rate sensitivity and has entered into an interest rate swap contract whereby it has agreed to pay a variable rate of interest on a nominal amount in exchange for a fixed rate of interest on the same nominal. With such a position, the value of both scheme assets and liabilities is either positively or negatively affected. The net position is that the funding status remains unmoved and thereby the position is hedged. Scheme A swaps a variable rate payment in exchange for a fixed one. There are two 'legs' to the contract, one fixed and one floating. Under normal circumstances the present value of the future payments under each leg of the swap would be a similar amount on initiation; but over time market movement is likely to vary from expectation.

Inflation is one of the main risks that pension schemes are exposed to as typically schemes' liabilities may be linked to inflation. Therefore, high inflation has a negative impact on the NPV of a scheme as liability values are higher and may create additional funding requests for the corporate sponsor. Inflation rate swaps can be used to reduce inflation risk. Similar to an interest rate swap there are two flows and payments are made between the two counterparties. In this example, Scheme A swaps a variable rate payment for a fixed one, with changes in the variable payment dependent upon changes in an inflation rate calculated on a nominal amount. In this example, the scheme funding status (net ratio of assets to liabilities) will remain unaffected and thereby the position is hedged.

UNIT 4

DERIVATIVES MARKETS

Global Context

The past decade has witnessed an explosive growth in the use of financial derivatives by a wide range of corporate and financial institutions. The following factors which have generally been identified as the major driving force behind growth of financial derivatives are the (i) increased volatility in asset prices in financial markets; the increased integration of national financial markets with the international markets; the marked improvement in communication facilities and sharp decline in their costs; the development of more sophisticated risk management strategies; and the innovations in the derivatives markets, which optimally combine the risk and returns over a large number of financial assets, leading to higher returns, reduced risk as well as transaction costs as compared to individual financial assets. The growth in derivatives has run in parallel with the increasing direct reliance of companies on the capital markets as the major source of long-term funding. In this respect, derivatives have a vital role to play in enhancing shareholder value by ensuring access to the cheapest source of funds. Furthermore, active use of derivative instruments allows the overall business risk profile to be modified, thereby providing the potential to improve earnings quality by offsetting undesired risks.

Increased investment and hedging activity in currency markets was not associated with uncertainty, since implied volatilities for the main currency pairs dropped significantly in the first quarter of 2005. It might instead have reflected realized and expected changes in exchange rate levels, and the need to adjust positions. After a prolonged depreciation, the dollar rose by 4.5% against the euro in the first quarter of 2005. Over the same period, risk reversal indicators derived from currency options started to signal that economic agents had changed their expectations about future exchange rate levels, with the previously expected depreciation of the dollar versus the euro turning toward expectations of stability or slight appreciation.

The past decade has witnessed the multiple growths in the volume of international trade and business due to the wave of globalization and liberalization all over the world.

As a result, the demand for the international money and financial instruments increased significantly at the global level. In this respect, changes in the interest rates, exchange rates and stock market prices at the different financial markets have increased the financial risks to the corporate world. Adverse changes have even threatened the very survival of the business world. It is, therefore, to manage such

risks; the new financial instruments have been developed in the financial markets, which are also popularly known as financial derivatives.

The basic purpose of these instruments is to provide commitments to prices for future dates for giving protection against adverse movements in future prices, in order to reduce the extent of financial risks. Not only this, they also provide opportunities to earn profit for those persons who are ready to go for higher risks. In other words, these instruments, indeed, facilitate to transfer the risk from those who wish to avoid it to those who are willing to accept the same. 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. In an estimate, the present annual trading volume of derivative markets has crossed US $ 35,000 billion, representing more than 100 times gross domestic product of India.

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.

Participants of derivative market

1. Hedgers
2. Speculators
3. Arbitrageurs

Hedgers

Hedgers are those who enter into a derivative contract with the objective of covering risk. Farmer growing wheat faces uncertainty about the price of his produce at the time of the harvest. Similarly, a flour mill needing wheat also faces uncertainty of price of input.

Both the farmer and the flour mill can enter into a forward contract, where the farmer agrees to sell his produce when harvested at predetermined price to the flour mill. The farmer apprehends price fall while the flour mill fears price rise. Both the parties face price risk. A forward contract would eliminate price risk for both the parties. A forward contract is entered into with the objective of hedging against the price risk being faced by the farmer as well as the flour mill. Such participants in the derivatives

markets are called hedgers. The hedgers would like to conclude the contract with the delivery of the underlying asset. In the example the contract would be settled by the farmer delivering the wheat to the flour mill on the agreed date at an agreed price.

Speculators

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

If only hedgers were to operate in the derivative markets, the number of participants in the market would be extremely limited. A farmer would find it difficult to locate a flour mill with perfectly matched and complimentary requirements in terms of quantity, quality, and timing of the delivery of the asset (wheat in this case).

Similarly, a flour mill would also find it difficult to locate a suitable farmer to supply the exact requirements. If middlemen are permitted to operate, the hedgers need not look for exact match, and instead they can deal with the middlemen who would buy the produce from the farmer in advance with anticipation of higher price in the future at the time of harvest. Such middlemen will be speculating on the future price and bid a current price in a manner that is likely to result in gain for them. By entering into a contract on the derivatives the speculators are assuming risk of price in future.

Speculators perform an extremely important function. They render liquidity to the market. Without speculators in the market not only would it be difficult for hedgers to find matching parties but the hedge is likely to be far from being efficient. Presence of speculators makes the markets competitive, reduces transaction costs, and expands the market size. More importantly, they are the ones who assume risk and serve the needs of hedgers who avoid risk. With speculators around, hedgers find counterparties conveniently.

Arbitrageurs

It would seem that hedgers and speculators would complete the market. Not really so because we assume that different markets are efficient by themselves and they operate in tandem. We describe derivative as the one that derives its price from the underlying asset. Structurally the markets for derivatives and the underlying are separate. For example, agricultural products would b€ bought and sold in the physical market (mandis), while futures on them are traded on the commodity exchange.

However, there has to be complete harmony between the mandis and commodity exchange. There cannot be any disparity in the prices in the mandis and the commodity exchange. The third category of participants, i.e. arbitrageurs, performs the function of making the prices in different markets converge and be in tandem with each other. While hedgers and speculators want to eliminate and assume risk respectively, the arbitrageurs take riskless position and yet earn profit. They are constantly monitoring the prices of different assets in different markets and identify opportunities to make profit that emanate from mispricing of products. The most common example of arbitrage is the price difference that may be prevailing in different stock markets. For example, if the share price of Hindustan Unilever is Rs 175 in National Stock Exchange (NSE) and Rs 177 in Bombay Stock Exchange (BSE), the arbitrageur will buy at NSE and sell at BSE simultaneously and pocket the difference of Rs 2 per share.

An arbitrageur takes risk neutral position and makes profits because markets are imperfect. Naturally, such imperfections cannot exist for long. These imperfections are extremely short-lived. The arbitrageur cashes upon these short-lived opportunities. Such actions restore the balance in prices and remove distortions in the pricing of assets. Fundamentally the speculators and arbitrageurs fall in the same category in as much as that both are not looking at owning or disowning the underlying asset by delivery like hedgers. Both speculators and arbitrageurs are also trying to render competitiveness to the market, thereby helping the price discovery process. Difference between the two lies in the amount of risk they assume.

While speculators have their opinions about the future price of the underlying asset by making investment, the arbitrageur is concentrating on the mispricing in different markets by taking riskless position with no investment of his own. By his actions an arbitrageur is restoring the balance and consistency among different markets, while speculators only hope for the desirable movement in prices. Arbitrageurs are the ones who prohibit speculators to over bid or underbid the prices in the derivatives as compared to the physical markets.

Functions of Derivative Markets

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

Enable Price Discovery

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

volumes, and increased sensitivity of participants to react to smallest of price changes. By increased depth in the market, faster and smooth dissemination of information among different participants, the process of discovery of price becomes more efficient.

Facilitate Transfer of Risk

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

Provide Leveraging

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

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

Other Benefits

The function of leveraging and risk transfer helps in efficient portfolio management. With a smaller fund at disposal, better diversification can be achieved with part of the fund allocation to derivatives assets. Derivatives provide a much wider menu to portfolio managers who constantly seek better risk return trade off. The range of choices would be far more restricted in the absence of derivatives. Since very large number of participants become active in the market (due to leveraging), the transaction costs are likely to be lower and lower with derivative markets.

Shrinking transaction cost reflected in spread of sell and buy prices is a sure sign of free market economy, and therefore efficient allocation of resources. Faster and efficient dissemination of information also helps in removing price disparities across geographies.

Derivatives can be extremely useful in smoothening out the seasonal variations in the prices of the underlying assets. Hoarding is viewed as a social stigma. Hoarding used for speculative purposes require scanty trading with large price variation among financially powerful persons acting in concert. Derivatives can help curb hoarding by continuous trading and increasing participation as it requires little capital outlay, leaving the field open to large number of participants reducing the financial muscle.

UNIT 5

Financial Derivatives Markets in India

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 td 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.

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.

Evolution of Derivatives in India

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

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

The Reserve Bank of India set up the Sodhani Expert Group which recommended major liberalization of the forward exchange market and had urged the setting up of rupee based derivatives in financial instruments. The RBI accepted several of its recommendations in August, 1996. A landmark step taken in this regard when the Securities and Exchange Board of India (SEBI) appointed a Committee named the Dr. L.C. Gupta Committee (LCGC) by its resolution, dated November 18, 1996 in order to develop appropriate regulatory framework for derivatives trading in India. While the Committee's focus was on equity derivatives but it had maintained a broad perspective of derivatives in general.

The Board of SEBI, on May 11, 1998, accepted the recommendations of the Dr. L.C. Gupta Committee and approved introduction of derivatives trading in India in the

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

Categories of Derivatives Traded in India

1. Commodities futures for coffee, oil seeds, and oil, gold, silver, pepper, cotton, jute and jute goods are traded in the commodities futures. Forward Markets Commission regulates the trading of commodities futures.
2. Index futures based on Sensex and NIFTY index are also traded under the supervision of Securities and Exchange Board of India (SEBI).
3. The RBI has permitted banks, Financial Institutions (F1's) and Primary Dealers (PD's) to enter into forward rate agreement (FRAs)/interest rate swaps in order to facilitate hedging of interest rate risk and ensuring orderly development of the derivatives market.
4. The National Stock Exchange (NSE) became the first exchange to launch trading in options on individual securities. Trading in options on individual securities commenced from July, 2001.
5. Options contracts are American style and cash settled and are available in about 40 securities Stipulated by the Securities and Exchange Board of India.
6. The NSE commenced trading in futures on individual securities on November 9, 2001. The futures contracts are available in about 31 securities stipulated by SEBI. The BSE also started trading in stock options and futures (both Index and Stocks) around at the same time as the NSE.

7. The National Stock Exchange commenced trading in interest rate future on June 2003. Interest rate futures contracts are available on 91-day 1-bills, 10-year bonds and 10-year zero coupon bonds as specified by the SEBJ.

Derivatives Trading at NSE/BSE

The most notable of development in the history of secondary segment of the Indian stock market is the commencement of derivatives trading in June, 2000. The SEBI approved derivatives trading based on futures contracts at (NSE) and (BSE) in accordance with the rules/bye-laws and regulations of the stock exchanges. To begin with, the SEBI permitted equity derivatives named stock index futures. The BSE introduced on 9 June, 2000 stock index futures based on the sensitive Index (also called SENSEX comprising 30 scripts) named BSX, and NSE started on June 12 2000 stock index future based on its index S&P CNX NIFTY (comprised 50 scripts).

In India, stock index futures are available for one-month, two-month and three month maturities. All the open positions in these contracts are settled daily. Further, the buyers and sellers are required to deposit margin with the respective stock exchanges determined as per the SEBI guidelines. To facilitate the effective risk management in the derivatives segment, all the important measures like minimum net worth requirement for the broker, determination of margin based on value at risk model, position limit for various participants, mechanism for collection and enforcement of margin, etc. have been put in place. Subsequently, the derivative products range had been increased by including options and futures on the indices and on several highly traded stocks. In an estimate, the product wise turnover of derivatives on the Indian stock markets as on July 6, 2002 is stock futures (50%), index futures (2 1%), stock options (25%) and index option (4%). It means stock futures are most popular derivative traded at the stock market of India.

The Technical Group has recommended the risk containment measure for exchange traded options on indices. The following are the important features of the risk containment framework for the trading and settlement of both index futures and index option contracts:

1. European style index options will be permitted initially. These will be settled in cash.

2. Index option contracts will have a minimum contract size of Rs 2 lakh, at the time of its introduction.

3. The risk containment measures described hereunder are only for premium style European option.

4. Index option contract will have a maximum maturity of 12 months and a minimum of three strikes, i.e., in the money, near the money and out of the money.

5. A portfolio based margining approach, which would take an integrated view of the risk involved in the portfolio of individual client will be adopted. It is for the first time that such an approach is introduced in the Indian stock market. It is inconsistent with the practices followed in the countries. This approach will not only cover the risk but also help in reducing the transaction costs in derivatives.

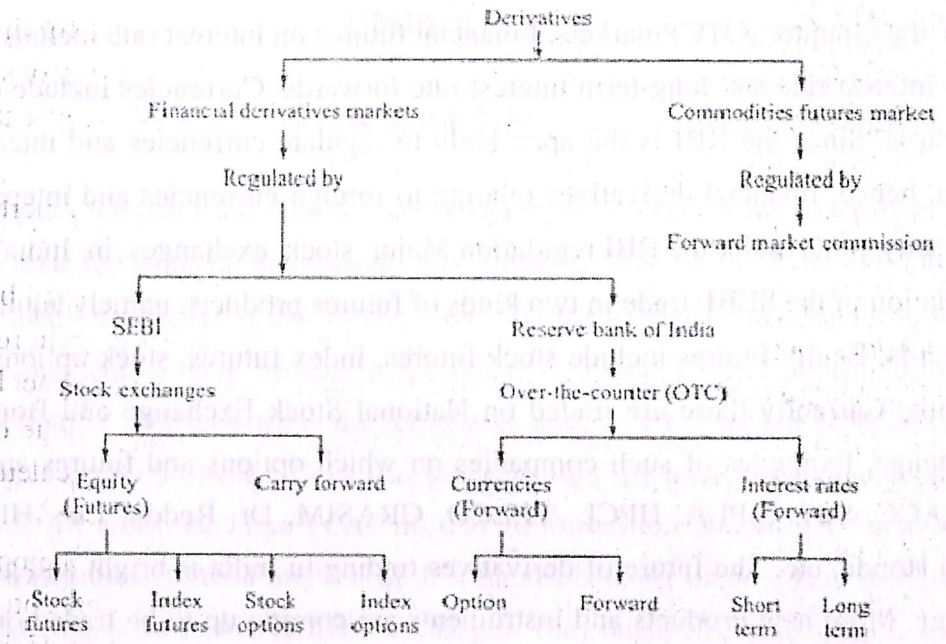
6. The initial margin requirements will be based on worst case loss of a portfolio of an individual client to cover a 99% value at risk over a one day horizon. The initial margin requirement will be netted at level of individual client and it will be on gross basis at the level of Trading/Clearing member. Further, the initial margin requirement for the proprietary position of Trading/Clearing member will also be on net basis.

7. The short option minimum margin equal to 30% of the Notional value of all short index option will be charged if sum of the worst scenario loss and the calendar spread margin is lower than the short option minimums margin.

8. Net option value will be calculated on the current market value of the option times the number of options (positive for long options and negative for short options) in the portfolio. The net option value will be added to the Liquid Net Worth of the clearing member.

9. For option positions, the premium will be paid in by the buyer in cash and paid out to the seller in cash on T+ 1 day until the buyer pays in the premium due shall he deducted from the available Liquid Net Worth on a real time basis. In case of index futures contracts, the mark-to-market gains losses for index futures position will continue to be settled.

Contrary to international experience, the growth of derivatives market did not take off as anticipated. The value of trading has been low. This is mainly attributed to the low awareness about the products and mechanism of trading among the market players and investors.



Structure of derivatives markets in India.

Emerging Structure of Derivatives Markets in India

Derivatives markets in India can be broadly categorized into two markets namely; financial derivatives markets and commodities futures markets. Financial derivatives markets deal with the financial futures instruments like stock futures, index futures, stock options, index options, interest rate futures, currency forwards and futures, financial swaps, etc. whereas commodity futures markets deal with commodity instruments like agricultural products; food grains, cotton and oil; metals like gold, silver, copper and steel and other assets like live stocks, vegetables and so on.

Financial derivatives markets in India are regulated and controlled by the Securities and Exchange Board of India (SEBI). The SEBI is authorized under the SEBI Act to frame rules and regulations for financial futures trading on the stock exchanges with the objective to protect the interest of the investors in the market. Further carry forward trading (Badla trading) is also regulated by the SEBI which is traded on the stock exchanges.

Some of the other financial derivatives like currency options and futures and interest rate futures are controlled by the Reserve Bank of India (RBI). These are dealt on

Over-the-Counter (OTC) markets. Financial futures on interest rate include both short-term interest rate and long-term interest rate forwards. Currencies include options and forwards. Since the RBI is the apex body to regulate currencies and interest rates in India, hence, financial derivatives relating to foreign currencies and interest rates are generally come under the RBI regulation.Major stock exchanges in India, under the regulation of the SEBI, trade in two kinds of futures products, namely equity and carry forwards. Equity futures include stock futures, index futures, stock options and index options. Currently these are traded on National Stock Exchange and Bombay Stock Exchange. Examples of such companies on which options and futures are available, e.g. ACC, SBI, CIPLA, HPCL, TELCO, GRASIM, Dr. Reddy, Lab, HLL, HDFC, Hero Honda, etc. The future of derivatives trading in India is bright and growing day by day. More new products and instruments are coming up to be traded on stock and commodity exchanges. Very soon we will have trading on interest rate futures on NSE and BSE.

UNIT 6

FORWARDS

Business Snapshot- SocGen's big loss in 2008 Derivatives are very versatile instruments. They can be used for hedging, speculation, and arbitrage. One of the risks faced by a company that trades derivatives is that an employee who has a mandate to hedge or to look for arbitrage opportunities may become a speculator. Je´ro^me Kerviel joined Socie´te´ Ge´ne´ral (SocGen) in 2000 to work in the compliance area. In 2005, he was promoted and became a junior trader in the bank's Delta One products team. He traded equity indices such as the German DAX index, the French CAC 40, and the Euro Stoxx 50. His job was to look for arbitrage opportunities. These might arise if a futures contract on an equity index was trading for a different price on two different exchanges. They might also arise if equity index futures prices were not consistent with the prices of the shares constituting the index. (This type of arbitrage is discussed in Chapter 5.) Kerviel used his knowledge of the bank's procedures to speculate while giving the appearance of arbitraging. He took big positions in equity indices and created fictitious trades to make it appear that he was hedged. In reality, he had large bets on the direction in which the indices would move. The size of his unhedged position grew over time to tens of billions of euros. In January 2008, his unauthorized trading was uncovered by SocGen. Over a threeday period, the bank unwound his position for a loss of 4.9 billion euros. This was at the time the biggest loss created by fraudulent activity in the history of finance. (Later in the year, a much bigger loss from Bernard Madoff's Ponzi scheme came to light.) Rogue trader losses were not unknown at banks prior to 2008. For example, in the 1990s, Nick Leeson, who worked at Barings Bank, had a mandate similar to that of Je´ro^me Kerviel. His job was to arbitrage between Nikkei 225 futures quotes in Singapore and Osaka. Instead he found a way to make big bets on the direction of the Nikkei 225 using futures and options, losing $1 billion and destroying the 200-year old bank in the process. In 2002, it was found that John Rusnak at Allied Irish Bank had lost $700 million from unauthorized foreign exchange trading. The lessons from these losses are that it is important to define unambiguous risk limits for traders and then to monitor what they do very carefully to make sure that the limits are adhered to.

A relatively simple derivative is a forward contract. It is an agreement to buy or sell an asset at a certain future time for a certain price. It can be contrasted with a spot contract, which is an agreement to buy or sell an asset today. A forward contract is traded in the over-the-counter market—usually between two financial institutions or between a financial institution and one of its clients. One of the parties to a forward contract assumes a long position and agrees to buy the underlying asset on a certain specified future date for a certain specified price. The other party assumes a short position and agrees to sell the asset on the same date for the same price. Forward contracts on foreign exchange are very popular. Most large banks employ both spot and forward foreign-exchange traders. Spot traders are trading a foreign currency for almost immediate delivery. Forward traders are trading for delivery at a future time.

Features of Forward Contract

1. It is an agreement between the two counter parties in which one is buyer and other is seller. All the terms are mutually agreed upon by the counterparties at the time of the formation of the forward contract.
2. It specifies a quantity and type of the asset (commodity or security) to be sold and purchased.
3. It specifies the future date at which the delivery and payment are to be made.
4. It specifies a price at which the payment is to be made by the seller to the buyer. The price is determined presently to be paid in future.
5. It obligates the seller to deliver the asset and also obligates the buyer to buy the asset.
6. No money changes hands until the delivery date reaches, except for a small service fee, if there is.

Classification of Forward Contracts

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

1. Hedge Contracts

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

2. Transferable Specific Delivery (TSD) Contracts

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

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

3. Non-Transferable Specific Delivery (NTSD) Contracts

These contracts are of such nature which cannot be transferred at all. These may concern with specific variety or consignment of goods or their terms may be highly specific. The delivery in these contracts is mandatory at the time of expiration. Normally, these contracts have been exempted from the regulatory provisions of Forward Act, but the Central Government, whenever feels necessary, may bring them under the regulation of the Act. It is evident from the above that the definition of hedge contracts corresponds to the definition of futures contracts while the latter two are not futures contracts, and hence, termed as forward contracts. Since in both hedge contracts and futures contracts, no specification about the underlying asset/commodity is mentioned because such limits are set by the rules of the exchange on which types can or cannot he delivered. If the variety is superior or inferior to the basis variety for delivery, in that case the prices are adjusted by means of premium or discount as the case may be. Such adjustments are popularly known as tendering differences. Thus, on this basis, it may be generalized that every futures contract is a forward contract but every forward contract may not be futures contract.

Forward Trading Mechanism

Forward contracts are very much popular in foreign exchange markets to hedge the foreign currency risks. Most of the large and international banks have a separate 'Forward Desk' within their foreign exchange trading room which is devoted to the trading of forward contracts. Let us take an example to explain the forward contract. Suppose on August 10, 2016, the treasurer of a British Multinational firm (MNC) knows that the corporation will receive one million US dollar after three months, i.e., November 10, 2016 and wants to hedge against the exchange rate movements. In this situation, the treasurer of the MNC will contact a bank and find out that the exchange rate for a three-month forward contract on dollar against pound sterling, i.e., £ I$ = 0.6250 and agrees to sell one million dollar. It means that the corporation has short forward contracts on US dollar. The MNC has agreed to sell one million dollar on July 10, 2016 to the bank at the future dollar rate at 0.6250. On the other hand, the bank has a long forward contract on dollar. Both sides have made a binding contract/commitment. Before discussing the forward trading mechanism, let us see some important terminology frequently used in the forward trading.

Long Position

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

Short Position

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

The Underlying Asset

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

Spot-Price

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

Future Spot Price

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

Delivery Price

The specified price in a forward contract will be referred to as the delivery price. This is decided or chosen at the time of entering into forward contract so that the value of the contract to both parties is zero. It means that it costs nothing to take a long or a short position. In other words, at the day on writing of a forward contract, the price which is determined to be paid or received at the maturity or delivery period of the forward contract is called delivery price. On the first day of the forward contract, the forward price may be same as to delivery price. This is determined by considering each aspect of forward trading including demand and supply position of the underlying asset. However, a further detail regarding this will be presented in forthcoming chapter.

The Forward Price

It refers to the agreed upon price at which both the counter parties will transact when the contract expires. In other words, the forward price for a particular forward contract at a particular time is the delivery price that would apply if the contract were entered into at that time. In the example discussed earlier, on April 10, 2016, 0.6250 is the forward price for a forward contract that involves the delivery of US dollar on July 10, 2016.

The Determination of Forward Prices

Forward contracts are generally easier to analyze than futures contracts because in forward contracts there is no daily settlement and only a single payment is made at maturity. Though both futures prices and forward prices are closely related, this will be described in the latter part of this chapter. It is essential to know about certain terms before going to determine the forward prices such as distinction between investment assets and consumption assets, compounding, short selling, repo rate and so on because these will be frequently used in such computation. We are not discussing these here in detail but the traders must be aware about them thoroughly. A brief view of these terms is explained here as under:

An investment **asset** is an asset that is held for investment purposes, such as stocks, shares, bonds, treasury, securities, etc.

Consumption assets are those assets which are held primarily for consumption, and not usually for investment purposes. There are commodities like copper, oil, food grains and live hogs.

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

Terminal value =A (1 +R) n and if it is compounded m times per annum then the terminal value will be Terminal value =A (1 +R/m) mn

Where A is amount for investment,

R is rate of return,

n is period for return and m is period of compounding.

Suppose A = Rs 100, R = 10% per annum, n = 1 (one year), and if we compound once per annum (m = 1) then as per this formula, terminal value will be

100(1 + 10)1 = 100(1.10) = Rs 110,

if m=2 then

100(1 + 0.05)2x1 = 100 x 1.05 x 1.05= Rs 110.25 and so on.

Short selling refers to selling securities which are not owned by the investor at the time of sale. It is also called 'shorting', with the intention of buying later. Short selling may not be possible for all investment assets. It yields a profit to the investor when the price of the asset goes down and loss when it goes up.

For example, an investor might contract his broker to short 500 State Bank of India shares then the broker will borrow the shares from another client and sell them in the

open market. So the investor can maintain the short position provided there are shares available for the broker to borrow. However, if the contract is open, the broker has no shares to borrow, then the investor has to close his position immediate, this is known as shortsqueezed.

Difference between forwards and futures

Apparently, forwards contracts and futures contracts seem to be similar, Both relate to a contract to be fulfilled on a future date at the Pre specified rate for a specific quantity. However, there are a number of differences between the forwards and the futures. The forwards contracts are private bilateral contracts. These are traded off-exchanges and are exposed to default risk by either party. Each forward contract is unique in terms of size, time and types of assets, etc. The price fixation may not be transparent and is not publicly disclosed. A forward contract is to be settled by delivery of the asset on the specified date.

On the other hand, futures contract is a contract to buy or sell a specified quantity of a commodity or a specified security at a future date at a price agreed to between the parties.

Since these contracts are traded only at organized exchanges, these have built-in safeguard against default risk, in the form of stock brokers or a clearing house guarantee. The idea behind futures contracts is to transfer future changes in the prices of commodities from one party to another. These are trade able and standardized contracts in terms of size, time and other features. These contracts are transparent, liquid and trade able at specified exchanges. Futures also differ from forwards in that former are subject to daily margins and fixed settlement period.

Both forwards and futures contracts are useful in cases where the future price of the commodity is volatile. For example, in case of agricultural products, say sugarcane, the peasant's revenue is subject to the price prevailing at the time of harvesting. Similarly, the sugar-mill is not sure whether it will be able or not to procure required quantity of sugarcane at the reasonable price. Both parties can reduce risk by entering into a forward or futures contract requiring one party to deliver and other party to buy the settled quantity at the agreed price regardless of the actual price prevailing at the time of delivery. Both result in a deferred delivery sale.

However, it can be offset by a counter contract.

Futures market is a formalized and Futures market is a formalized and standardized forward market. Players and sellers do no meet by chance but trade in the centralized market. No doubt, the standardization process eliminates the flexibility available in the informal contacts (i.e., forwards).

Futures have four specific characteristics as against the forwards:

1. Liquidity, as futures are transferable.
2. Standard volume.
3. Counter-party guarantee provided by the Exchange.
4. Intermediate cash flows.

Futures contracts have evolved out of forwards and possess many of the characteristics of forwards. In essence, futures are like liquid forward contracts. As against forwards, futures as a technique of risk management, provide several services to the investors and speculators as follows

(i) Futures provide a hedging facility to counter the expected movements in prices.
(ii) Futures help indicating the future price movement in the mart.
(iii) Futures provide an arbitrage opportunity to the speculators.

Forward Prices Versus Futures Prices

Whether the forward prices are equal to futures prices, this is very important and debatable issue. It is argued that if risk free interest rate is constant and the same for all maturities, in such market situations, lie forward price will be same as the futures prize the contract. However, in actual practice, the interest rates do not remain constant and usually vary unpredictably, then forward prices and futures prices no longer remain the same. We can get sense of the nature of the relationship by considering the situation where the price of the underlying asset is strongly positively correlated with interest rates. Since in futures contracts, there is daily settlement, so if current price(s) increases, an investor who holds a long future position, makes an immediate profit, which will be reinvested at a higher than average rate of interest.

Similarly when current price(s) decreases, the investor will incur immediate loss, and this loss will be financed at a lower than average rate of interest. However, this position does not arise in the forward contract because there is no daily settlement and interest rate movements will not have any affect till maturity. It is further argued that when spot (current) prices are strongly positively correlated with the interest rates, futures prices will tend to higher than the forward prices, similarly, if spot prices are strongly negatively correlated with the interest rates then forward prices will tend to higher than the futures prices. It is further observed that though there may be theoretical difference between forward prices and futures prices due to various factors like taxes, transaction costs, treatment of margin and default risk, but this difference is very small which may be ignored. Thus, in our further discussion in various chapters, both forward contracts and futures contracts are assumed to be the same and the symbol F will be used to represent both futures price and forward price same at time zero.

UNIT 7

FUTURES

Introduction

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

Futures

A futures contract, or simply called futures, is a contract to buy or sell a stated quantity of a commodity or a financial claim at a specified price at a future specified date. The parties to the futures have to buy or sell the asset regardless of what happens to its value during the intervening period or what happens to be the price on the date when the contract is implemented. Both the parties to the futures have a right to transfer the contract by entering into an offsetting futures contract. If not transferred until the settlement/specified date, then they have obligations to fulfill the terms and conditions of the contract. Futures are traded on the exchanges and the terms of the futures contracts are standardized by the exchange with reference to quantity, date, units of price quotation, minimum change in price (tick), etc.

Futures can be in respect of commodities such as agricultural products, oil, gas, gold, silver, etc., or of financial claims such as shares, debentures, treasury bonds, share index, foreign exchanges, etc. In a futures contract, the parties fix the terms of the transaction and lock in the price at which the transaction will take place between them at future date. The futures contract, as they appear to be, providing for the physical delivery of the asset, however, in practice most of the futures are settled by and offsetting futures contract. If a particular futures is not settled by the party himself then it will be settled by the exchange at a specified price and the difference is payable by or to the party. The basic motive for a future is not the actual delivery but the hedging for future risk or speculation. Further, in certain cases, the physical asset does not exist at all. For example, in case of Stock Index Futures, the Index is the weighted average price and cannot be delivered. So, such futures must be cash settled only.

Futures are traded at the organized exchanges only. Some of the centers where futures are traded are Chicago Board of Trade, Tokyo Stock Exchange, London International Financial Futures Exchange (LIFFE), etc. The exchange provides the counter-party guarantee through its clearing house and different types of margins system. Futures contracts are marked to market at the end of each trading day. Consequently, these are subject to interim cash flows for adverse or favourable price movement. With reference to trading in Stock Index Futures, SEBI has provided that the participating parties have to deposit an initial cash margin as well as that difference in traded price and actual price on daily basis. At the end of the settlement period or at the time of squaring off a transaction, the difference between the traded price and settlement price is settled by cash payment. No carry forward of a futures contract is allowed beyond the settlement period. National Stock Exchange (NSE) has issued the Futures and Options Regulations, 2000 which are applicable to the derivative contracts (both futures and options) traded at the NSE.

Basic Mechanism of a Futures Contract

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

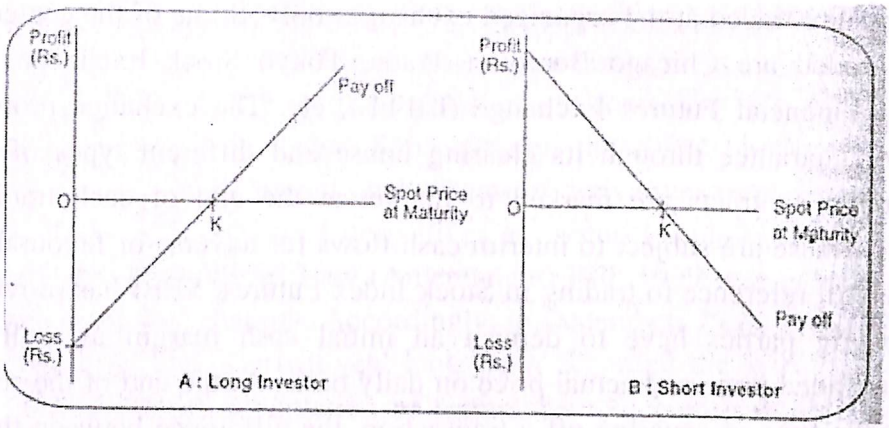
The profit or payoff position of a futures contract depends on the differences between the specified price (of the futures contract) and the actual market price prevailing on the maturity date. For example, if an investor has purchased a futures contract in HLL at the rate of Rs 300 and one contract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

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

Loss = Futures Price – Spot Price at Maturity

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

Loss = Spot Price at Maturity – Futures Price



A futures contact is zero sum game. Profit to one party is the loss of the other party. Simple reason being that every long position is represented by a short position in the market. The pay off positions of the long investor and short investor in futures are shown in Figure In Figure (A), K is the strike price. The figure shows that as the spot price at maturity increases, the profit of the long investor also increases. This break-even level is one when spot price is equal to strike price. Similarly, Figure (B) shows that maximum profit to short investor appears if the spot price is 0.

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

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

Contract Size of Futures Contracts

One contract of futures includes a specific number of units of underlying asset. For example, at present, a futures contract in NIFTY is consisting of 100 units. So, if NIFTY Futures is traded at 3,750, then the value of one contract is Rs 3, 75,000. In case of stock futures, the value of one futures contract need not be less thaw Rs 2, 00,000. Number of shares included in one futures contact is changing from time to time.

Types of Financial Futures Contracts

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

Interest Rate Futures

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

Foreign Currencies Futures

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

Stock Index Futures

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

Bond Index Futures

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

Cost of Living Index Futures

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

Operators/Traders in Futures Market

Futures contracts are bought and sold by a large number of individuals, business organizations, governments and others for a variety of purposes. The traders in the futures market can be categorized on the basis of the purposes for which they deal in this market.

Usually financial derivatives attract following types of traders which are discussed here as under:

Hedgers

In simple term, a hedge is a position taken in futures or other markets for the purpose of reducing exposure to one or more types of risk. A person who undertakes such position is called as 'hedger'. In other words, a hedger uses futures markets to reduce risk caused by the movements in prices of securities, commodities, exchange rates, interest rates, indices, etc. As such, a hedger will take a position in futures market that is opposite a risk to which he or she is exposed. By taking an opposite position to a perceived risk is called 'hedging strategy in futures markets'. The essence of hedging strategy is the adoption of a futures position that, on average, generates profits when the market value of the commitment is higher than the

expected value. For example, a treasurer of a company knows the foreign currency amounts to be received at certain futures time may hedge the foreign exchange risk by taking a short position (selling the foreign currency at a particular rate) in the futures markets. Similarly, he can take a long position (buying the foreign currency at a particular rate) in case of futures foreign exchange payments at a specified futures date.

The hedging strategy can be undertaken in all the markets like futures, forwards, options, swap, etc. but their modus operandi will be different. Forward agreements are designed to offset risk by fixing the price that the hedger will pay or receive for the underlying asset. In case of option strategy, it provides insurance and protects the investor against adverse price movements. Similarly, in the futures market, the investors may be benefited from favourable price movements.

Speculators

A speculator may be defined as an investor who is willing to take a risk by taking futures position with the expectation to earn profits. The speculator forecasts the future economic conditions and decides which position (long or short) to he taken that will yield a profit if the forecast is realized. For example, suppose a speculator has forecasted that price of gold would be Rs 5500 per 10 grams after one month. If the current gold price is Rs 5400 per 10 grams, he can take a long position in gold and expects to make a profit of Rs 100 per 10 grams. This expected profit is associated with risk because the gold price after one month may decrease to Rs 5300 per 10 grams, and may lose Rs 100 per 10 grams. Speculators usually trade in the futures markets to earn profit on the basis of difference in spot and futures prices of the underlying assets. Hedgers use the futures markets for avoiding exposure to adverse movements in the price of an asset whereas the speculators wish to take position in the market based upon such movements in the price of that asset. It is pertinent to mention here that there is difference in speculating trading between spot market and forward market.

In spot market a speculator has to make an initial cash payment equal to the total value of the asset purchased whereas no initial cash payment except the margin money, if any, to enter into forward market. Therefore, speculative trading provide the investor with a much higher level of leverage than speculating using spot markets. That is why, futures markets being highly leveraged market, minimums are set to ensure that the speculator can afford any potential losses.

Arbitrageurs

Arbitrageurs are another important group of participants in futures markets. An arbitrageur is a trader who attempts to make profits by locking in a risk less trading by simultaneously entering into transactions in two or more markets. In other words, an arbitrageur tries to earn riskless profits from discrepancies between futures and spot prices and among different futures prices. For example, suppose that at the expiration of the gold futures contract, the futures price is Rs 5500 per 10 grams, but the spot price is Rs 5480 per 10 grams. In this situation, an arbitrageur could purchase the gold for Rs 5480 and go short a futures contract that expires immediately, and in this way making a profit of Rs 20 per 10 grams by delivering the gold for Rs 5500 in the absence of transaction costs.

The arbitrage opportunities available in the different markets usually do not last long because of heavy transactions by the arbitrageurs where such opportunity arises. Thus, arbitrage keeps the futures and cash prices in line with one another. This relationship is also expressed by the simple cost of carry pricing which shows that fair futures prices, is the set of buying the cash asset now and financing the same till delivery in futures market. It is generalized that the active trading of arbitrageurs will leave small arbitrage opportunities in the financial markets. In brief, arbitrage trading helps to make market liquid, ensure accurate pricing and enhance price stability; it involves making profits from relative mispricing.

Spreaders

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

UNIT 8

FUTURE CONTRACT IN INDIA

Apart from the various features of different futures contracts and trading, futures markets play a significant role in managing the financial risk of the corporate business world. Recently, financial executives and treasurers are frequently using the various tools available to control their corporate risks and exposures. Financial derivatives instruments, in this respect, have been very useful, popular and successful innovations in capital markets all over the world. Recently, it is noted that financial futures markets have been actively functioning in both developed as well as developing countries.

Evolution of Futures Market in India

- Organized futures market evolved in India by the setting up of "Bombay Cotton Trade Association Ltd." in 1875. In 1883, a separate association called "The Bombay Cotton Exchange Ltd." was constituted.
- Futures trading in oilseeds were started with the setting up of Gujarati Vyapari Mandali in 1900. A second exchange, the Seeds Traders' Association Ltd., trading oilseeds such as castor and groundnuts, was setup in 1926 in Mumbai. Then, many other exchanges trading in jute, pepper, turmeric, potatoes, sugar, and silver, followed.
- Futures market in bullion began at Mumbai, in 1920.
- In 1940s, trading in forwards and futures was made difficult through price controls till 1952 when the government passed the Forward Contract Regulation Act, which controls all transferable forward contracts and futures.
- During the 1960s and 70s, the Central Government suspended trading in several commodities like cotton, jute, edible oilseeds, etc. as it felt that these markets helped increase prices for commodities
- Two committees that were appointed—Datwala Committee in 1966, and Khusro Committee in 1980, recommended the reintroduction of futures trading in major commodities, but without much result.

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

Functions of Futures Market

Futures markets like any other market or industry serve some social purposes. In the past section of this chapter, we have seen that futures markets have been recognized as

meeting the needs of some important users like hedgers, speculators, arbitrageurs, spreaders, etc. In the light of those, we will discuss the uses of financial futures market in the society as a whole in the context of risk transference, price stabilization, price discovery, price registration etc.

Hedging

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

For example, a farmer bears the risk at the planting time associated with the uncertain harvest price his wheat will command. He may use the futures market to hedge this risk by selling a futures contract. For instance, if he is expected to produce 1000 tons of wheat in next six months, he could establish a price for that quantity (harvest) by selling 10 wheat futures contracts, each being of 100 tons. In this way, by selling these futures contracts, the farmer intends to establish a price today that will be harvested in the futures. Further, the futures transactions will protect the farmer from the fluctuations of the wheat price, which might occur between present and futures period.

In brief, futures markets hedging activities are very much useful for society since they control, shift, avoid, reduce, eliminate and manage efficiently various types of risks. Further, derivatives enable the investors to modify suitably the risk characteristics of their portfolios, or to shift risk on to those who are willing to assume it for higher profits. In the absence of futures markets, the cost of risk to economy could be higher and might be worse off.

Price Discovery

Another important use of futures market is the price discovery which is the revealing of information about futures cash market prices through the futures market. As we know that in futures market contract, a trader agrees to receive or deliver a given commodity or asset at a certain futures time for a price which is determined now. It means that the futures market creates a relationship between the futures price and the price that people expect to prevail at the delivery date. In the words of M.J. Powers and D. Vogel, as stated in their book entitled, "Inside the Financial Futures Market", futures markets provide a mechanism by which diverse and scattered opinions of the futures are coalesced into one readily discernible number which provides a consensus of knowledgeable thinking. It is evident from this statement that

futures prices provide an expression consensus of the today's expectations about a specified future time. If these expectations are properly published then they also perform an information or publicity function for the users and the society. By using the information about the futures prices today, the different traders/observers in the market can estimate the expected spot price in the future time of a given asset. In this way, a user of the futures prices can make consumption or investment decisions more wisely. Further, price discovery function of the futures market also leads to the inter temporal inventory allocation function. According to this, the traders can compare the spot and futures prices and will be able to decide the optimum allocation of their quantity of underlying asset between the immediate sale and futures sale.

Financing Function

Another important function of a futures market is to raise finance against the stock of assets or commodities. Since futures contracts are standardized contracts, so, they make it easier for the lenders about the assurance of quantity, quality and liquidity of the underlying asset. Though this function is very much familiar in the spot market, but it is also unique to futures markets. The reason being the lenders are often more interested to finance hedged asset stock rather than un-hedged stock because the hedged asset stock are protected against the risk of loss of value.

Liquidity Function

They are operated on the basis of margins which are determined on the basis of rides involved in the contract. Under this the buyer and the seller have to deposit only a fraction of the contract value, say 5 percent or 10 percent, known as margins. It means that the traders in the futures market can do the business a much larger volume of contracts than in a spot market, and thus, makes market more liquid. That is why the volume of the futures markets is much larger in comparison to the spot markets. This is also known as gearing or leverage factor. It means that a trader in the futures markets can gear up his capital 10 times and 20 times if the margin/deposit is 10 percent and 5 percent respectively, resulting in his profit or loss, as a proportion of his capital is 10 times or 20 times magnified. Gearing is the British term and in American parlance it is known as leverage. This is explained by the following example:

Example

A speculator estimates a price increase in the silver futures market from the current futures price of Rs 7500 per kg. The market lot being 10 kg, he buys one lot of futures silver for Rs 75,000 (7500x 10). Assuming the 10 percent margin, the speculator is to deposit only Rs 7500. Now supposing that a 10 percent increase occurs in the price of silver to Rs 8250 per kg. The value of transaction will also increase, i.e., Rs 82,500,

and hence, incurring profit of Rs 7500(82,500-75,000) on this transaction. In other words, the speculator earns in this transaction Rs 7500 on the investment of Rs 7500, being 100 percent profit on investment, and vice-versa. From the above example, it is evident that futures markets operations are highly risky due to gearing effect. So they are more attractive for the speculators.

Price Stabilization Function

Another important function of a futures market is to keep a stabilizing influence on spot prices by reducing the amplitude of short term of fluctuations. In other words, futures market reduces both the heights of the peaks and the depth of the troughs. The major causative factors responsible for such price stabilizing influence are such as, speculation, price discovery, tendency to panic, etc. A detail discussion on price stabilization function of futures market will be made in the forthcoming chapters.

Disseminating Information

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

Further, such information disseminating service enables the society to discover or form suitable true/correct/equilibrium prices. They serve as barometers of futures in price resulting in the determination of correct prices on spot markets now and in futures. They provide for centralized trading where information about fundamental supply and demand conditions are efficiently assimilated-and acted on.

The financial futures markets have generated employment opportunities by creating a significant number of jobs and attracted a considerable volume of transactions from non-residents. Indirectly, it is another way of generating foreign exchange for the countries. Further the futures markets act as 'starter form of investment resulting in a wider participation in the securities markets. They attract young investors and act as catalysts to the growth of securities markets. They enable individuals and managers of funds to devise or design strategies for proper assets allocation, yield enhancements and reducing risks.

For example, futures markets quotations are also useful to other sectors of society besides speculators and hedgers. Which goods or commodities are to be produced and in which financial assets the investment is to be made, such decisions are assisted by the futures market prices. In brief, the futures markets enhance economic activities in the society in general, resulting in growth of economic development of the country.

UNIT 9

MARKING TO MARKET

Initial Margin and Mark to Market

In the discussion on payoff positions in futures, it has been shown that the ultimate profit or loss position of a party to a futures contract depends on the spot price of the underlying asset on the maturity date. As the parties are betting on the future spot price of the asset, their expectations may not come true and they may suffer loss. In view of this position, SEBI has provided that the buyer as well as the seller, both have to deposit an initial margin with the stock exchange broker on the date of the transaction. If the initial value of the futures contract is Rs 1,50,000 and the initial margin is 10%, then buyer and seller both have to deposit Rs 15,000 each with their respective brokers. From the date of the transaction till the squarring off date or maturity date, the futures price may rise or fall, as a result of which a partly may incur loss. The futures contracts are to be mark to market on daily basis i.e., additional margin money is to be deposited with the broker in view of the loss occurring till a particular date. For example, in the above case, the value of contract falls to Rs 1, 45,000 next day, and then mark to market margin of Rs 5,000 is to be deposited.

So, instead of waiting until the maturity date for the parties to book losses, SEBI requires all positions to recognize losses on daily basis as these accrue. This daily setting is called mark to market, where the maturity date does not govern the accrual of losses. Margin system is one basic difference between the forwards and futures. The forwards are simply kept till the maturity date without any intervening cash flows whereas the futures follow pay-as-you-go system.

Convergence Property

As futures contracts mature and are compulsorily settled on the specified maturity date, the futures price and the spot price of the underlying asset on that date must converge.

This may be called the convergence property. If the two prices are not equal then every investor would like to make profit by capitalizing the opportunity. But then, who will lose?

On the date of the settlement, the two prices would almost be same.

For example, an investor takes a long position in Nifty Futures (1 month) and holds that position till maturity. The sum of daily settlements (mark to market) would be equal to FT - F0 where F0 is initial futures price at contract time and FT is futures price on maturity.

As explained above, FT will be equal to ST due to convergence property, where ST is spot price of asset on maturity. So, the profit on maturity is S - F0 and it tracks changes in the price of the underlying asset. In Table, the convergence property and its effect on profit/loss on NIFTY futures have been shown.

Day	Future price	Profit/loss	Cumulative profit
0	1650	-	
1	1680	30	30
2	1685	5	35
3	1695	10	45
4	1685	-10	35
5	1690	5	40
6	1692	2	42

Due to the convergence property, the spot price of NIFTY on Day 6 could be 3692 and profit at settlement is (3692-3650) i.e., Rs 42 per unit. The same profit is also shown by column 3 and 4. The net receipts in mark to market are also Rs 42. So, the convergence property states that the futures prices and spot prices are equal on the maturity date. However, before maturity, the futures prices may differ substantially from current spot prices. So, from the point of view of the investor, if the futures contract and the asset are held until maturity, he bears no risk because on the maturity date, the asset value is equal to the current future price. Risk is eliminated because on that day, the futures prices and spot prices are equal. However, if the futures contract and assets are to be liquidated earlier, the investor in this case bears 'basis risk'. The reason being that future price and spot price are not in perfect lock up position at all times before maturity, and the profit/loss on one may not perfectly offset the loss/profit on the other.

Open Interest

In case of futures contracts, for every long position, there is simultaneously a short position. Open interest is a technical term used to refer to the number of contracts outstanding. In order to find out the open interest, the long and short are not added, rather the total long or short contracts are defined as open interest. The net position of the clearing house is always zero. Calculation of open interest is made in a very special way. Suppose, A, B, C, D, E and F are different investors. '+' refers to buying a futures contract and a '-' refers to selling of a futures contract on the same underlying asset. In practice, when trading in particular futures begins, the 01 is zero.

As time passes and more and more transactions take place, net OI positions fluctuate. As maturity date approaches, most of the parties square off their transactions and the net 01 position may become zero. It may come down to zero even before the maturity date. If still some positions are left, these will be cash settled or delivery settled as the case may be, on the maturity date.

The Operation of Margin

In addition to the clearing house, there are some other safeguards for futures contracts, important among these are requirements for margin and daily settlement. In this section, we will discuss the margin requirement applicable in case of investor and as a trader of the clearing house. As we know that two parties are directly trading an asset in the futures market for a certain prices there are obvious risks for backing out of any of the parties to the contract. It is also possible that one of them may not have the financial resources to honour the contract. That is why one of the important roles of the exchange is to organize the futures trading in such a way that the default risk will be minimum. This is why margins come into picture.

The Concept of Margin

Before entering into a futures contract, the prospective trader (investor) must deposit some funds with his broker which serves as a good faith deposit. In other words, an investor who enters into a futures contract is required to deposit funds with the broker called a margin. The basic objective of margin is to provide a financial safeguard for ensuring that the investors will perform their contract obligations. The exchanges set minimum margins but the brokers may require larger margins if they are concerned about an investor's financial situation because they are ultimately responsible for their clients' losses. The amount of margins may vary from contract to contract and even broker to broker. The margin may be deposited in different forms like cash, bank's letter of credit and treasury securities.

Normally the investor who posts this margin retains the title of the securities deposited as margin. The margin account may or may not earn interest. Some brokers may simply pay them money 'market interest rates on their margin account. However, most of the brokers usually do not pay interest on margin in money. This loss of interest is the cost of margin requirement.

Types of Margin

There are three types of margin such as initial margin, maintenance margin and variation margin. The initial margin is the original amount that must be deposited into account to establish futures position. It varies from stock to stock. To determine the initial margin, the exchange usually considers the degree of volatility of price movements inthe past of the underlying the asset. After that, the exchange sets the initial margin so that the clearing house covers losses on the position even in most adverse situation. The initial margin approximately equals the maximum daily price fluctuation permitted by the exchange for that underlying asset.

The exchange has the right to increase or decrease the quantum of initial marginal depending upon the likely anticipated changes in the futures price. For most of the futures contracts, the initial margin may be 5 percent or less of the underlying asset's value. After proper completion of all the obligations associated with a investor's futures position, the initial margin is returned to trader.

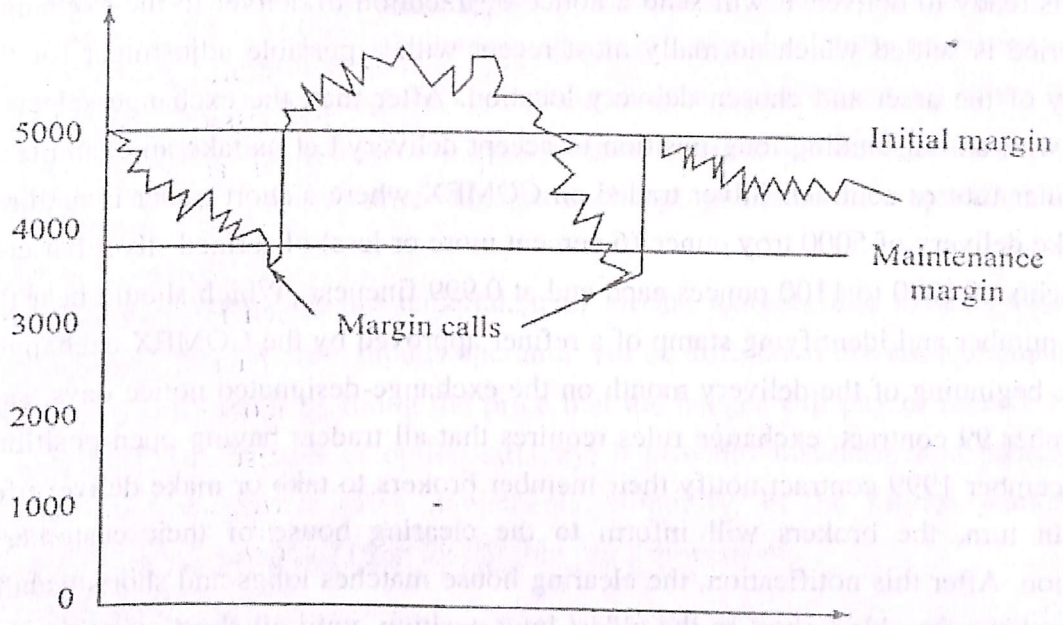
The Maintenance Margin

The maintenance margin is the minimum amount which must be remained (kept) in a margin account. In other words, so much minimum, balance in the margin account must be maintained by the investor. This is normally about 75 percent of the initial margin. If the futures prices move against the investor resulting in falling the margin account below the maintenance margin, the broker will make a call, i.e., asking the client to replenish the margin account by paying the variation. Hence, the demand for additional fund is known as a margin call.

For example, assume that the initial margin on a futures contract is Rs 5,000 and the maintenance margin Rs 3,750 (75% of the initial margin). The next day assume that the party has sustained a loss of Rs 1,000, reducing the balance in margin to Rs 4,000. Further assume that on the next day the price decreased and sustained loss is Rs 500. Thus, the balance remained in the margin account to Rs 3,500, below the maintenance margin. In this situation, the broker will make a call (margin call) to replenish the margin account to Rs 5,000, the level of initial margin.

The Variation Margin

It refers to that additional amount which has to be deposited by the trader with the broker to bring the balance of the margin account to the initial margin level. For instance, in the above mentioned example, the variation margin would be Rs 1500 (Rs 5000— Rs 3500), i.e., the difference of initial margin and the balance in the margin account, the same has been shown in Fig. If the investor does not pay the initial margin immediate, the broker may proceed to unilaterally close out the account by entering into an offsetting futures position.



Account equity and margin requirements.

Margins and Marking-to-Market (Daily Settlement)

It has been observed that the initial margin, sometimes, is even less than 5 percent which seems to be very small considering the total value of the futures contract. This smallness is reasonable because there is another safeguard built in the system, known as daily settlement marking-to-market. In the futures market, all the transactions are settled on daily basis. Thus, the system of daily settlement in the futures market is called marking to market. The traders realize their gains or losses on the daily basis to understand this process of daily settlement. The basic purpose of the mark-to-marking is that the futures contracts should be daily marked or settled and not at the end of its life. Every day, the trader's gain (loss) is added or (subtracted), the margin on the case may be. This brings the value of the contract back to zero. In other words, a futures contract is closed out and rewritten at a new price every day.

Closing a Futures Position (Settlement)

There are four ways to close the futures position, namely, physical delivery, cash settlement, offsetting and exchange of future for physicals (EFP).

Physical Delivery

One way of liquidating of futures position is by making or taking physical delivery of the goods/asset. The exchange has provided alternatives as to when, where and what will be delivered. It is the choice of the party with a short position. When the

party is ready to deliver, it will send a notice of intention to deliver to the exchange. The price is settled which normally most recent with a possible adjustment for the quality of the asset and chosen delivery location. After that, the exchange selects a party with an outstanding long position to accept delivery.Let us take an example of particular futures contract: Silver traded on COMEX where a short-trader is required to make delivery of 5000 troy ounce (6 percent more or less) of refined silver bar cost in heights of 1000 to 1100 ounces each and at 0.999 fineness. Which should bear the serial number and identifying stamp of a refiner approved by the COMEX exchange? At the beginning of the delivery month on the exchange-designated notice days, say, December 99 contract, exchange rules requires that all traders having open positions in December 1999 contract notify their member brokers to take or make delivery for this. In turn, the brokers will inform to the clearing house of their customer's intention. After this notification, the clearing house matches longs and shorts usually by matching the oldest short to the oldest long position, until all short quantities are matched. Delivery notices are then to all the traders through their brokers indicating to whom their delivery obligations runs and when, where and in what quantities is to be made. Some exchanges impose heavy penalty in case of default by any party. When delivery is satisfactory made then the clearing house notify and accord the same. In case of financial futures, delivery is usually made by wire transfer.

Cash Settlement/Delivery

This is relatively new procedure followed for setting futures obligations is through cash delivery. This procedure is a substitute of physical delivery and hence, do not require physical delivery. The exchange notifies about this where cash delivery as the settlement procedure. There are certain financial futures like stock indices futures, certain treasury securities, euro-dollar, time deposits, municipal bonds, etc. When a cash settlement contract expires, the exchange sets its final settlement price equal to the spot price of the underlying asset on that day. In other words, it is simply marked-to-market at the end of the last trading day to handover the underlying assets. Since cash settlement contracts are settled at the spot price, their futures prices are converged to the underlying spot prices. Therefore, the prices of cash settlement contracts behave just like the prices of delivery contracts at their expiration period.

UNIT 10

PRICING OF FUTURES

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

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

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

$$S0 = F0/(1 + r)t$$

$$F0 = S0 \times (1+r)t$$

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

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

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

(iii) Risk-free rate of interest.

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

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

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

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

(iv) The futures contract period is also a quarter.

What should be the price of futures?

say, S = Current spot price of the asset

F Futures price

r = % Financing cost per futures period

y = % Yield on investment per futures period

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

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

In the example given above,

F = 100 + 100 (.02 -.03) = Rs 99

So, the futures price should be Rs 99. What happens if the futures price is Rs 92 or Rs 107? The position can be explained as follows:

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

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

He would be able to make a profit of Rs 8.

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

Offsetting

The most common and popular method of liquidating the open futures position is to effect an offsetting futures transaction or via a reversing trade which reverses the

existing open position. For example, the initial buyer (long) liquidates his position by selling (going short) an identical futures contract (which means same delivery month and same underlying asset). Similarly, the initial seller (short) goes for buying (long) an identical futures contract. After executing these trades, these are reported to the clearing house then both trade obligations are extinguished on the books of the brokers and the clearing house.

No doubt, the clearing house plays a significant role in facilitating settlement by offset. In comparison to the physical delivery, this method is relatively simple which requires good liquidity in the market, and entails only, the usual brokerage costs.

For example, there are two parties X and Y. X has an obligation to the clearing house to accept 10,000 bushels of cotton in September and to pay Rs 180 per bushels. For them at that time. X does not wish to actually receive the oats and want to exit the futures market earlier.

Similarly, Y has a obligation to the clearing house to deliver 10,000 bushels of cotton in September and to receive Rs 180 per bushels. Both party can reverse or offset their position in that way whereby buyer becomes seller and seller becomes the buyer. Before the due date i.e., September, X will sell September contract for cotton at Rs 190 per bushels Y will buy at Rs 190 per bushels.

Exchange of Futures for Physicals (EFP)

This is another method of liquidating the futures contract in a form of physical delivery, called exchange of futures for physicals. In this method, a party who holds a futures contract may like to liquidate his position that is different from those the exchange offers.

For example, a party may like to deliver the assets before the specified futures period, or may deliver the asset at different place, or deliver outside the normal trading hours, etc.

In simple terms, the contracts fulfilled by the parties on non-contract terms under this technique. For example, a party with a long gold futures position may wish to take delivery in Los Angels rather than in New York, as the contract specifies. Further, the EFP system permits to exchange a futures position for a cash position that meets both the parties' preferences, of course, for EFP, the party must find another party willing to make the trade.

The exchanges allow the parties to deliver under non-contract terms, and without going through the trading pits. However, both the short and the long in an EFP transaction must notify the exchange and the clearing house of the said EFP agreement so that the clearing house can make proper book entries to extinguish the respective short and long positions on its books.

The Exchange of Futures for Physicals (EFP) differs in certain respects from the offsetting method. First, the trader actually exchanges the asset in physical form. Second, such agreements are not performed/closed by a transaction on the floor of the exchange.

Third, the two trades negotiate privately the price and other terms of the contract which are usually different from the specifications. Since these agreements are negotiated outside the trading pit, so they are also called ex-pit transaction. Further, regulatory authorities and exchange rules require that all the futures trading be liquidated in the pit, hence, the EFP is the one recognized exception to this general rule. These contracts are also known as against actual or versus cash transactions.

Theories of Futures Prices

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

1. The Cost-of-Carry Approach

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

1. Storage costs
2. Insurance costs
3. Transportation costs
4. Financing costs

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

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

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

Another important carrying cost is cost of financing the underlying asset. For example, if gold costs Rs 5000 per 10 grams and the financing rate are one percent per month then the financing charge for carrying the gold forward is Rs 50 per month (1% of 5000). Apart from the carrying cost on an underlying asset, there can be possibility of earning a yield on storing the asset. Such yield is known as 'convenience yield' from holding stocks. For example, in case of wheat, there could arise extra yield due to low production of wheat due to bad weather in futures.

A). The Cost-of-Carry Model in Perfect Market

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

Futures price = Cash (spot) price + Carrying cost

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

1. There are no information or transaction costs associated with the buying and selling the asset.
2. There is unlimited capacity to borrow and lend.
3. Borrowing and lending rates are the same.
4. There is no credit risk. No margin is required on buying and selling the asset.
5. Goods can be stored indefinitely without loss to the quality of the goods.
6. There are no taxes.

B)The Cost-of-Carry Model in Imperfect Market

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

Direct Transaction Cost

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

Unequal or Differential Borrowing and Lending Rates

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

Restriction on Short- Selling

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

Bid-Ask Spread

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

Storage Problem

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

2. The Expectation Approach

This approach is advocated by distinguished luminaries like J. M. Keynes, J. R. Hicks and N. Kalidor who argued the futures price as the market expectation of the price at the futures date. Many traders/investors, especially those using futures market to hedge, would like to study how today's futures prices are related to market expectations about futures prices. For example, there is general expectation that the price of the gold next April 1 will Rs 5200 per 10 grams. The futures price today for July 1 must be somewhat reflects this expectation. If today's futures price is Rs 5180 of gold, going long futures will yield an expected profit of Expected futures profit = Expected futures price - Initial futures price Rs 20 = Rs 5200 - Rs 5180. Any major deviation of the futures prices from the expected price will be corrected by speculative activity. Profit seeking speculators will trade as long as the futures price is sufficiently faraway from the expected futures spot price. This approach may be expressed as follows:

$$F0.t = E0\ (St)$$

Where F0.t. is Futures price at time t = 0 and E0 (St) is the expectation at t = 0 of the spot price to prevail at time t.

The above equation states that the futures price approximately equals the spot price currently expected to prevail at the delivery date, and if, this relationship did not hold, there would be attractive speculative opportunities. In simple terms, the futures price

are influenced to some extent on expectations prevailing at the current time. Under this hypothesis, if markets are operating properly then Current futures price = Expected futures spot price.

This is also known as hypothesis of unbiased futures pricing because it advocates that the futures price is an unbiased predictor of the futures spot price, and on an average, the futures price will forecast the futures spot price correctly.

We have seen above that on an average' or 'approximately' words have been used to equalize the current futures price with the expected futures spot price. Why does this relationship hold only approximately? There are two arguments to the question. Firstly, it is due to transaction costs, and secondly due to risk aversion of the traders. Transaction costs can keep the futures price from exactly equalling the expected futures spot price.

3. Futures Prices and the Capital Asset Pricing Model

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

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

Systematic-Risk Explanation

It is observed that, sometimes, the futures prices differ from expected futures spot prices even after adjusting for systematic risk because of unevenly distributed demand by hedgers for futures positions. For example, if hedgers are dominating in the market through short sales then long hedgers will receive an expected profit in addition to any systematic risk premium.

4. An Integrated Approach

The various theories presented earlier, sometimes, present controversial view, e.g. one theory states that futures price are based on carrying costs whereas other one argues purely on expectations or forecast. A number of empirical studies have attempted to verify the reliability of these theories and have resulted in greater clarity and better applicability.

In this section, an attempt is made to integrate the various stands of these theories here in brief:

1. Futures prices of those assets which have continuous production or continuous storage capacity broadly follow the carrying cost approach.
2. Those goods or assets which are of discontinuous production or storage nature (perishable nature) should follow expectation approach.
3. It was also observed that the expectations also influence the futures prices of continuous production or storage products. It was seen that the carry cost approach determines the maximum limit of spread but not the minimum limit. Further, fluctuations within the maximum limit are often related to expectation approach.
4. It is also observed that expectations may predominate, sometimes, even in continuous

production or storage markets, for such periods indicated in the present by some futures events like ongoing strike, railway disruption, futures labour unrest weather conditions, expected election, etc. which are expected to change the market situation.

5. It is also noticed that the normal backwardation approach tends to exist in those markets which are relatively thin, where speculators are induced to enter in the market.

UNIT 11
FUTURES & HEDGING

The Concept of Basis Risk and Hedging

Understanding basis risk is fundamental to hedging. It is noted earlier that basis is the difference between the spot price (cash price) and futures price of an underlying asset. If the spot price is higher than the futures price, then the basis will be called as positive or over and vice-versa. This concept in equation form is as under:

Basis tT = Cash price t - Futures pricet T

If the futures prices and cash prices always change by the same amount then the basis will not change and it will be zero. It means there could be no change in the basis,

if Futures price = Cash price, then

Basis tT = Futures price - Cash price = 0

There is basis risk when the changes in futures prices and cash prices are not equal. Further in this case, if the magnitude (in units) of the cash futures positions are identical then any loss (gain) in the value of the cash position will be totally offset by the gain (loss) in the value of the futures position. Prior to expiration, the basis may be positive or negative. For example, low-interest rate currency or gold or silver assets, usually futures price is greater than the spot price, which means that basis is negative and vice-versa. When the change in spot price is more than the change in futures price, the basis will increase which is known as a strengthening of the basis. Similarly, if the change in spot price is less than the change in futures price, the basis will decrease; it is referred to as a weakening of the basis.

In this section, we will discuss the concepts and principles involved in designing a specific hedging strategy. So, different issues concerning to it like how to select a futures contract for hedging, how to determine and calculate the optimal hedge ratio, how to design and manage a hedging strategy and so on will be discussed.

Deciding on the Futures Contract

The basic objective of an hedging strategy is to minimize risk or to maximize hedging effectiveness. In this respect, the first step towards designing a particular hedging strategy is to decide about the futures contract to be undertaken. For this purpose, two aspects are considered: first, what kind of futures to use, and second, which contract month of that futures to be used.

a). Which Futures Contract

While deciding about the futures contract to be undertaken, the hedger must consider that the correlation between the cash and futures prices must be very high. When hedging an asset on which no futures contract is traded, the choice is more difficult.

Thus, first starting point to select a futures contract is to select such assets which are inter-related. In other words, evaluating the correlation coefficients of various price risk associated with, for example, with jet fuel, heating oil, gasoline, crude oil, etc. Likewise, with gold we can use gold coins, bullion, silver, silver coins, etc.

b) Which Contract Month

The second important consideration in designing a hedging strategy is to select the contract month. We see that futures contracts are available in the market of different months. So the selection of month of a futures contract will depend upon the such period where the futures and spot prices are highly correlated. Obviously, the prices of the near month contract are the most highly con-elated with cash price. Thus, using the near month futures contract will reduce basis risk (or variance of the basis) the most. Since it is seen that the variance of the basis increases as the price correlation between cash and futures price decreases. Hence, hedging with the near month futures contract is preferable because it minimizes the basis variation.

It should be noted that the principle of choosing the futures contract should be applied in the context of specific hedging situations. Matching cash and futures obligations in different situations will be another way of dominating or minimizing basis risk. This strategy, of course, will be useful only if the duration of a hedger's cash obligations is fixed and known in advance, and there exist a matching futures contract where the hedger can not estimate his cash obligation with certainty, then in this situation he will not be able to pursue a matching strategy, but may want to hedge continuously.

Thus, hedging in a continuous cash obligation, there can be two alternatives:

(a) Hedging with a nearby futures and rolling the hedge forward,

(b) Hedging with a more distant futures contract, and rolling it less frequently.

Both the alternatives have their own mechanism depending upon the hedging objective. For example, using a more distant contract usually increases basis risk because its price will be less correlated with spot market prices. But the brokerage cost and other transaction costs will be more due to frequent sales and purchases in the market. No specific rule can be made to decide between these alternatives. However, the hedgers in most cases, prefer to hedge with a futures contract that has a high price correlation either with the near month or the second month contract.

Hedging Objectives

In the prior discussion of hedging strategies, we have assumed the only objective of hedging is to minimize the risk. However, sometimes, the hedgers may be willing to assume more risk in order to earn more profit because eliminating all price risk will lead to eliminating the profit of the firm, which may not be good at all the time. Thus,

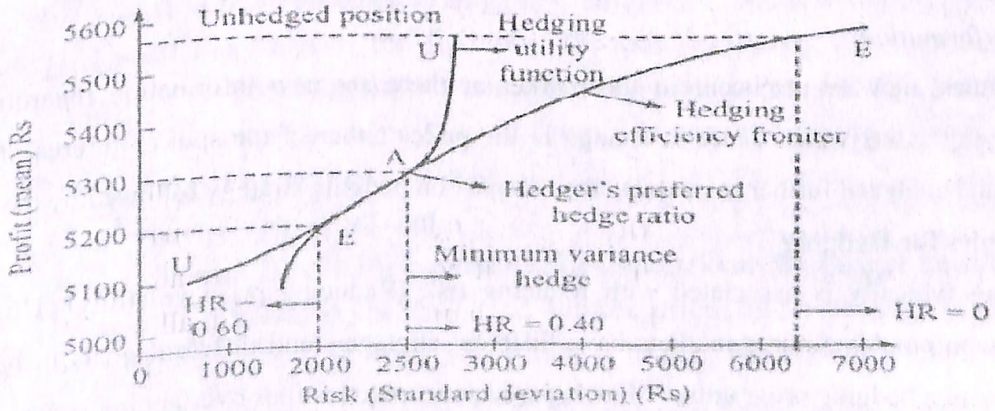
the hedgers may use such hedging ratio other than the minimum-variance hedge ratio, or willingly may go for under hedging.

Undoubtedly the decision relating to hedging ratio or how much to hedge will depend upon the hedger's risk preference. The lesser he hedges, the more risk he assumes. Not only this, the hedger may change his hedging strategy later on due to his strong belief about the futures price movements. So hedging objective is a relative concept and much depends upon the risk and return. In other words, it is the tradeoff between profits and risk reduction through hedging because it is observed that risk could be reduced but at the cost of lost profits. Figure depicts trade off between risk and profit at the different level of hedge ratios. The hedger may choose the risk and return combination that he most prefers, or that he finds optimal. In this figure, line EE represents the hedging efficiency frontier: the most efficient combinations of risk and return that can be achieved by varying the hedge ratio.

The line UU represents the highest level of utility which the hedger can achieve by hedging (being on the efficient frontier EE). The slope of UU represents how the hedger values change in risk relative to changes in profits. The value replaces on changes in risk versus changes in profit will determine his decision.

For example, at the point E, the hedge ratio is 0.60 where the expected profit is Rs 5200 at Rs 2000 standard deviation. Further, if he chooses the hedge ratio 0.40, by doing so he will increase risk to Rs 2500 (by standard deviation). Point A where UU and EE touch (or tangent), indicates the hedger's optimal ratio (β= 0.40). This hedge strategy yields a profit of Rs 5300 and a standard deviation of Rs 2500, which yields a profit utility to the hedger.

In brief, the hedge can remain completely unhedged (β = 0), or can adopt them minimumvariance hedge (β = 0.60) yielding lower utility than that it would be at a hedge ratio of 0.40.



Management of the Hedge

After establishing an hedge, it is essential to manage it effectively. So regular monitoring and making adjustments are the key factors in managing of the hedge. There also needs to be a systematic evaluation of the effectiveness of the hedge relative to its anticipated (or excrete measure). Further, if the desired results are not being achieved from the hedging then the reasons should be identified and necessary steps be taken to improve hedge effectiveness in the futures. To manage effectively the hedging, following steps are taken:

Monitoring the Hedge

Continuous monitoring on the performance of an hedging is essential. For this purpose, the following information should be available regularly on an up-to-date basis:

Cash Position

The hedger must get the information of the current size of the cash position being hedged. What are the changes in its magnitude since the inception of hedge? What are the gains or losses on this position to date? What are the reasons of such deviation, if any.

Futures Position

Likewise cash position, the information regarding the size of futures position, profits and losses incurred to date on this position, etc. be collected for further consideration.

Margins

All such information concerning the margin like the total amounts of funds dedicated to margin requirements, net financing to-date, ng costs to- and further, the availability of funding arrangements to meet futures margin calls, etc. should be available continuously.

Basis Movements

All such information regarding the changes in basis should be collected to see whether they are consistent with a priori expectations or there is any major deviations at the particular time intervals.

New Information

Sometimes, new events occur in the market or there are new information regarding the underlying assets which cause to change in the prices either of the spot or futures must be noted and analyzed further to evaluate their impact on hedging strategy followed by the firm.

Strategies for Hedging

Hedging typically is associated with reducing risk (Reducing price volatility). However, those who employ futures markets have different strategies and different goals in order to implement a hedging programme. Market participants practice four overlapping strategies:

- Reduction of risk: the primary use of futures for hedging is to reduce the price variability associated with the cash asset position. Naive, regression, and duration methods determine the appropriate number of futures contracts for a hedge position. The objective of the regression and duration methods is to minimize the risk associated with a cash position.
- Selective hedging: hedging only during those time periods when a forecast determines that the cash position will lose money is called selective hedging. If the forecasts are correct then risk is minimised during the hedged periods; meanwhile the asset earns positive returns during the un hedged periods. If the forecasts are incorrect, then risk is not reduced. Many institutions employ some type of market timing to decide when to use selective hedging
- "Speculating on the basis": when the returns from the hedge are a consideration in whether the hedge will be undertaken, then this approach is equivalent to predicting the change in the basis during the hedge period.
- Optimal risk-return hedging: the optimal hedge decision considers both the reduction in risk and the return from the combine cash-futures position. Such an optimal position is associated with portfolio analysis.

The above strategies also can be designated as passive or active strategies. A passive strategy is independent of cash market price/interest rate expectations. Passive strategies depend on the risk attitude of the hedger and the volatility of the cash markets. Active strategies require a forecast of future cash price/interest rates for implementation. The forecast helps the money manager decide when and how much of the cash position to hedge. Thus, an active hedging strategy readjusts the hedging position over time.

The "reduction of risk" strategy listed above is a passive strategy. "Selective hedging" and "speculating on the basis" are active strategies. The "optimal risk-return" strategy can be either a passive or active strategy depending on whether the risk attitude of the hedger or the forecasts of the cash market determine the size of the hedge position.

Avoiding Losses: Sell or Hedge?

A typical question concerning hedging is, "Why should I hedge when I can sell the cash asset if I expect prices to decline?" In fact, selling the cash asset is preferable in some circumstances. The principal rule for deciding whether to make a transaction in the cash market or to hedge in the futures market depends on many factors.

If you can accomplish your goal "effectively" in the cash market, then complete your transaction in that market.

The key to this rule is the word "effectively." In many situations one or more of the following factors cause difficulties if the transaction is completed in the cash market:

- Liquidity: the cash market for a given asset often is not liquid for large trades. Thus, the portfolio hedger who sells or buys the cash asset, or the dealer who shorts the asset, causes a significant price change in that security when liquidity does not exist. There is no liquidity problems for trades in most (near-term) financial futures contracts.
- Cost: the commissions and size of the bid-ask spread in the cash market often cause the cash transaction to be expensive relative to the same transaction in the futures market. For example, trades in a stock portfolio cost ten times the equivalent trade in futures.
- Execution: a futures transaction is initiated much quicker than a cash transaction due to liquidity reasons.
- Short selling: a short sale in the cash market typically is expensive.
- Internal policy or government-regulations: these factors can prevent the desired cash market transaction. For example, a portfolio manager often is required to have a given minimum percentage of assets in bonds rather than in cash or short-term securities, or a financial institution may be prevented from shorting a cash security to obtain an effective cash market hedge.
- Credit risk: creating a forward or short sale in the cash market often involves an implicit credit risk on the part of the participants. Futures transactions are completed with the cleaning house, virtually eliminating the credit risk problem.

Future prices on stock indices

An index can be thought of as an investment asset that pays dividends. The asset is the portfolio of stocks underlying the index, and the dividends are the dividends that would be received by the holder of this portfolio. Often there are many stocks underlying the index providing dividends at different times. To a reasonable approximation, the index can then be considered as an asset providing a continuous dividend yield. If q is the dividend yield rate, then the futures price is

$$F_0 = S_0 e^{(r-q)*T}$$

If $F_0 > S_0 e^{(r-q)*T}$, profits can be made by buying the stocks underlying the index and shorting futures contracts.

If $F_0 < S_0e^{(r-q)*T}$, profits can be made by shorting or selling the stocks underlying the index and taking a long positions in futures contracts. These strategies are known as index arbitrage.

Stock index futures can be used to hedge the risk in a well-diversified portfolio of stocks. As you know, the relationship between the expected return on a portfolio of stocks and the return on the market is described by the beta (β). When β=1, the return on the portfolio tends to mirror the return on the market. When β=2, the excess return on the portfolio tends to be twice as great as the excess return on the market.

When the β of the portfolio equals 1, the position in futures contracts should be chosen so that the value of the stocks underlying the futures contracts equals the total value of the portfolio being hedged. When β=2, the portfolio is twice as volatile as the stocks underlying the futures contract and the position in futures contracts should be twice as great. In general, the correct number of contracts to short in order to hedge the risk in the portfolio is

$$N=\beta*P/A$$

where P is the value of the portfolio and A is the value of the underlying one future contract (it is 250 times the current index price). This formula assumes that the maturity of the futures contract is close to the maturity of the hedge and ignores the daily settlement of the futures contract.

Example

A company wishes to hedge a portfolio worth 5.000.000 over the next three months using an S&P500 index futures contract with four months to maturity. The current level of the S&P500 is 1000, the futures price is 1010, and the β of the portfolio is 1,5. The value of the assets underlying one futures contract is 1000*250=250.000. The correct number of futures contracts to short is, therefore,

1,5*5.000.000/250.000=30

To show that the hedge works, we suppose the risk-free rate is 4% per year and the value of the S&P500 index is 900, while the futures price id 902. The risk-free rate is 1% per three months. Assume that the dividend yield on the index is 1% per annum, or 0,25% per three months. This means that the index declines by 9,75% during the three months. From CAPM we find that the return of the portfolio

$$R_P = R_f + b^*(R_M + q_M - R_f) = 1+1.5*(-10+0.25-1) = -15.125\%$$

The gain from the short futures position is

(1010-902)*250*30=810.000

The expected value of the portfolio at the end of the 3 months is:

5.000.000*(1-0.15125)=4.243.750

It follows that the expected value of the hedger's position, including the gain on the hedge is

4.243.750+810.000=5.053.750.

The net gain is about 1%. This is expected. The return on the hedged position during the three months is the risk-free rate. It is easy to verify that roughly the same return is realized regardless of the performance of the market.

UNIT 12

OPTIONS CONTRACTS

Introduction

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

Consider an option on the share of a firm, say ITC Ltd. It would confer a right to the holder to either buy or sell a share of ITC. Naturally, this right would be available at a price, which in turn is derived from the price of the share of ITC? Hence, an option on ITC would be priced according to the price of ITC shares prevailing in the market. Of course this right can be made available at a specific predetermined price and remains valid for a certain period of time rather than extending indefinitely in time.

The unique feature of an option is that while it confers the right to buy or sell the underlying asset, the holder is not obligated to perform. The holder of the option can force the counterparty to honour the commitment made. Obligations of the holder would arise only when he decides to exercise the right. Therefore, an option may be defined as a contract that gives the owner the right but no obligation to buy or sell at a predetermined price within a given time frame. It is the absence of obligation to perform for one of the parties that makes the option contract a substantially different derivative product from forwards and futures, where there is equal and binding obligation on both the parties to the contract. This unique feature of an option makes several applications possible that may not be feasible with other derivative products.

Terminology of Options

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

Call Option

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

Put Option

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

Buyer or Holder

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

Writer or Seller

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

Premium

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

Strike Price

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

Strike Date/Maturity Date

The right to exercise the option is valid for a limited period of time. The latest time when the option can be exercised is called the time to maturity. It is also referred to as expiry/maturity date. These terms would become clearer when the two basic options, call and put are described in detail.

Call Option

Assume that share of ITC is currently trading at Rs 180. An investor, John, believes that share is going to rise at least to Rs 220 in the immediate future of the next three months. John does not have adequate funds to buy the shares now but is expecting to receive substantial money in the next three months. He cannot afford to miss an opportunity to own this share. Waiting for three months implies not only a greater outlay at a later point of time, but also means foregoing of substantial potential gains. Another investor, Mohammad, holds contrary views and believes that optimism of John is exaggerated. He is willing to sell the share.

What can John do under these circumstances where he cannot buy the shares on an outright basis now? He possibly could borrow to acquire the stock of ITC. This is fraught with risk of falling prices. Amongst the many alternatives that may be available to John is included an instrument called call option. He can instead buy a call option from Mohammad (assuming he is willing to confer the same) stating that John has a right to buy a share of ITC from Mohammad at a price of, say, Rs 190 at

any time during the next three months. This would be a call option (the option to buy). John is the holder of the option, while Mohammad is the writer/seller of the option. In case John decides to buy the share (exercise the option) he would pay Rs 190, the strike/ exercise price. The period up to which John can exercise this option is three months. Note that John has the option, which he may not exercise, but Mohammad has no such choice and he stands committed to deliver the share and receive Rs 190 from John, irrespective of the price of ITC share at that time. Naturally, Mohammad would not provide such a right for free as he is obligated to perform at the option of another. Therefore, Mohammad would charge some fee, called option premium, to grant this right to John. This premium is determined inter alia by the price of the underlying asset, the ITC share. We shall discuss later how this premium is decided.

We now discuss the circumstances when John would exercise his option. He would use this right only when the actual price of the ITC share has gone beyond Rs 190 (the exercise price). Imagine it has moved to Rs 200. By exercising the option he stands to gain immediately Rs 10, as he gets one share from Mohammad by paying Rs 190 and sells immediately in the market at Rs 200. Logically, John would not exercise the option if the price remained below Rs 190. In any case he loses the premium paid. If the price remains below Rs 190, Mohammad would not be asked to deliver and the upfront premium he received would be his profit. We may generalize the outcome of a call option in the following manner. As long as the price of the underlying asset, S, remains below the strike price, X the buyer of the call option will not exercise it; and the loss of the buyer would be limited to the premium paid on the call option c and if the price is more than exercise price the holder exercises the option and generates profit equal to the difference of the two prices.

Alternatively,

When S <X Buyer lets the call expire Loss = premium c

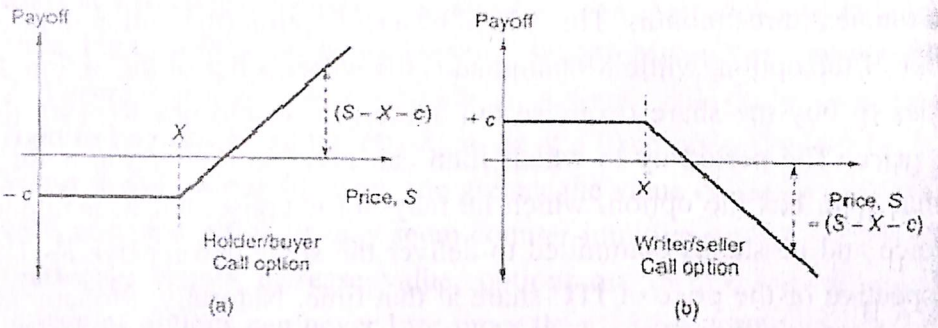
S=X Buyer is indifferent Loss = premium c

S>X Buyer exercises the call option Gain = S- X— c

Mathematically, the value of the call is given by Equation (2.1)

Value of the call option = Max (0, S— X) - c (2.1).

A graphical depiction of the payoff of the holder and the writer of the call option is easier to comprehend and is presented in Figure



Put Option

Put option is similar to call option except the fact that it is an option to sell. Again we take a small example from stock markets to clarify how put option works. Again assume that share of ITC is currently trading at Rs 180. An investor, John, in possession of the share (it is not necessary to have the share to enter into an options contract) believes that the share is likely to fall to Rs 150 in the immediate future of the next three months. John is not sure of the fall but would like to exit from his investment at Rs 175.

He is seeking protection against the heavy fall in the price. Another investor, Mohammad, holding contrary views believes that the pessimism of John is exaggerated. He is willing to buy the share at Rs 175 since he feels that is the lowest it can go. John believes ITC is a good long-term buy but is unsure when the scrip would show its potential. He does not want to exit unnecessarily. Under these circumstances John can buy a put option (the right to se4 to Mohammad stating that he has a right to sell a share of ITC to at a price of Rs 175 at any time during the next three months. In case John decides to sell the share (exercise the option) he would receive Rs 175, the strike/exercise price in the next three months. John has the option, which he may or may not exercise, but Mohammad has no such choice and he stands committed to pay the agreed price and claim the share.

Like in the call option, Mohammad would not grant such a right for free and charge some fee, called option premium. This premium is determined inter alia by the price of the underlying asset, the ITC share. John would exercise his option only when it is profitable to do so. The option would become profitable when the actual price of the ITC share falls below Rs 175 (the exercise price). Imagine that it has moved to Rs 160. By exercising the option John stands to gain immediately Rs 15 by placing the share to Mohammad and realize Rs 175 from him and using the proceeds to acquire a share of ITC from the market at Rs 160. This keeps his earlier position intact and yet

gives Rs 15 as profit. Logically, John would not exercise the option if the price remains above Rs 175. However, under all circumstances he loses the premium paid.

We may generalize the outcome of a put option in the following manner. As long as the price of the security remains below the strike price the buyer of the option will exercise it because he stands to gain; otherwise his loss would be limited to the premium paid on the put option p.

When S< X Buyer exercises the option Gain= X— S—p

When S= X Buyer is indifferent Loss = premium, p

When S> X Buyer lets the contract expire Loss = premium, p

Mathematically, the value of the put is given by Equation2.2.

Value of the put option = Max (0, X— S) – p (2.2)

The graphical view of the payoff for put option, holder and writer is shown in Figure a and (b).

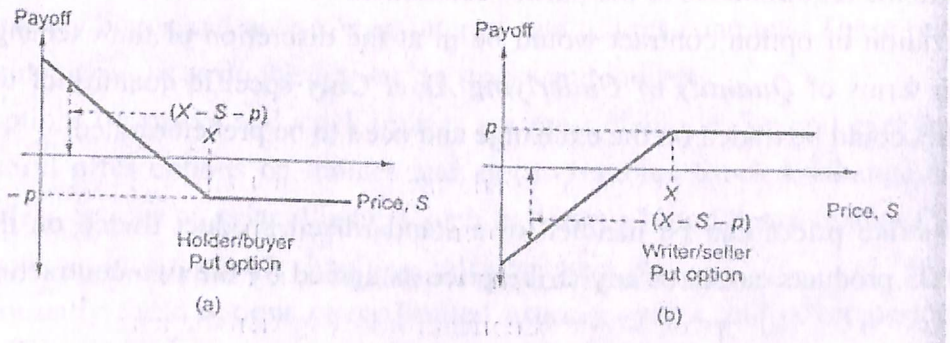
(a) The payoff diagrams for call and put options as depicted in Figures and respectively,

(b) reveal that the payoff of options is not linear. While it may be unbounded at one end the

(c) other end is limited to loss/gain equal to the premium of option. This non-symmetrical nonlinear

(d) payoff results from feature of 'right but no obligation' and makes options different

(e) from other derivative products



UNIT 13

TYPES OF OPTIONS

Types of Options

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

- Based on nature of exercise of options
- Based on how are they generated, traded, and settled
- Based on the underlying asset on which options are created

Nature of Exercise: American Versus European

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

Nature of Markets: OTC Versus Exchange Traded

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

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

Strike Prices

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

Expiration Dates

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

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

Ways of Settlement

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

Nature of Underlying Assets

Like forwards and futures, options too can have any asset as underlying. Options on stocks, indices, commodities, currencies, and interest rates are available either OTC or on exchanges. Though not available in India as of now, options on commodities are traded internationally on agricultural products, live stock, food products, energy, and metals.

Options are also available on various currencies, such as US dollar, euro, yen, pound, etc. In major exchanges in the USA and Europe as also other parts of the world. Options on currencies are mostly OTC.

Besides, options are also traded on the exchanges on futures contracts rates. Options on futures have futures contract as underlying asset, which give the buyer a right to buy (call) or sell (put) the specified futures contract within or at specified time. Naturally, the expiry of the futures contract must extend beyond that of option contract.

Similarly, options can also be traded on interest rates, either on cash assets such as treasury bonds and notes, or on interest rate futures contracts. These options serve the same purposes as do the options on stocks and indices.

Options on stocks and stock indices are most common. Several exchanges across the world offer options on indices and stock. National Stock Exchange (NSE) in India offers options on several indices such as Nifty, a broad-based index of 50 stocks from banking, information technology, infrastructure, etc.

Presently these options cover limited exercise prices and cover periods up to three months. However, internationally options for longer periods of up to two to three years are also available. NSE attempts to provide minimum j five strike prices—two ITM, one ATM, and two OTM at any point of time).

Naked (Uncovered) and Covered Option

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

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

Covered callcall sale = Short call + Long futures

Covered put sale = Short put + Short futures

The Underlying Assets in Exchange-Traded Options

Various assets, which are actively traded on the recognized exchanges, are stocks, stock indices, foreign currencies and futures contracts. These have been explained in brief here as under:

Stock Options

Options on individual shares of common stock have been traded for many years. Trading on standardized call options on equity shares started in 1973 on CBOE whereas on put options began in 1977. Stock options on a number of over-the-counter stocks are also available. While strike prices are not because of cash dividends paid to common stock holders, the strike price is adjusted for stock splits, stock dividends, reorganization, recapitalizations, etc. which affect the value of the underlying stock. Stock options are most popular assets, which are traded on various exchanges all over the world. For example, more than 500 stocks are traded in United States. One contract gives the holder the right to buy or sell 100 shares at the specified strike price. In India, the National Stock Exchange and Bombay Stock Exchange have started option trading in certain stocks from the year 2001.

Foreign Currency Options

Foreign currency is another important asset, which is traded on various exchanges. One among these is the Philadelphia Stock Exchange. It offers both European as well as American option contracts. Major currencies which are traded in the option markets

are US dollar, Australian dollar, British pound, Canadian dollar, German mark, French franc, Japanese yen, Swiss franc, etc. The size of the contract differs currency to currency. This has been explained in more detail in the chapter on currency option.

Index Options

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

The money value of the stock index underlying an index option is equal to the current cash index value multiplied by the contracts multiple. This is calculated as: Rupee value of the underlying index = Cash index value x Contract multiples For example, the contract multiple for the S&P 100 is $100. So, assume, the cash index value for the S&P 100 is 750 then the dollar value of the S&P 100 contracts is 750x 100 = $75,000.

Futures Options

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

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

Interest Rate Options

They are another important options contract, which are popular in the international financial markets. Interest rate options can be written on cash instruments or futures.

There are various debt instruments, which are used as underlying instruments for interest rate options on different exchanges. These contracts are referred to as options on physicals.

Recently, these interest rate options have also gained popularity on the over-the-counter markets like on treasury bonds, agency debentures and mortgagebacked-securities. There are governments, large banking firms and mortgage-backed-securities dealers who make a market in such options on specific securities.

Leaps Options

These options contracts are created for a longer period. The longest time before expiration for a standard exchange traded option is six-months. However, Long Term Equity Anticipated Securities (LEAPS) are option contracts designed to offer with longer period maturities even up to 39 months. These LEAPS options are available on individual stocks and some indexes. Usually, they are designed for a particular purpose.

Flex Options

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

Exotic Options

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

UNIT 14

OPTIONS STRATEGIES

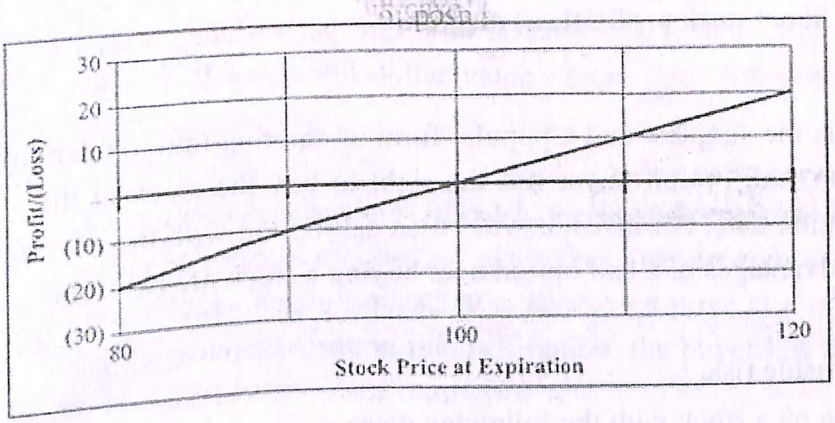
The following are the basic elementary strategies:

Long Stock	Short stock
Long call	Long put
Short call	Short put

Let us see each of them in detail. In this section we will discuss these strategies and other advanced strategies. Throughout our discussion on option strategies, we will make use of profit/loss diagrams as they are our eyes and ears to discern all options-based strategies.

Long Stock

When an investor expects that a particular stock will rise, until the advent of derivatives investors will buy that stock as they have only that choice to profit from their bullish expectations. In this case, the investor theoretically has unlimited profit; potential and losses are limited to the price he paid while acquiring the stock. Hence, if the stock price rises over what he paid for, he will be gaining and vice versa. The payoff for a stock is shown in Figure



Profit/Loss diagram

Short Stock

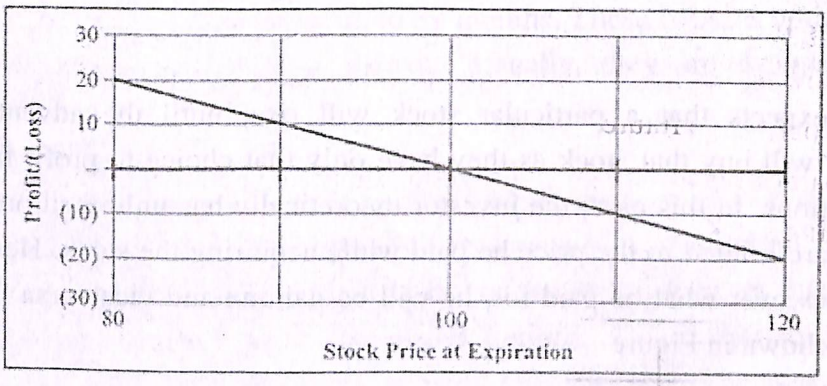
This strategy will be resorted to when one is having bearish expectations or when one expects the stock price to come down. Though this is currently not permitted in India for everyone, the mechanics of short selling involve the following:

(a) Borrowing the stock for a specified period from someone who holds it; for instance, a broker.

(b) Selling the borrowed stock now at the current market price.

(c) At the end of investment horizon, the stock will be bought from the market and will be returned to the broker/stock lender.

This is a bearish strategy involving limited profits but unlimited losses because at maximum the stock price may decline to zero and this extreme case represents the maximum profit potential. On the other hand, if price moves against the seller then he has to put up with unlimited losses as prices are unbounded on the upside (i.e., they can go up to infinity theoretically).



Short stock profit/ (loss) diagram

Long Call

Buying call options is the simplest and a popular form of entering into the derivatives market. By definition, call option buyer has the right to buy the stock at the strike price until the expiration date. An investor will buy a call option with the expectation of a price rise. The advantages of a call option over buying a stock are two fold:

(a) Leverage, and

(b) Limiting the downside risk.

Consider a call option on a stock with the following data:

Strike price = Rs 100 Current market price = Rs 100

Time to expiry = 90 days Volatility = 25%

Interest rate = 5%

The payoff diagram for this option is shown in Figure.

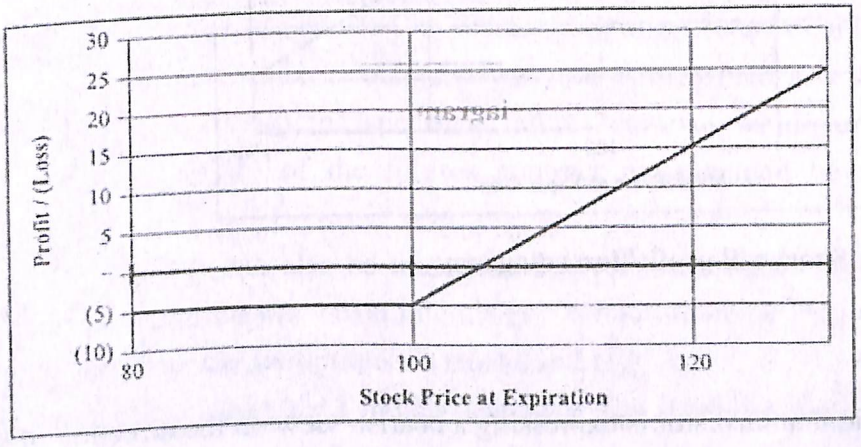
Now, in order to buy 100 shares, the investor has to invest Rs 10,000 and if the stock gains Rs 5 over the next day, his gain will be Rs 500 (100 shares x 5 per share) and return on investment = 5% over a day {(500/10000) x 100}.

But if the investor bought 100 options, he will pay Rs 555.50 as option premium and the gain for the same Rs 5 over next day will take the price of the option to Rs 8.723 or Rs 3.168 gain for each option, in which case the profits will be 3.168 x 100 316.80, translating into a return of 57% over the day.

Therefore, call options entail investors to realize large percentage of gains for a modest advance in the underlying price. But leverage is a double-edged sword and a Rs 5 decline over the next day will cause the option price to fall to Rs 3.11 and the percentage losses would be around 45%. Therefore, the price of a larger reward is a larger risk. But the call buyer's losses are limited to the premium paid while the stock buyer's risk is the entire investment of Rs 10,000. Hence the call option can be viewed as a sort of insurance in case the stock falls instead of going up. Thus, a call option provides the following benefits to the buyer:

Translate a bullish view on the market into actual position and retain the ability to buy the underlying stock in the future.

- Insure a major part of the capital due to losses arising from declines in the market prices of the underlying stock.



Long call profit/(loss) diagram

Hence we can understand that option buyer is having a bullish view on underling's volatility along with a bullish view on the underling's direction. But the option buyer is exposed to theta risk - the option loses its value by Rs 0.034 everyday, even when all other things remain the same. This may not seem as an innocuous number but remember that this is well before 90 days to expiry and that theta increases rapidly as expiry date comes near.

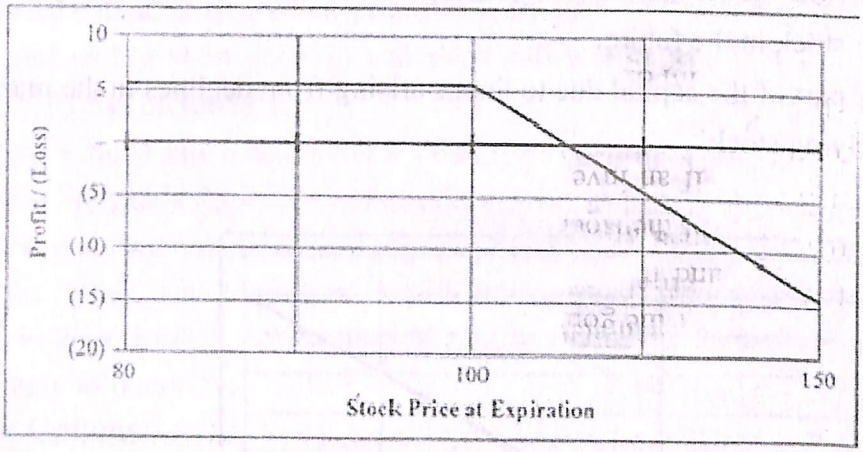
Therefore, an option buyer has to note that:

- An increase in underling's price and increase in actual and/or implied volatility will be beneficial.
- The elapsing time will fritter away the premium, and this hurts the buyer more when there is no increase in volatility or the underling's price.

Short Call

When an investor sells a call option, he definitely expects that the stock price will not rise. Though the outlook of the investor is not very positive, he is not utterly bearish since in order to profit the market need not decline; even if it stands still, he will gain the premium.

So, a call seller's view on the market is generally neutral to bearish. Similar to the view on underling's direction, a short trader in options expects that the underlying's volatility will also decline. Let us see the Greeks in Table to decipher more clearly the consequences of this strategy.

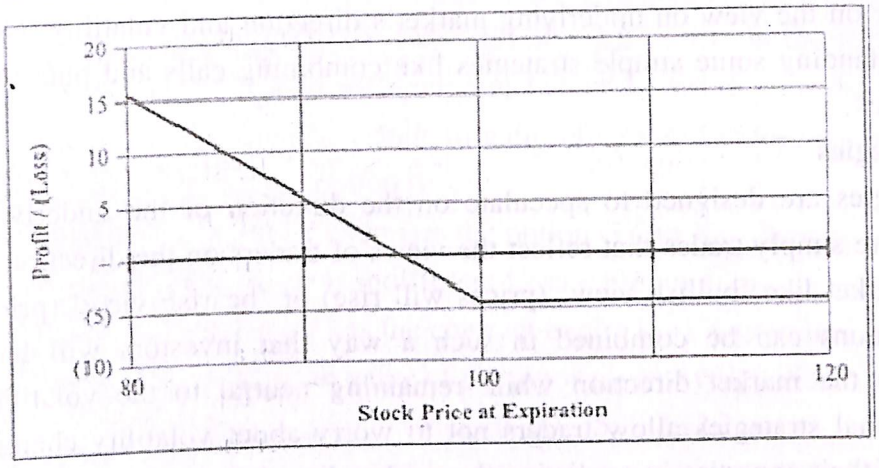


Short call profit/(loss) diagram

Long Put

By buying a put option, an investor is expressing a bearish view on the direction of the underling's price. Put options are extremely useful tools in markets where short selling is not permitted legally. Though futures can also serve as an alternative means of short selling, they offer no protection if the investor's reading of the market pulse is wrong. A put option holder, if he is also long in the underlying stock, is ensured that a large part of the current market value is not lost. Since options are instruments that expose the holders not only to the underlying asset price's direction but also to the volatility, so a put option holder is expressing a neutral to bullish view on the implied volatility. Therefore, a put option holder expects the market price of the underlying to decline and anticipates that volatility would increase (or at least will remain same).

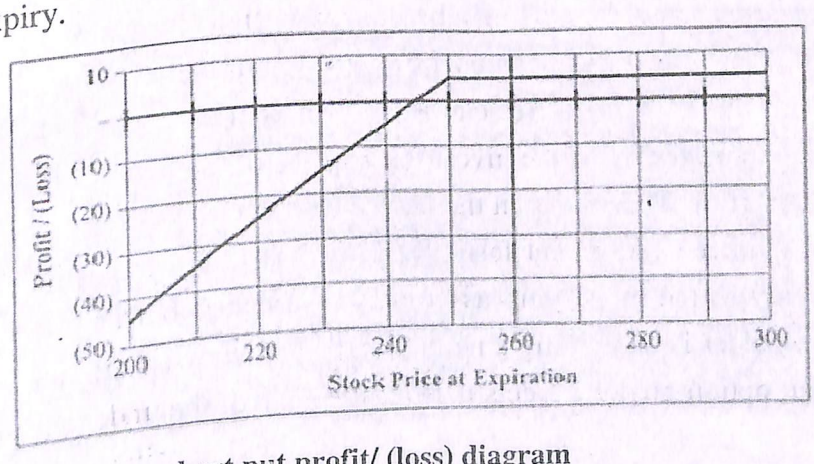
Let us understand the put option with the help of greeks and the profit/loss diagram given in Table and Figure respectively



Long put profit/ (loss) diagram

Short Put

The seller of a put option has an obligation to buy the underlying asset at the exercise price. Therefore, the put seller expects that the underlying's price will definitely not decline though he may not be sure about the price rising, he should be certain that the stock will not go down. Put writing can also be considered as a strategy of acquiring the underlying asset at or below the going market price. For instance, when the market price of a stock is Rs 264 and if a 250 strike put option with 75 days to expiry is trading at Rs 5.24, the buyer of the stock has to pay Rs 250 to buy the stock (assume r = 5% and volatility = 25%). If an investor expects that prices will not go beyond Rs 250, then by selling this put he can actually get the stock at a price less than Rs 250 (because he will earn a premium of Rs 5.24, which will reduce the cost of purchase of the stock). However, the seller will be hurt if the price falls significantly before the expiry.



short put profit/ (loss) diagram

These are known as the basic building blocks since they form the basis for constructing a variety of esoteric spreads and combinations that will yield different payoffs depending on the view on underlying market's direction and volatility. Now let us start understanding some simple strategies like combining calls and puts with the underlying stock.

Directional Strategies

Directional strategies are designed to speculate on the direction of the underlying market. So, they are simply trades that reflect the views of traders on the direction of the underlying market like 'bullish view' (prices will rise) or 'bearish view' (prices will decline). Options can be combined in such a way that investors will have exposures only to the market direction while remaining neutral to the volatility. Therefore, directional strategies allow traders not to worry about volatility changes and to make use of their expertise in predicting the market direction.

It may appear that these are not very special strategies as one can always speculate about the direction of the market with the help of the underlying assets directly or with the help of futures. But it has to be noted that these two instruments allow traders to benefit only when their predictions about the direction turn out to be right; but if their predictions or beliefs do not turn up right, they will have to put up with unlimited losses. With options you get the best of both worlds - have unlimited gains if you predict the market direction correctly otherwise content with the limited losses. Also, as discussed in the earlier sections, options provide the investors with ample leverage, which is another possibility that trading with the underlying assets alone would not be providing.

UNIT 15

PRICING OF OPTIONS

Basics of Option Pricing

An option provides the holder with the right to buy or sell a specified quantity of an underlying asset at a fixed price (called a strike price or an exercise price) at, or before, the expiration date of the option. Since it is a right and not an obligation, the holder can choose not to exercise the right and allow the option to expire. There are two types of options - call options and put options.

Call and Put Options: Description

A call option gives the buyer of the option the right to buy the underlying asset at a fixed price, called the strike or the exercise price, any time prior to the expiration date of the option: the buyer pays a price for this right. If at expiration, the value of the asset is less than the strike price, the option is not exercised and expires worthless. If, on the other hand, the value of the asset is greater than the strike price, the option is exercised - the buyer of the option buys the stock at the exercise price and the difference between the asset value and the exercise price comprises the gross profit on the investment. The net profit on the investment is the difference between the gross profit and the price paid for the call initially.

A put option gives the buyer of the option the right to sell the underlying asset at a fixed price, again called the strike or exercise price, at any time prior to the expiration date of the option. The buyer pays a price for this right. If the price of the underlying asset is greater than the strike price, the option will not be exercised and will expire worthless. If on the other hand, the price of the underlying asset is less than the strike price, the owner of the put option will exercise the option and sell the stock at the strike price, claiming the difference between the strike price and the market value of the asset as the gross profit -- again, netting out the initial cost paid for the put yields the net profit from the transaction.

A put has a negative net payoff if the value of the underlying asset exceeds the strike price, and has a gross payoff equal to the difference between the strike price and the value of the underlying asset if the asset value is less than the strike price.

Determinants of Option Value

The value of an option is determined by a number of variables relating to the underlying asset and financial markets.

1. Current Value of the Underlying Asset: Options are assets that derive value from an underlying asset. Consequently, changes in the value of the underlying asset affect the value of the options on that asset. Since calls provide the right to buy the underlying

asset at a fixed price, an increase in the value of the asset will increase the value of the calls. Puts, on the other hand, become less valuable as the value of the asset increase.

2. Variance in Value of the Underlying Asset: The buyer of an option acquires the right to buy or sell the underlying asset at a fixed price. The higher the variance in the value of the underlying asset, the greater the value of the option. This is true for both calls and puts. While it may seem counter-intuitive that an increase in a risk measure (variance) should increase value, options are different from other securities since buyers of options can never lose more than the price they pay for them; in fact, they have the potential to earn significant returns from large price movements.

3. Dividends Paid on the Underlying Asset: The value of the underlying asset can be expected to decrease if dividend payments are made on the asset during the life of the option. Consequently, the value of a call on the asset is a decreasing function of the size of expected dividend payments, and the value of a put is an increasing function of expected dividend payments. A more intuitive way of thinking about dividend payments, for call options, is as a cost of delaying exercise on in-the-money options. To see why, consider an option on a traded stock. Once a call option is in the money, exercising the call option will provide the holder with the stock, and entitle him or her to the dividends on the stock in subsequent periods. Failing to exercise the option will mean that these dividends are foregone.

4. Strike Price of Option: A key characteristic used to describe an option is the strike price. In the case of calls, where the holder acquires the right to buy at a fixed price, the value of the call will decline as the strike price increases. In the case of puts, where the holder has the right to sell at a fixed price, the value will increase as the strike price increases.

5. Time To Expiration On Option: Both calls and puts become more valuable as the time to expiration increases. This is because the longer time to expiration provides more time for the value of the underlying asset to move, increasing the value of both types of options. Additionally, in the case of a call, where the buyer has to pay a fixed price at expiration, the present value of this fixed price decreases as the life of the option increases, further increasing the value of the call.

6. Riskless Interest Rate Corresponding To Life Of Option: Since the buyer of an option pays the price of the option up front, an opportunity cost is involved. This cost depends upon the level of interest rates and the time to expiration on the option. The riskless interest rate also enters into the valuation of options when the present value of the exercise price is calculated, since the exercise price does not have to be paid (received) until expiration on calls (puts). Increases in the interest rate will increase the value of calls and reduce the value of puts.

To this end, let us start with what we know about an option's price - it is made up of intrinsic value and time value. Intrinsic value is the difference between its exercise

price and the current price of the underlying asset, or symbolically

$$IW = St - X$$

Where St is the spot price of the asset and X is the exercise price of the asset.

Therefore, one can see that the higher the spot price of the asset relative to the exercise price, the higher (lower) will be a call (put) option's value because the strike price X remains unchanged and as spot price moves up, the intrinsic value goes up and hence the option's value will also go up. Consider the intrinsic value of a call option with an exercise price of Rs 100. As the spot price rises over Rs 100, the intrinsic value increases, thereby also increasing the option price. This can be noted from Table

Spot price and intrinsic value of a call option

Spot price(Rs)	Intrinsic value
90	0
95	0
100	0
105	5
110	10
115	15
120	20
125	25

So the first factor identified by us is the spot price of the underlying asset and as it increases, the call option's price will also increase. In contrast to the call option, a put option will lose its value as the spot price increases. This makes sense since as the spot price rises, the incentive for exercising the put option will come down and the holder will chose to allow the put lapse.

The next part of the intrinsic value is defined by exercise price X. Now for a call option, the lower the strike price, the more beneficial it is for the buyer and vice versa for a put option. As options are struck at higher (lower) exercise prices, they will become lesser (more) useful for the buyer to profit from the call (put) option. Consider two October call options on infosys - one with a strike price of Rs 1620 and the other

with a strike price of Rs 1740. If these two options are available, any buyer would like to pay the minimum possible amount and consequently chooses the 1620 call over the 1740 call.

Therefore, the price of the call with a lower exercise price will be more than the call with a higher exercise price. A similar logic (but in opposite direction) applies in the case of put option, i.e., options at higher strikes will be preferred by put buyers since they can sell the underlying stock at higher prices. The same can be observed from the real world prices of options that are given in Table on the Infosys stock when the spot is trading at Rs 1820.30.

Call option prices of on TATAMOTORS (Aug 26, 2016)

Exercise price	Option price
1620	203.50
1650	170
1680	142
1710	110.95
1740	80.65

The second part of an option's price is the time value - given as the difference between option price and the intrinsic value. The time value is the amount that the buyers are willing to pay for the possibility that the option may become profitable to exercise sometime before expiration. In other words, option buyers believe that the price may be unattractive today but price fluctuations in the future may make the option profitable. Therefore, longer the time to expiry, the greater is the probability that at expiry the asset price will be significantly different from the exercise price and hence higher will be the option's price, which is exactly reflected in the real world prices depicted in Table

Time to expiry and option prices

Option details	Option price
Infosys October 1770 call	53.70
Infosys November 1770 call	82.20
RIL October 580 call	0.50
RIL November 580 call	6.05

The greater the expected movement in the price (higher the volatility) of the underlying asset, the greater the chance of the asset rising largely over (for a call) or below (for a put) the exercise price at expiry which leads to profitable exercise and hence the more valuable the option for its holder. This movement in the asset prices is termed as volatility.

One may wonder higher volatility may also work against the holder, i.e., higher volatility may lead to a steeper fall (rise) in the underlying asset price but an option buyer need not worry about this and it will not hurt him since he will not exercise the option to buy (sell) the underlying asset.

To understand the role of volatility, consider the following example.

Assume that a stock is currently traded at Rs 100 and a call option on this stock with a strike price of Rs 100. The payoff of this option is dependent on the price of the stock at expiry. Consider that the stock can assume the prices as given in Table but the probability of the stock assuming that value is dependent on its volatility.

Volatility and option prices

Current price	Likely prices	Call payoff	**Probability of low volatility**	Probability of high volatility
100	80	0	0.10	0.30
	90	0	0.20	0.10
	100	0	0.40	0.20
	110	10	0.20	0.10
	120	20	0.10	0.30

Price of the call if volatility is low will be equal to:

0 x 0.10 + 0 x 0.20 + 0 x 0.40 + 10 x 0.20 + 20 x 0.10 = Rs 4

Price of the call if volatility is high will he equal to:

0 x 0.30 + 0 x 0.10 + 0 x 0.20 + 10 x 0.10 + 20 x 0.30 = Rs 7

So it is clear from the above example that higher the volatility, higher will be the option's price.

Interest rates will also affect the option prices but the role of interest rates in option pricing is quite complex. Intuitively we can say that when an investor buys a call option instead of the stock itself, he can save capital that can be invested in a risk-free asset.

Consequently, the higher the rate of interest, the higher will he the value of a call option.

We can summarize the effect of each factor on the option's value as given in Table.

Factors affecting option prices

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

UNIT 16
OPTION PRICING MODELS

The binomial model provides insight into the determinants of option value. The value of an option is not determined by the expected price of the asset but by its current price, which, of course, reflects expectations about the future. This is a direct consequence of arbitrage. If the option value deviates from the value of the replicating portfolio, investors can create an arbitrage position, i.e., one that requires no investment, involves no risk, and delivers positive returns. To illustrate, if the portfolio that replicates the call costs more than the call does in the market, an investor could buy the call, sell the replicating portfolio and be guaranteed the difference as a profit. The cash flows on the two positions offset each other, leading to no cash flows in subsequent periods. The option value also increases as the time to expiration is extended, as the price movements (u and d) increase, and with increases in the interest rate.

1. Game theory approach: A portfolio comprising an option and the stock is constructed in such a way that the final value of the portfolio is independent of the stock's price, which is the only cause for uncertainty. When this uncertainty is removed using risk neutral valuation and arbitrage arguments, the options price can be determined.

2. Replicating portfolio: In this method, a portfolio is constructed and this consists of the stock and buying/selling a risk-free zero-coupon bond. The portfolio will be constructed such that it mirrors the option payoffs for every state. Invoking the arbitrage arguments, the option price is determined as equivalent to the value of the replicating portfolio. We will illustrate the second method with the help of the below example

Example 2.1

Consider a stock which is currently trading at Rs 100 and in exactly one year, the stock price will be either Rs 80 or Rs 120. We do not have any a priori probabilities. If the interest rate is 5%, what is the price of a call option on t-is stock with a strike price of Rs 110 and expiry in one year's time?

Solution

We will construct a replicating portfolio that mimics the option's expiry payoff. This portfolio comprises a position in the underlying stock and a risk-free debt security. Now

the question is: what combination of stock and debt security generates the same returns as a call option?

We know that at expiry the call will be worth Rs 10 (120 - 110) if the stock goes up and zero if the stock moves down.

Let us assume that we need to buy A number of shares and a zero-coupon bond of a current value of B. The initial value of this portfolio will be:

$\Pi 0 = \Delta. 100 + B$ (9.1)

The final value of the portfolio after one period will be:

$\Pi 1 = \Delta. 120 + B \times e0.05x1$

If the stock goes up and

$\Pi 1 = \Delta. 90 + B \times e0.05x1$

If the stock price goes down Since the portfolio is mimicking the payoff of the call option, we can write the above equation as:

$\Delta. 120 + B \times e0.05x1 = 10$

$\Delta. 90 + B \times e0.05x1 = 0$

And

If we substitute the value of B x e0.05x1 as $-\Delta. 90$

From equation (9.3) in equation (9.2),

we obtain $\Delta. 120 - \Delta. 90 = 10$

or $\Delta = 1/3$ and $B = -28.54$ (the negative sign shows that the 'bond has to sold short).

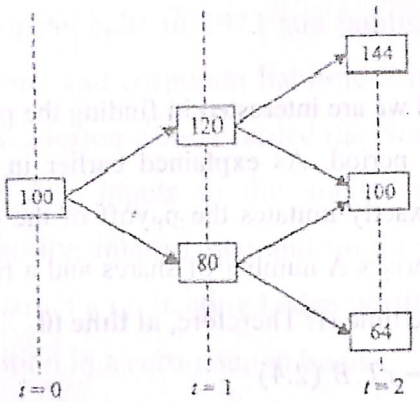
$\Pi 0 = 1/3. \Delta. 100 - 28.54 = 4.79$

Which is nothing but the option's price?

The same approach that we used in this example lies at the heart of the Binomial Option Pricing Model (BOPM), a rigorous and a powerful tool for pricing a wide variety of options. John Cox, Stephen Ross and Mark Rubinstein introduced this model in an influential paper published in the Journal of Financial Economics.

Binomial Option Pricing Model

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

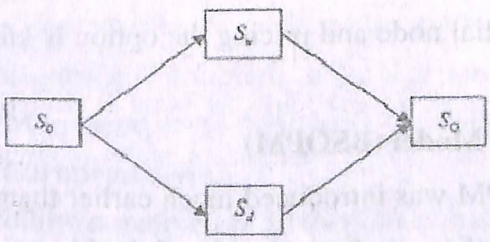


Two – period binomial tree.

Let us understand the binomial tree's terminology. The tree depicted in Figure is a two- period binomial tree and the stock price changes two times. Each point where two lines meet is termed as a node, which represents a possible future price of the stock. The tree is called as binomial because the spot price at every node can either move up or down.

If we denote the stock price at the beginning as S0 and Su as the stock price in an up state and Sd as the stock price in a down state, then we can define the up factor as Su/So and down factor as Sd/So. The probability that the stock price will move from one node to another is called as transition probability. The binomial trees as given by Cox, Ross and Rubinstein, CRR here after have some important characteristics, which are given below:

1. Length of the time interval remains constant throughout the tree, i.e., if the interval between the nodes is in months, it will be months everywhere and if it is in terms of years, it will years everywhere.
2. Volatility remains constant throughout the tree.
3. Transition probability remains the same in the entire tree.
4. The trees are recombining, i.e., an up move followed by a down move will take the stock to the same value as a down move followed by an up move.



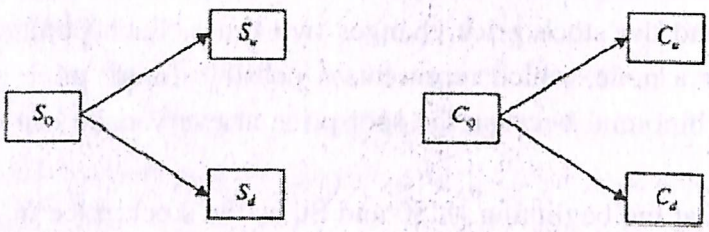
A Recombining Tree

Single Period Binomial Model

Assume that a stock price follows a binomial model and we are interested in finding the price of a European option that expires at the end of one period. As explained earlier in the numerical example, formulate a hedge portfolio that exactly imitates the payoff of the call option in all the states. This hedge portfolio at to comprises Δ number of shares and a risk-less zero-coupon bond maturing to the par value B by the time t1. Therefore, **at time t0**

$$Value\ of\ Portfolio\ \Delta.S0\ +\ e-rT.B\ (2.4)$$

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



Multi-Period Binomial Model

Earlier we considered that the time between now and the maturity day of the option is one period but the binomial model can be used to price an option wherein the life of the option may be divided into any number of periods or steps. The procedure of pricing the option remains the same

Finding the value of the option at the terminal nodes.

Setting the price of the option at the nodes preceding the terminal nodes using the one- period pricing formula, i.e.,

$C0 = e\text{-}rT\ \{pCu + (1 - p)\ Cd\}$

Repeat the process till we reach the initial node. This process of moving from the terminal node to the initial node and pricing the option is known as bachvard induction.

Black—Scholes Option Pricing Model (BSOPM)

Chronologically speaking, BSOPM was introduced much earlier than binomial option pricing, but for ease of understanding we first considered the binomial model. Infact, Black—Scholes provided the first ever closed form of solution for pricing the

European calls in 1973 and published the path-breaking paper titled "The pricing of options and corporate liabilities" in Journal of Political Economy. Prof. Scholes and Prof. Merton were awarded the Nobel Prize for their contributions in option pricing.

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

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

As the formula depends on constantly changing factors like volatility, current market price of the stock, etc., the portfolio mix has to be constantly adjusted so that it will reflect the current outputs of Black—Scholes. Hence this portfolio is called as dynamic portfolio and the act of maintaining the portfolio in balance is called as hedge rebalancing. The mathematical derivation of the Black—Scholes model is quite complicated and requires understanding of a sophisticated branch of mathematics called as stochastic calculus, the details of which are out of the scope of this book.

B-S Model Assumptions and Limitations

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

(a) **Frictionless markets**. More precisely it means there are no transaction costs, shortselling is permitted, existence of similar borrowing and lending rates and infinitely divisible assets. This is not a severely restrictive assumption since the intention is to separate the effect of market forces on option prices.

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

(c) **The option is European style.**

(d) **Asset prices follow a geometric Brownian motion.** In other words, asset returns are normal and stationary. Many critics called this assumption as the biggest hole in

the B-S formula, including its inventor Prof. Fisher Black in an influential article in the Journal of Applied Corporate Finance in 1989.

But this way of making simplifying assumptions to describe the complex real world more well-mannered is followed in many disciplines of Sciences and also in economics and finance from ages, and in that spirit this model is not an exception. More importantly, despite these seemingly deficient assumptions, the model does a reasonable job in pricing a variety of derivative instruments.

But the real utility of BSOPM is that it provides us a mechanism to hedge an option and the cost of hedging gives us insights into the likely price of the option. In the B-S model, all the data inputs are directly observable except volatility. In the next section, we will see some important ways of estimating volatility.

The Model

The version of the model presented by Black and Scholes was designed to value European options, which were dividend-protected. Thus, neither the possibility of early exercise nor the payment of dividends affects the value of options in this model.

The value of a call option in the Black-Scholes model can be written as a function of the following variables:

S = Current value of the underlying asset

K = Strike price of the option

t = Life to expiration of the option

r = Riskless interest rate corresponding to the life of the option

$\square^2$ = Variance in the ln(value) of the underlying asset

The model itself can be written as:

$$\text{Value of call} = S\,N(d_1) - K\,e^{-rt}\,N(d_2)$$

where

$$d_1 = \frac{\ln\left(\frac{S}{K}\right) + \left(r + \frac{s^2}{2}\right)t}{s\sqrt{t}}$$

$$d_2 = d_1 - \square\sqrt{t}$$

The process of valuation of options using the Black-Scholes model involves the following steps:

Step 1: The inputs to the Black-Scholes are used to estimate d_1 and d_2.

Step 2: The cumulative normal distribution functions, $N(d_1)$ and $N(d_2)$, corresponding to these standardized normal variables are estimated.

Step 3: The present value of the exercise price is estimated, using the continuous time version of the present value formulation:

Present value of exercise price = $K e^{-rt}$

Step 4: The value of the call is estimated from the Black-Scholes model.

The Replicating Portfolio in the Black-Scholes

The determinants of value in the Black-Scholes are the same as those in the binomial - the current value of the stock price, the variability in stock prices, the time to expiration on the option, the strike price, and the riskless interest rate. The principle of replicating portfolios that is used in binomial valuation also underlies the Black-Scholes model. In fact, embedded in the Black-Scholes model is the replicating portfolio.

Value of call = $S N(d_1)$ − $K e^{-rt} N(d_2)$

Buy $N(d_1)$ shares Borrow $K e^{-rt} N(d_2)$

N(d1), which is the number of shares that are needed to create the replicating portfolio is called the *option delta.* This replicating portfolio is self-financing and has the same value as the call at every stage of the option's life.

k exchange like NIFTY S&P CNX traded on National Stock Exchange of India, the S&P 500 Index is composed of 500 common stocks, etc. These indices provide summary measure of changes in the value of particular segments of the stock markets which is covered by the specific index. This means that a change in a particular index reflects the change in the average value of the stocks included in that index. The number of stocks included in a particular index may depend upon its objective, and thus, the size varies index to index. For example, the number of stocks included in SENSEX is 30 whereas 500 stocks are covered in Standard and Poor's 500. There are, however, some common features of these stock indices which are as under:

Features

1. A stock index contains a specific number of stocks, i.e., specification of certain sector number of stocks like 30, 50, 100, 200, 500 and so on.
2. Selection of a base period on which index is based. Starting value of base of index is set to large round like 100, 1000, etc.
3. The method or rule of selection of a stock for inclusion in the index to determine

the value of the index.

4. There are several methods commonly used to combine the prices of individual stock like arithmetic average, weighted average, etc.

5. There are three types of index construction like price weighted index, return equally weighted index and market capitalization weighted index.

6. A stock index represents the change in the value of a set of stocks which constitute the index. Hence, it is a relative value expressed as weighted average of prices at a specific date.

7. The index should represent the market and be able to represent the returns obtained by a typical portfolio of that market.

8. A stock index acts as a barometer for market behaviour, a benchmark for portfolio performance. Further, it also reflects the changing expectations about the market.

9. The index components should be highly liquid, professionally maintained and accurately calculated. In the present section, we will not discuss the mechanism of construction of a stock index. However, it is beneficial to understand thoroughly the details of construction of an stock index particularly in which the investor is interested to trade. Because when the differences and interrelationships among the indexes are understood, it will be easier to understand the differences among the futures contracts that are based on those indexes.

The changes of stock index futures prices are very similar to that of the underlying stock index. This has been observed by the various studies conducted in this respect. Comparing the returns on futures indexes and cash indexes, it has been found that there is very little difference between these two indexes. However, the volatility of the futures indexes is somewhat greater than the cash stock indexes.

The Standard and Poor's 500 (S & P500) index is based on a portfolio of 500 different stocks: 400 industrials, 40 utilities, 20 transportation and 40 financials. The weights of the stocks in portfolio at any given time reflect the stock's total market capitalization. (Stock price x No. of shares outstanding). The index accounts for about 80 percent of market capitalization of all the stock listed on New York Stock Exchange.

UNIT 17
STOCK INDEX

Before discussing the concept of stock index futures, we should know about the term stock index. A stock index or stock market index is a portfolio consisting of a collection of different stocks. In others words, a stock index is just like a portfolio of different securities' proportions traded on a particular stock exchange like NIFTY S&P CNX traded on National Stock Exchange of India, the S&P 500 Index is composed of 500 common stocks, etc.

These indices provide summary measure of changes in the value of particular segments of the stock markets which is covered by the specific index. This means that a change in a particular index reflects the change in the average value of the stocks included in that index. The number of stocks included in a particular index may depend upon its objective, and thus, the size varies index to index. For example, the number of stocks included in SENSEX is 30 whereas 500 stocks are covered in Standard and Poor's 500. There are, however, some common features of these stock indices which are as under:

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Settlement Procedures or Delivery

Stock index futures are nearly always settled for cash delivery, in contrast to most futures contracts where physical delivery of an underlying asset is called for. Thus, in the stock index futures contract, no physical delivery (shares or securities certificates) are delivered by the seller (short). This means that all the futures positions which are open at the close of the final trading day of the futures contract are settled by a cash transfer. This amount is determined by reference to the cash price at the close of trading in the cash market in the last trading day in the futures contract. Probably the stock index futures were the first to employ cash settlement as a substitute for physical delivery. The reason being that it is very difficult to deliver (for example the 500 proportions of various stocks in S&P Index 500) all the stocks which is more cumbersome and costly than the cash settlement. Further, if any investor is interested in actual delivery of a stock, he can easily purchase the same from the cash market. Hence, the settlement in futures index contracts is convenient and less costly. Further the effect of the cash settlement forces the futures prices of stock index futures to be identical to the cash stock index at the settlement.

The Stock Index Futures Prices

Stock index futures, like most other financial futures, are also traded in a full carry market. It means that cost-of-carry model provides (which we have been already discussed in detail in Chapter 4) a virtually complete understanding of the stock index futures pricing. As per this, futures price must be equal to the spot price plus other cost of carrying charges, and if the conditions of this model are not fulfilled or violated then arbitrage opportunities will arise. A trader (or investor) would buy the stocks that underlie the futures contract and sell the futures and will carry the same until the futures expiration. When the stocks are priced very low relative to the futures, the cash-and-carry strategy is attractive.

Example

Let us explain the above concept with an example. Assume that the present time is zero and an investor decides to purchase one share of State Bank of India (SBI) for Rs 300, as currently trading in the market. For this he borrows from the market Rs 300 to buy this stock. We assume that the SBI will declare after six months 6 percent dividend which will be further invested the proceeds for another six months at the rate of 10 percent.

Total profit = Pl + 19.80-330

where Pl is current value of the stock at the expiration.

If the current value of the SBI at expiration is Rs 320 then the profit from this transaction to the investor will be Rs 9.80 (320 + 19.80 - 330). From the afore mentioned

example, we can generalize to understand the total cash inflows from a cash-and-carry strategy. The futures prices must be equal to the price of the shares underlying stock index plus the cost of carrying the stock minus the futures value of the received dividends. So, in the stock index futures valuation, two considerations are most important like carrying cost and dividend income to be received on the underlying stocks.

Theoretical Value or Fair Value for Stock Index Futures

A stock index futures price has its fair value when the entire cost of buying the stock and carrying them to expiration is covered, i.e., the purchase price of the stocks plus interest, less the futures value of the dividends. Thus, in the cost-of-carry model the futures price must equal this entire cost-of-carry.

Example

Calculation of fair or theoretical (or no arbitrage) price.

Assume on November 1, 2016, BSE sensitive index is 3200. What is theoretical price on that date for the December, 2016 sensitive index futures contract, which matures on December, 2016? Further assume, the borrowing cost for short period is 10 percent and expected dividend (return) available annualized is 4 percent based on historical yields.

Carrying period = 44 days from November 1, 2016 to December 15, 2016

Fair value = Ft.T = St (1 + c) –

Ft.T = St St (Ci - Di)

= 3200 + 3200(0.10 -0.04)

= 3200 + 23.14 = 3223.14

The example observed how to calculate the futures theoretical value BSE index (sensitive) using actual cash index actual and the actual borrowing and dividend rates. In this case, the theoretical BSE index value is 3223.14, is greater than the cash index value of 3200 by 23.14 points because the borrowing (financing cost) rate is higher than the dividend yield. The theoretical value of the futures contract, therefore, is Rs 1,61,157 (Rs 50x 223.14).

Further if index futures for the above period from now are trading at a level above 3223.14, the investor can buy index and simultaneously sell index futures to lock in the gain equivalent to the futures price-fair price. However, it should be noted that the cost of transportation, taxes, margins, etc. are not taken into consideration while calculating the fair value. Similarly, if index is at a level below the fair' value, it will trigger severe arbitrage.

This arbitrage between the cash and the futures market will continue till the prices between both markets get aligned.

It should also be further noted that the cost-and-carry model gives an approximate index about the true futures price (theoretical value). But in the market, the observed price is an outcome of price discovery mechanism through the forces of demand supply and others. These forces may change from time to time resulting in difference between the fair price and actual price of the index futures, and thus, leads to arbitrage opportunities in the market. However, market forces of arbitrageurs will quickly restore parity when the variation becomes wide.

Earlier we have observed the calculation of the theoretical value of stock index futures contract, and then, the arbitrage opportunities available on such contracts. Stock arbitrage, in reality, may not be as easy and cost-less as explained earlier. There are several reasons observed for the difference between the actual and theoretical futures prices.

A few important explanations for the observed differences are stated below in brief.

1. We may make error in estimating theoretical futures values due to assumed variables like dividend yield, interest rate, etc. Further, the cash index value may have been either wrong or not up-to- date.
2. Trading in the stock markets incurs transaction costs. This involves commission to the brokers, execution costs and others. These costs result in the different valuation of futures prices whereas cash prices do not usually based on these.
3. The asset underlying a stock index futures contract is in reality more concept than an asset. In other words, it is difficult to buy the large number of securities needed in the proportions required to duplicate exactly a stock index futures.
4. The reported value of the cash stock index may almost be correct due to 'sale' price quotations. Index quotations are based on the last sale prices of the shares included in that index, which sometimes may not be the current quotes.
5. All proceeds from the short sales are usually not available to potential arbitrageurs, as normally, observed in the case of small or retail investors.
6. Sometimes, it is also difficult to borrow the required stock to short an entire cash portfolio.
7. Finally, it is evident that the theoretical values are calculated on the assumption of constant dividend yield over the holding period, which sometimes in reality may not be true. The actual dividend yield usually vary and further, there is a seasonality in dividends too.

Besides the observed relationship of differences between the actual and theoretical values of stock index futures, there is also consistency found between these, but within the transaction costs bounds. The difference exceeds two index points on only three days.

However, it has been noted that the stock index arbitrage has been highly successful in maintaining the theoretical relationship between cash and futures stock index prices.

Stock Index Futures as a Portfolio Management Tool

Funds managers or money managers use stock index futures basically for three purposes; hedging, asset allocation and yield enhancement. These are discussed here in this section.

Stock Index Futures as a Hedging Tool

First of all, we should know who need the stock index futures for using them as a hedging tool. All such investors, specifically managing a huge pool of funds or public funds like pension funds, mutual funds, life insurance companies, investment and finance companies, banks, endowment funds, public provident funds, etc. would like to reduce their fund's exposure to a fall in stock values caused due to uncertainties about futures market developments. This can be done by selling the shares and repurchasing them at a later time, but this strategy is not so appropriate because it would incur substantial transaction costs.

As a result, funds managers prefer to hedge with stock index futures instead of altering their portfolio structure, directly and repeatedly. Hedging is also done through stock index options but this will be discussed in other chapter concerning to the 'options'. Before proceeding to the discussion regarding hedging, one needs to understand some background on risks relating to stock investments and portfolio management. There are two types of risks associated with holding a security:

1. Systematic risk

2. Unsystematic risk

All the stocks are exposed to such factors which are not controlled by the firm itself, these are called market risk factors like changes in the interest rates, inflation rates, government trade policies, economic activities, political factors, changes in tax laws and so on. Such risk is termed as market risk or systematic risk.

On the other hand, unsystematic or firm specific risk is related to the particular firm or an industry. This risk can be diversified by having diversified portfolio of many shares. Market risk cannot be eliminated by diversification since each of the stock moves with the market to some degree. Thus, stock index futures can be used to hedge or manage this risk.

Speculation and Stock Index Futures

After discussing the case of arbitrage and hedging, let us now consider the speculating

with stock index futures. As we know that basic objective of the speculators is to earn super profit by going either bullish or bearish in the market. Index futures permits them an ideal instrument where the vagaries of individual stocks, settlement cycles, etc. do not have so much of an impact as they do on specific stock. The speculators can select a strategy where they can have a bullish view and go long on futures. Similarly, they can have a bearish view and go short in futures.

Earlier before the stock index futures came into existence, the speculators had two alternatives. Firstly, they can select the liquid stocks which would move with the index so that they can take a position in them for the expected move. But this move would be too risky. Secondly, they can select the entire stocks as in the index and trade in all of them. The basic of liquid stocks may mimic the index to some extent but still individual stock variations will affect the returns, and moreover, it is too costly with high amount of commission, etc. But now with the introduction of stock index futures, such limitations mentioned are taken care of. Now the speculators can take up either long position on the contract, paying a small margin, and seek to ride the expected trend and vice-versa for the bearish view-sell short index contract and cover when the index falls lower.

Stock Index Futures Trading in Indian Stock Market

SEBI Board accepted the recommendations of Dr. L.C. Gupta Committee on May 11, 1998 and approved introduction of derivatives trading in India in the phased manner. The recommendation sequence was 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 derivatives trading in India. As a result, both the stock exchanges, National Stock Exchange of India (NSE) and Bombay Stock Exchange of India (BSE) took the initiative to introduce futures trading in India. The brief particulars of their products are given here as under.

NSE's N FUTIDX NIFTY (NIFTY)

The National Stock Exchange of India introduced futures named 'NIFTY' on June 12, 2000. The salient features of this instrument are:

1. Name of the instrument is N FUTIDX NIFTY.

2. The underlying index S&P CNX NIFTY (NSE 500).

3. Contract size. The index futures will be quoted as per the underlying asset which means that it will quote just like the Nifty in points. The value of the contract (contract size), a multiplier of 200 is applied to the index. It means that the value of a contract

will be (Rs 200x index value) on that particular date. The multiplier can be thought of as the market lot for the futures contract. This can be changed from time to time.

4. NSE has introduced three contracts for one month, two months and three months maturities. These contracts of different maturities may be called near month (one month), middle month (two months) and far month (three months) contracts. The month in which the contract will expire is called the contract month, for example, contract month of April 2003 contract will be April, 2003.

5. Expiry. Each contract would have a specific code for representation purpose on the system. All these contracts will expire on a specific day of the month and currently they are fixed for the last Thursday of the month. As soon as the near month contract expires, middle contract will become near and so on.

6. Tick size/price step. Tick size is the minimum difference between two quotes of similar nature. Since the index futures would be traded in term of index points, the tick size is to be defined in points only. The Nifty tick size is Rs 0.05 which will be converted into points.

7. Position limits. Present, both types of contracts as for speculation and hedging purposes are allowed to be traded. However, these are subject to change from time to time.

8. Trading hours. Trading hours are 10.30 a.m. to 3.30 p.m.

9. Margins. NSE fixes the minimum margin requirements and price limits on daily basis which are subject to change periodically.

10. Settlement. Position remaining open at the close of business on the last day of trading are marked-to-market according to the official opening level of the NSE-NIFTY on the following day. There is daily settlement also on the closing of futures contract.

BSE's BSX

The Bombay Stock Exchange introduced stock index futures trading on June 9, 2000 with the name of the instrument as BSX with the underlying BSE Sensitive Index (SENSEX).

The features regarding its trading are more or less same with the NSE's NIFTY index futures.

A few important features are given in brief here as under:

1. Date of start June 9, 2000

2. Security name BSX

3. Underlying security BSE Sensitive Index (SENSEX)

4. Contract size Sensex value x 50

5. Tick size 0.1 point of Sensex (equivalent to Rs 5)

6. Minimum price fluctuation Rs 5

7. Price band Not applicable

8. Expiration months Three months

9. Trading cycle A maximum of three months, the near month, next month and far month

10. Last trading day/Expiry day Last Thursday of the month or the preceding trading day.

11. Settlement in cash on T + 1 Basis.

12. Final settlement Index closing price on the last trading days

13. Daily settlement price Closing of futures contract price

14. Trading hours 9.30 am to 3.30 pm

15. Margin Up front margin on daily basis.

UNIT 18

SWAPS

Introduction

Need is the mother of invention is a general saying and the evolution of swap as a financial instrument is the classical and a rather recent example of the proverb. There is near unanimity among the financial experts that swaps developed out of the constraints and the regulatory controls with respect to cross-border capital flows faced by large corporations in the 1970s. When multinational corporations operating in various countries could not remit funds back and forth among their subsidiaries due to exchange controls exercised by various governments on the capital flows, they came out with innovations of back-to-back or parallel loans among themselves. Upon removal of restrictions on the capital flows, these loans later developed into a full financial product called swaps. Since then the market has grown to be as large as 1414 trillion' in 2016 as the amount of principal involved in swap transactions and continues to further grow at a rapid rate.

Parallel loans involve four parties—two multinational corporations and two subsidiaries in two different countries. Imagine IBM as one USA-based company with a subsidiary in London and British Telecom as another company having operations in New York. The subsidiary of British Telecom needs money in US dollar, while the subsidiary of IBM in London has fund requirements in British pound. Due to regulatory controls neither IBM USA nor British Telecom can fund their subsidiaries. To overcome the problem British Telecom can arrange funds in British pound to fund the requirement of the subsidiary of IBM in London.

Similarly, IBM USA may raise funds in US dollar to fund the operations of British Telecom in New York. Such an arrangement is called back-to-back or parallel loans. These amounts would be re-exchanged at maturity at a rate determined in advance. Besides overcoming regulatory controls, there were other economical advantages that caused the development of swaps as full blown financial product and became popular even after the removal of regulatory controls. By this simple arrangement, each firm has access to capital markets in foreign country and makes use of their comparative advantage of borrowing in different capital markets. The growth of the swaps has been so phenomenal that in 1984 a need for standardization, uniform practices for documentation, trading, and settlement was felt leading to the formation of International Swaps and Derivatives Association (ISDA).

Back-to-back/parallel loans posed several difficulties of finding matching parties with identical needs in terms of amount of principal, timing, and duration of loans,

periodicity and nature (fixed or variable) of interest payments, all of which must match to conclude a successful deal. Solutions to these problems were found by intermediary banks, and they later became dealers in swaps from mere arrangers of swaps between two parties. Back-to- back loans were an example of financial swap, which had its origin in the 1970s. By the early 1980s the same principle was adopted to develop another swap arrangement based on interest rates known as interest rate swap.

Swap, in the simplest form, may be defined as an exchange of future cash flows between two parties as agreed upon according to the terms of the contract. The basis of future cash flow can be exchange rate for currency/ financial swap, and/or the interest rate for interest rate swaps. Apart from interest rates and currency rates, the formula for determination of the periodic cash flows can be equity returns, commodity prices, etc. In essence one of the cash flow would be fixed, called fixed leg, while the other called floating leg would be variable depending upon the value of the variable identified for the swap.

The SWAP Dealer/Bank

The illustration above assumed perfect matching of needs of Company A and Company B. How does Company A and Comnanv B locate each other is a big question? Normally firms do not disclose their specific needs of loans, borrowings, interest rates, etc. Even the routine transactions of buying and selling the foreign currency in the forward market are rarely done by importers and exporters directly. All of them resort to banks for buying and selling foreign currency. Apart from difficulties in locating each other if Company A and Company B were to have the swap arrangement directly there would be the following likely problems.

1. Both of them would assume default risk (also known as counterparty risk) associated

with swap on each other, as one of the parties to the transaction may not honour the commitments made in the swap.

2. Matching of needs in terms of principal amount of borrowing, its timing, periodicity of payment of interest, and final redemption of the borrowing, etc. would be a difficult task.

These difficulties in the swap need to be overcome; else the swap market would remain extremely small. In fact, the growth in the swaps is primarily attributed to the roles the banks have played as swap intermediaries. Following are the functions of swap intermediary.

Facilitating the SWAP Deal

The difficulties in finding a matching counterparty can be reduced if an intermediary is involved. The intermediary or the swap dealer is normally a bank who has widespread network. Due to deep knowledge of financial markets, network of large number of customers, and exact understanding of client's needs it is easier for banks to locate matching counterparties. Like the forward rates are offered by banks to facilitate the foreign exchange transaction, few banks offer ready market for firms to enter and exit the swap deals.

Warehousing

Banks are performing the role of market maker in swaps. One can obtain a quote on demand for a swap deal with bank without waiting for a matching counterparty. There are several requirements to be matched. For example, one party may look for interest rate swap for Rs 100 crore on semi-annual basis for three years, while the counterparty may want swap for Rs 80 crore on quarterly basis for 2-1/2 years only. Here the bank may take exposure of Rs 20 crore in the hope of finding another suitable party. This is called warehousing where bank may enter swaps on its own. The bank carries the risk of interest rate fluctuations till a matching counterparty is found. This risk is normally covered through interest rate futures. Hedging through interest rate futures has to be done only for net exposure in swaps as banks are likely to have a portfolio of swaps which can nullify the interest rate risk for major part of exposure.

Assuming Counterparty Risk

Most important of all, banks mitigate the counterparty risk for both the parties to the swap by becoming the counterparty to each of them. In the example depicted in Figure Company A would be far more comfortable if the counterparty were a bank rather than Company B. Same would be true for Company B. By becoming counterparty the overall risk to the swap transaction, which normally is large due to its long term nature, stands reduced substantially.

Of course, for providing a facilitating role and assuming the counterparty risk, the swap broker needs to earn remuneration. This has to be borne by the two parties to the swap transaction. However, each of the party stands to gain in terms of having an exact deal, desired timing, and reducing counterparty risk. The benefits are worth the cost.

Company A pays fixed interest rate at 8.50% to bank, who pays only 8.45% to Company B. In exchange the bank receives floating interest from Company B at M + 30 bps but pays 5 bps less to Company A at M + 25 bps. Bank earns 10 bps.

Plain Vanilla' Interest Rate Swap with Intermediary

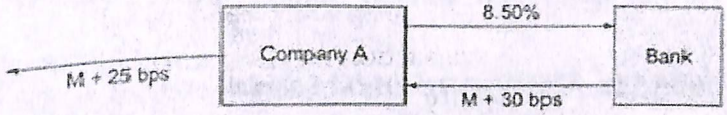
Figure depicts the swap transaction with bank as intermediary charging 5 bps from each party, as each of them receives 5 bps less that what they would receive without the intermediary .

Applications of SWAPS

Having explained the mechanism of the swap transaction, let us focus on what swaps can achieve. Swaps can be used to (a) transform the floating rate liability to fixed rate liability and vice versa, (b) transform floating rate assets to fixed rate asset and vice versa, (c) hedge against fluctuating interest rates, and most importantly (d) reduce cost of funds. We examine each of them.

Transforming Nature of Liabilities

Interest rate swaps are generally used for creating synthetic, fixed, or floating rate liabilities with a view to hedge against adverse movement of interest rates. Let us consider Company A, which has borrowed from the market on floating rate basis at MIBOR + 25 bps. It pays to its lenders at floating rate. Further, the company considers that interest rates would rise in future. In view of rising interest rates it would like to have liability that is fixed in nature rather than variable. Therefore, it decides to enter into a swap with the bank paying fixed 8.50% and receiving MIBOR +30bps as depicted in figure



Company A pays fixed interest rate at 8.50% to bank. Bank pays M + 30 bps in return. Company A continues to pay M + 25 to its lenders as originally agreed.

Swap to Transform Floating Rate liability to Fixed rate

What is the result of this swap? It simply transforms the liability to a fixed payment at 8.450/u p.a. as shown below.

Payment to lenders MIBOR+25bps

Less: Receipt from Bank under swap - (MIBOR + 30 bps)

Payment to Bank under swap 8.50%

Net payment, Fixed 8.45%

Similarly, any firm can transform its fixed rate liability to floating rate by entering the swap with bank for paying floating and receiving fixed. Naturally, the firm would use such a swap when it believes that interest rates are likely to fall in future and locking-in a fixed rate would prove advantageous.

1. **Changing Nature of Liability from Fixed to Float**

Five years back, Fasteners Ltd had raised loans through 10-year debenture issue worth Rs 100 crore with fixed interest of 12%. After the issue the interest rates remained constant for sometime. But now they have been at around IO%and are likely to come down further. Fasteners Ltd wish to contain the cost of funding for the remaining 5 years.

A bank has offered a swap rate of 9.5001o_9.60010 against MIBOR for a period of 5 years. Depict the swap arrangement and find out the new nature of liabilities the firm can have.

Solution

Fasteners Ltd has liability on a fixed interest of 12 percent. By entering swap with the bank it 1110 may transform the liability from fixed rate to floating rate based on MIBOR. Under the swap arrangement, Fasteners Ltd can receive fixed and pay MIBOR. The bid rate of swap (9.50°Io) would be applicable. The swap arrangement is shown below (see Figure E 3.1).

The cost of funds for Fasteners Ltd would be = 12.00% - 9.50% + MIBOR MIBOR + 2.50% In case interest rates fall below 9.50%, which is expected, the firm would end up paying lesser interest than what it is paying now. The interest rate payable would be market based.

2. ***Transforming Nature of Assets***

Assets provide income to investing firms based on the interest rates. If the interest rates fall the income too falls. In the circumstance of falling interest rates the firms would like to change the complexion of assets that are on floating rate to fixed rate. Similarly, in times of rising interest rates firms earning interest would like to remain with the market trend rather than get a fixed rate.

Now a sume that Company A has made an investment by subscribing to bonds carrying 9% fixed coupon. Bonds have still some years to mature but the interest rates are showing a rising trend, which is expected to continue. Company A faces a potential loss of income.

What can Company A do? Changing the portfolio of bonds by selling fixed rate bonds and buying floating rate bonds is one solution. An easier way is to enter the swap as depicted in Figure, where it receives floating and pays fixed rate. By doing so the nature of income transforms from fixed 9.00% to MIBOR + 80 bps as shown:

Receipt from investments 9.00%

Less: Payment to Bank under swap -8.50%

Receipt from Bank under swap MIBOR + 30 bps

Net Receipts, Floating MIBOR + 80 bps

3. **Transforming Fixed Rate Asset to Floating Rate**

If MIBOR moves beyond 8.20% in future, Company A would benefit from the situation.

Similarly, another can transform its floating rate income to fixed rate income by having the swap. Naturally, firms would use such a swap when they believe that interest rates are likely to fall in future.

Hedging With SWAPS

The examples of changing the nature of liabilities and/or assets from fixed to floating and vice versa demonstrate hedging applications of swaps. The need to change the omplexion of assets and liabilities arises only when the firms stand to gain from such a exercise. Swaps can be fruitfully used to hedge against the adverse interest rate situations.

There are other ways to hedge against adverse situations but at times swap could prove more efficient. For example, a firm may have borrowed on fixed rate basis for 10 years. After a few years if the interest rates start downward movement the possible recourse with the firm is to approach the lender to change the nature of loan from fixed to variable. This would be resisted by the lender. A better course of action is to enter into a swap arrangement with another. The firm achieves its objective.

Similarly, a fund may have subscribed to a portfolio of fixed rate bonds to generate desired level of income. If interest rates rise subsequent to the subscription, the fund loses the opportunity to raise income. One of the alternatives available is to change the portfolio from fixed to floating rate bonds. It may pose serious limitations like availability of such bonds, transaction costs associated with change of portfolio, etc. An attractive alternative is to enter the swap to transform the nature of asset from fixed to floating, where it receives cash flow based on floating rate in exchange of

paying the fixed rate. More importantly the swap transaction remains off balance sheet, thereby, keeping the much desired confidentiality.

Reducing Cost of Funds

The most important use of swaps, which seems to be primarily responsible for the popularity and growth of swaps, is its potential to save cost for the firms. An example will illustrate how swaps can be used to reduce cost. Assume that a highly rated Firm AAA can raise funds in the fixed rate market at 10% and in the floating rate market at MIBOR + 100 bps. The current rate of MIBOR is 8%. Another firm comparatively lower rated at A can mobilize capital at 121% and MIBOR + 200 bps in the fixed rate and floating rate markets respectively.

Other Swaps

Swap implies interchange. It need not be on interest rate or currencies alone. The basic idea of the swap is to have the interchange based on different parameters so that the complexion of asset of liability changes from fixed to variable or vice versa, as may be needed.

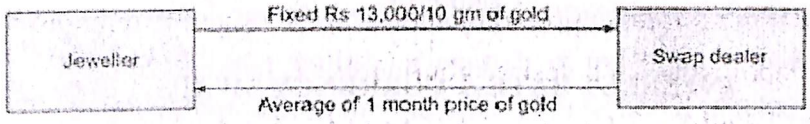
Commodity Swaps

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

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

Consider a case of a jeweller who makes ornaments using gold. Gold prices change almost continuously but the prices of the product cannot change that often, causing the profit of the jeweller to fluctuate. By entering into a swap where the jeweller pays a fixed rate for gold but receives cash flow determined on the basis of current price of gold, the cost can be fixed. A plain vanilla swap with monthly cash flows where, jeweller pays, fixed rate (Rs 13,000 per 10 gm) but receives on the basis of monthly average price is depicted in Figure. This swap would provide the hedge against the fluctuating price of gold.

Like other swaps this swap can be done for a notional quantity of gold that need not be exchanged. The life of the swap contract too can be fixed. More complex swaps can be where the two legs are on different commodities, differenty currencies.

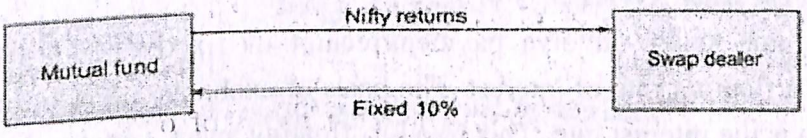


Jeweller pays fixed price of Rs 13,000 per 10 gm of gold in exchange of receiving the average price of gold during the month.

'Plain Vanilla' Commodity Swap

Equity SWAPS

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



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

'Plain Vanilla' Equity Swap

By such a swap the mutual fund locks in a return of 10% on the value of the swap. The part of the portfolio would then be transformed from equity to bonds. Again we do not exchange the principal and it remains only notional, serving the purpose of computation of cash flows. In the event of negative returns in a period, the mutual fund would in fact receive on both the legs of the swap.

Innovations in the swaps are taking place at a fast pace. Swaption, the options on swaps, are also becoming popular. A call swaption gives one the right to pay a fixed payment of interest and a put swaption gives the holder a right to receive a fixed rate of interest. In each case the holder pays a nominal front-end premium to cover, the risk of rising interest rate or falling interest rate. With regard to comparison with other derivatives such as options and futures, swap is OTC product taking into account the specific needs of counterparties with financial institutions and banks serving as intermediaries.

UNIT 19

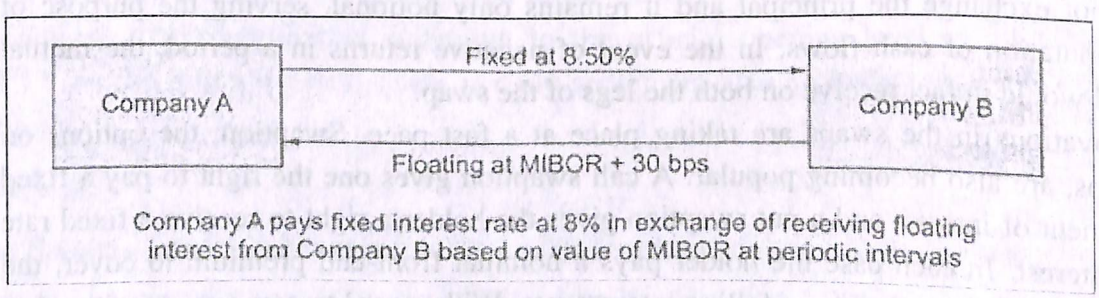
INTEREST RATE & CURRENCY SWAPS

Interest Rate swaps

If the exchange of cash flows is done on the basis of interest rates prevalent at the relevant time, it is known as interest rate swap. The simplest example of interest rate swap is a forward contract where only one payment is involved. In a forward transaction of any commodity the buyer acquires the commodity and incurs an outflow of cash equal to the forward price, F If the buyer after acquiring the commodity were to sell it for the spot price 5, then there would be a cash inflow of S. From the cash flow perspective a forward contract for the buyer is a swap transaction with inflow of S and outflow of F. Likewise, the seller would have equivalent cash flows in the opposite direction. Therefore, a forward contract can be regarded as a swap with a single exchange of cash flow; alternatively swap can be viewed as a series of several forward transactions taking place at different points of time.

Features of Interest Rate SWAP

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



'Plain Vanilla' Interest Rate Swap

Assuming that the swap between Company A and Company B is (a) for a period of three years, (b) with semi-annual exchange of interest, (c) on notional principal of Rs 50 crores the cash flows for Company A for 6 semi-annual periods for an assumed

MIBOR would be as per Table. What is received/paid by Company A is paid/received by Company B.

With the context of the example just described, the following salient features of the swap may be noted.

1. *Effective Date:* All the cash flows pertaining to fixed leg are known at the time of entering the swap at T = 0, referred as effective date.

2. *Resetting of Floating Leg Cash Flow:* The cash flow for floating leg of the swap is determined one period in advance when the floating rate becomes known. Therefore, at the time of entering the swap both the amounts of interest are known. The first receipt of cash flow at T = 6 months is known at T = 0 and is done at MIBOR of 8% plus 30 bps. The date on which the next floating rate payment is decided is called reset date.

3. *Notional Principal:* No principal amount is exchanged either at initiation or conclusion of the swap. It remains a notional figure for determination of amount of interest on both the legs.

4. *Exchange Differential: Cash Flow* The exchange of interest is done on net basis as depicted in last column of Table, with positive sign as cash inflows and negative signs as cash outflows for Company A. The cash flows for Company B would be opposite to that of Company A.

5. *Different Convention to Calculate Fixed and Floating Interest:* The method of calculation of interest on the two legs can be defined in the swap agreement being an over-the-counter (OTC) product between two parties. However, the convention is to calculate the two legs of interest are different and as follows:

For Fixed Leg : Actual/365, and For Floating Leg : Actual/360

For simplicity of exposition, in the example 180 days are assumed for all semi-annual periods with 360-day year.

Interest Rate Swap—Reducing Cost of Funds

As against fixed payment of 10.00% to its original lenders Firm AAA pays floating at MIBOR + 200 bps and receives 11.5% fixed. This not only transforms the liability from fixed to floating rate the firm wanted in the first place, but also reduces the cost to MIBOR + 50 bps as against MIBOR +100 bps that it would have incurred without the swap thereby gaining advantage of 50 bps. Similarly, Firm A too can transform its liability to fixed rate as it desired and also reduce the cost of funds to 11.50% as against 12.00%, which it would incur if it were to go the market directly. The swap again gives an advantage of 50 bps.

Cost Reduction Example:

Two Indian firms MRF and DLF are contemplating to raise finance of Rs 100 crore each. They have been offered following loans by a bank.

Fixed Rate Floating Rate

MRF 12.00% MIBOR + 70 bps

DLF11.00% MIBOR + 30 bps

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

Solution

The absolute advantage for DLF is 100 bps in fixed rate market while it is 40 bps in the floating rate market. Though DLF wants to raise finance at floating rate, the firm must access the fixed rate market and then enter into a swap deal with MRF to convert the fixed rate liability into floating rate. The total benefit to be availed is 60 bps the differential of absolute advantage of DLF in the two markets. Of this benefit 10 bps would be taken away by the bank, while the remaining 50 bps may be shared equally by both the parties through a swap. One such structure is presented below (see Figure E).

Interest Rate Swap: A Schematic View with Intermediary

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

Rationale for Swap-the Comparative Advantage

The remarkable aspect about the swap was its ability to reduce the cost of funds for both the firms, as we see in the Figure. Normally one expects that one would gain at the expense of the other. But in a swap both the parties were able to reduce the cost of funds.

The explanation lies in theory of comparative advantage.

Even though Firm AAA had absolute advantage in both kinds of borrowing with

respect to Firm A, what is of significance is the comparative advantage. Firm AAA had absolute advantages of 200 bps in the fixed rate market and 100 bps in the floating rate market.

Types of Interest Rate SWAPS

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

Fixed-to-Floating

In the fixed-to-floating rate swaps the party pays fixed rate of interest to the bank or swap dealer and in exchange receives a floating rate interest determined on the basis of a reference/benchmark rate at predetermined intervals of time. Such a swap is used by a firm wich has floating rate liability and it anticipates a rise in the interest rates. Through the swap the firm will cancel out the receipts and payments of floating rate and have cash outflow based on the fixed rate of interest.

Floating-to-Fixed

In this kind of swap the party pays floating rate of interest to the bank or swap dealer and in exchange receives a fixed rate interest at predetermined intervals of time. Such a swap is used by a firm who has fixed rate liability and it anticipates a fall in the interest rates. Through the swap the firm will cancel out the receipts and payments of fixed rate liability and have cash outflow based on the floating rate of interest.

Basis SWAP

In contrast to the fixed-to-floating or floating-to-fixed where one leg is based on fixed rate of interest, the basis swaps involve both the legs on floating rate basis. However, the reference rates for determining the two legs of payment are different. Basis swaps are used where parties in the contract are tied to one asset or liabilities based on one reference rate and want to convert the same to other reference rate. For example, if a firm having liabilities based on T-bills rate wants to convert it to MIBOR-based rate, then the firm can enter a basis swap where it pays MIBOR-based interest to the swap dealer in exchange of receiving interest based on T bills rate.

CURRENCY SWAPS

In a currency swap the exchange of cash flows between counterparties take place in two different currencies. Since two currencies are involved, currency swaps become different from interest rate swaps in its uses functionality, and administration. The first recorded currency swap was initiated in 1981 between IBM and World Bank. Where the exchange of cash flows is in two different currencies on the basis of a predetermined formula of exchange rates, it is known as currency swap. More complex swaps involve two currencies with fixed and floating rates of interest in two currencies.Such swaps are called 'cocktail swaps'.

Features of Currency SWAP

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

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

1. Exchange of principal at the time of setting the swap deal at the current spot rate
2. Exchange of periodic interest payments
3. Exchange of the principal back upon maturity

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

Currency swaps may be classified as following

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

(a) Fixed-to-Floating

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

(b) Floating-to-Floating

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

Hedging Against Exchange Rate Risk

Currency swaps cover different kind of risk. It is way of converting liabilities or assets from one currency to another. While in case of interest rate swaps assets or liabilities are transformed from fixed interest rate to floating or vice versa providing hedge

against fluctuating interest rates, the currency swaps provide a hedge against exchange rate risks as it transforms liability/asset from one currency to another.

Let us consider an example to see how multinational firms face currency risks and how can these be overcome through a swap deal.

Assume that an Indian firm needs funds for its US operations. The firm raises funds in Indian rupees and commits to serve the interest obligation and the final repayment in Indian rupees. The funds raised in rupees are converted in US dollar to acquire assets in the USA. These assets provide income in US dollar. The Indian firm is facing a risk if rupee strengthens (dollar depreciates) in the currency markets as it receives lesser rupee amount for the fixed return earned in US dollar.

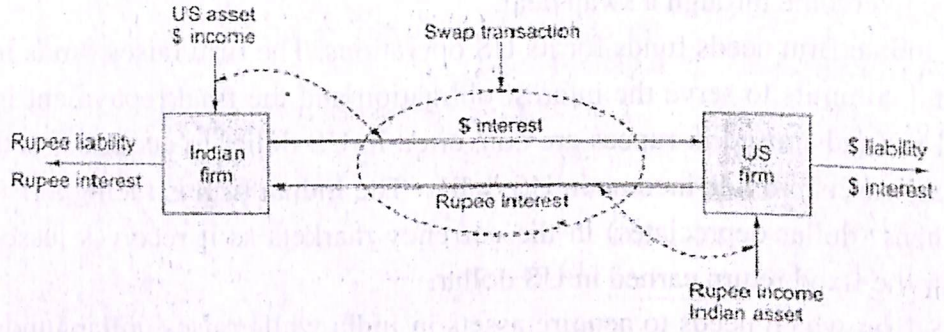
Similarly, an US firm which needs to acquire assets in India while raises dollar funds in USA, faces the same risk. Its earnings would be in Indian rupees and the liabilities need to be serviced in US dollar. Like the Indian firm the US firm also faces a risk of shortfall in US dollar if dollar appreciates (or rupee depreciates).

The vulnerability of both, the Indian firm and the US firm, is due to uncertainty of exchange rate movement, which may take place in either direction. While depreciation of dollar harms the Indian firm it benefits the US firm. In case dollar appreciates, the US firm is at loss while the Indian firm gains. The risks for both the firms arise because it is not known what direction exchange rates would take. Even though it is possible to make an estimate of the likely direction of exchange rates based on many theories, such as purchasing power parity (PPP) and interest rate parity (IRP), we are concerned here with the unexpected and adverse movement of exchange rates as all forecasts factor in the likely movement while making estimates.

The element of risk can be removed if the Indian firm and the US firm enter into a swap as depicted in Figure, which would reveal that the Indian firm has financed its US operations by creating rupee liability. This liability to be serviced by income generations in US dollar faces currency exchange rate risk. Likewise, the US firm having funded Indian operations through US dollar loan would be serviced by rupee income and needs to be converted to US dollar for payment of interest and principal in future whenever they fall due. Under the swap transaction the mismatch of cash inflow and cash out flow in different currencies for both the firms can be eliminated, by US firm agreeing to pay rupee generated out of its Indian operations to Indian firm in exchange of Indian firm agreeing to pay dollar generated out of its US operations.

Thus the rupee asset income flows to the Indian firm, facilitating service of rupee liability. In exchange, US dollar asset income flows to the US firm to meet its US dollar obligations. Both the firms avoid the conversion of currencies from one to

another eliminating the exchange rate risk. Through the swap both the firms will have assets and liabilities translated in the same currency eliminating the currency risk.



Currency Swap-Converting Asset/ Liability from One Currency to Another

Hedge Against Exchange Rate Risk

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

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

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

Solution

TCS Ltd is targeting annual profit of Rs 270 Iakh as shown below.

Income in US dollar = 15% of $ 200 lakh = $ 30 lakh p.a.

Equivalent rupee = Rs 1,350 lakh p.a.

Interest payment = 12°/s of Rs 9,000 lakh = Rs 1,080 lakh p.a.

Anticipated profit = 1350 - 1,080 = Rs 270 lakh p.a.

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

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

Income in rupee = 15°/s of Rs 9,000 lakh = Rs 1,350 lakh p.a.

Equivalent dollar = $ 30 lakh p.a.

Interest payment = 8% of $ 200 lakh = $ 16 lakh p.a.

Anticipated profit = 30 - 16 = $ 16 lakh p.a.

If Indian rupee depreciates, the firm will receive lesser annual income than expected and hence, face a risk of reduction in profit to the extent of depreciation in rupee, liability being fixed in dollar.

While appreciation of rupee is good for the US firm and detrimental to the Indian firm, the position reverses if rupee depreciates.

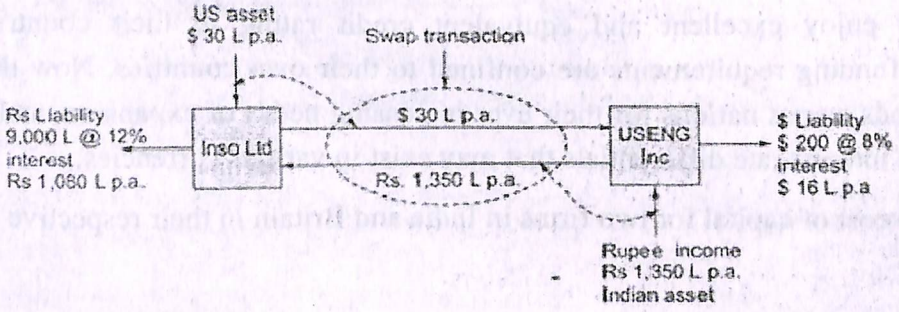
2. By entering into a swap arrangement both the firms can eliminate the volatility of spread.

Under the swap arrangement at current rate of Rs 45 per $:

(a) US firm will pay Indian firm Rs 1,350 lakh annually earned out of its joint venture in India.

(b) Indian firm will pay $30 lakh annually earned out of acquisition in the USA.

A schematic diagram of the swap arrangement is shown in Figure E. The spread after the swap arrangement becomes fixed for both the firms irrespective of exchange rate. The US firm will lock-in a return of $ 16 lakh and the Indian firm will assure profit of Rs 270 lakh after the swap arrangement. Without the swap the income for both the firms in the USA and India were subject to fluctuations due to currency exchange rate. After the swap the spreads for two firms would become stable.



Currency Swap-Converting Asset/Liability from One Currency to Another Reducion in the Cost of Funds

Like interest rate swaps, currency swaps can also be used to reduce funding cost for multinational firms needing funds in different currencies. Again the guiding principle is theory of comparative advantage. In the interest rate swap the comparative advantage emanated from differential pricing in the floating rate and fixed rate

markets. Here the comparative advantage will result from two distinct and separate markets governed by altogether different sets of rules and operating in vastly different economic conditions.

Though the exchange rate mechanism provides a link among these markets and economies, the link is a frail one as compared to the strong linkages the capital and debt markets have in a single economy. The quality spread in domestic markets is based on the credit rating of the parties. In the international markets the credit rating for the same firm may vary substantially across nations, as firms are generally better known in their own country and lesser known in a foreign country.

Further, exchange control regulations of the land may discourage borrowing to the non-residents by stipulating a higher rate. Therefore, the comparative advantage is likely to be more pronounced in two markets in two different economies, as compared to similar markets of the same economy. As such the credit quality spread is expected to be larger in the different currency markets than the credit quality spread in the fixed/floating rate markets.

Greater spread in credit quality increases the comparative advantage. Increased comparative advantage opens up more avenues for currency swaps. However, the size of the market may be limited as only multinational firms will be the beneficiaries of currency swap transactions.

As a simple example consider two multinational firms—one Indian and one British. Both the firms enjoy excellent and equivalent credit rating in their countries. However, their funding requirements are confined to their own countries. Now they need to raise funds across nations for their ever increasing needs of expansion, and to capitalize on the interest rate differentials that may exist in various currencies.

Following is the cost of capital for two firms in India and Britain in their respective currencies.

	Indian Market	**British Market**
	Rupee Market	**Pound Market**
Indian Firm	10%	6%
British Firm	14%	4%
Advantage - British Firm	-4%	2%

Clearly and naturally, the Indian firm enjoys an advantage over the British firm in

India and the British firm commands more credibility in Britain as compared to the Indian firm. Notice that the absolute advantage may not be in favour of the same firm as was the case in the interest rate swap. The comparative advantage here is 6%. If the two firms borrow in the required currency the total cost of funds will be 20%, i.e. the Indian firm borrows pound at 6% and the British firm borrows rupee at 14%. However, if they borrow as per the comparative advantage theory and exchange each other's commitment, the total cost of funds can be reduced to 14% with British firm borrowing pound at 4% and Indian firm borrowing rupee at 10%. Both the firms can benefit by 6% in aggregate if they enter into a swap arrangement wherein

(a) Indian firm mobilizes funds in rupees in the Indian market at 10%,

(b) Indian firm lends the rupee funds to British firm at ho/n,

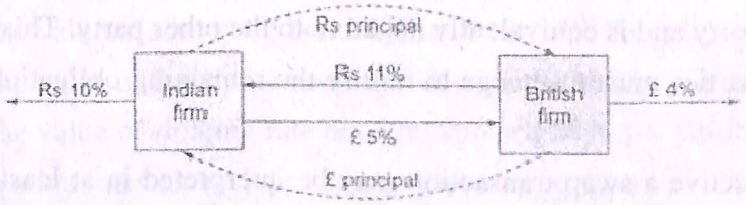
(c) British firm raises funds in the British market in pound at 4%

(d) British firm lends the same funds to the Indian firm at 5%,

(e) Exchange the interest payment periodically, and

(f) Finally, exchange the principal upon redemption.

The schematic diagram of the swap arrangement and cost of funds for both the firms is shown in Figure.



UNIT 20
VALUATION OF SWAPS

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

Valuing Interest Rate Swap

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

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

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

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

Swap as Pair of Bonds

The most common interpretation of interest rate swaps is to consider the inflows and outflows of interest at periodical intervals equivalent to that of bonds. In an interest rate swap one leg of transaction is on a fixed rate and the other leg is on the floating rate of interest. We also know that if one owns a bond he receives interest and if one issues a bond he pays the interest. Therefore, a swap comprises the following.

1. The cash inflow equivalent to the interest on the bond owned
2. The cash outflow equivalent to paying the interest on the bond issued Interest rate swap

Therefore, a swap is a pair of bonds—one issued and the one owned. A swap where one pays fixed and receives floating can be viewed as combination of having issued a fixed rate bond, paying the fixed coupon rate and simultaneously owning a floating rate bond, receiving a floating rate as per the market conditions, as depicted in Figure. While setting up the swap the coupon rate (the fixed leg receipts/payments) is fixed in such a manner that the values of cash inflows and cash outflows are equal and both the parties to the swap arrangement are in equilibrium, the net present value of the cash flows being zero. This forms the basis of fixing the initial price of the swap determined in terms of fixed rate of interest payable or receivable upon exchange of a floating benchmark rate.

For Firm A in Figure the equivalent of MIBOR may be taken as 6%, at the time of initiating swap.

However, the interest rates are dynamic and the value of cash flows as determined at the start of swap will not remain same as time elapses. The value of the swap will depend upon the behaviour of bond prices with respect to changes in the interest rates. Following rules about bond prices may be handy while valuing swaps.

1. The value of fixed rate bond will increase with the fall in interest rates.
2. The value of fixed rate bond will decrease with increase in interest rates.
3. The value of floating rate bond remains equal to par value as coupon rate is aligned with arket rates on each periodic payment of interest.
4. The value of floating rate bond changes subsequent to payment of each interest, if the interest rate structure has changed since then, but again gets aligned to the par value on the next payment of interest.

Since the change in value of the floating rate bond will only be nominal and temporary (it changes only during the two interest payments), the value of swap determined on the basis of difference in the present values of the fixed and floating legs, is predominantly dependent upon the value of fixed rate bond.

The value of the bond with fixed rate payments will be equal to sum of coupon payments and the notional principal amount discounted at an appropriate rate. The discount rate to be used for each coupon payment is known from the term structure of interest rates.

Example:

Value of Interest Rate Swap

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

Solution

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

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

Present Value of Cash Flow of the Fixed Leg

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

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

Value of Floating Leg

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

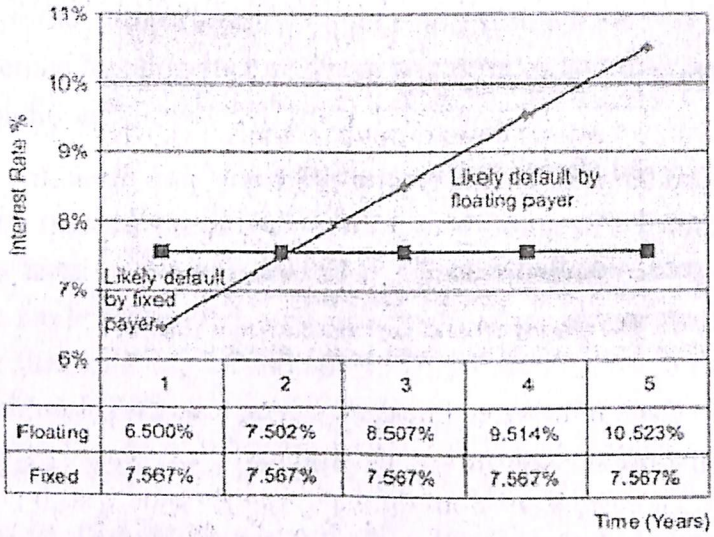
The present value of the cash outflow is more by Rs 15.15 for a principal of Rs 100. If the bank pays Rs 15.15 lakh for the principal amount of Rs 1 crore, the firm may exit the swap.

Counterparty Risk and Swaps

The swap rate of 8.34% can be interpreted as a weighted average of the floating rate payments over the period of swap. It is like YTM of a bond, which equates all cash flows of the bond to its price with a single discount rate. The floating rate payments are based on the implied forward rates. The two legs of fixed and floating payments are not equal but the aggregate of these payments become equal at the conclusion of the swap deal The floating rate payments will be either more or less than the fixed rate payments, depending upon the direction of the term structure of interest rates.

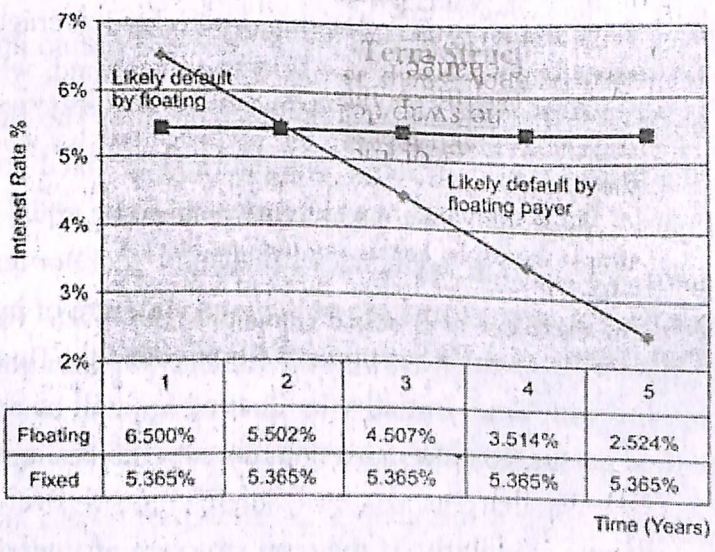
If the term structure of interest rate is upward sloping then the floating rate payments will keep increasing with time. Initially the floating leg will be smaller than the fixed leg, and as the time passes floating rate payments start increasing and exceed the fixed leg payments.

This is shown in Figure. Similarly, if the term structure of interest rates is downward sloping, the floating rate payments will be higher than the fixed leg during the initial years of swap and reduce subsequently as shown in Figure. Eventually, at the end of the swap the pay out on both the legs would be equal in either case.



	1	2	3	4	5
Floating	6.500%	7.502%	8.507%	9.514%	10.523%
Fixed	7.567%	7.567%	7.567%	7.567%	7.567%

Swap Payment (Upward Sloping Term Structure)



	1	2	3	4	5
Floating	6.500%	5.502%	4.507%	3.514%	2.524%
Fixed	5.365%	5.365%	5.365%	5.365%	5.365%

Swap Payment (Downward Sloping Term Structure)

This has important implication with regard to counterparty risk in a swap deal. In case of upward sloping term structure of interest rates, the fixed rate payer pays more than what he receives in the early part of the swap. There is net cash outflow during initial years of the swap deal, and hence fixed rate payer is the only party likely to default in the initial years. In the later stages of the swap the floating rate payment

exceeds the fixed rate payments and hence the floating rate payer is more likely the default party.

The situation reverses if the term structure of interest rates is downward sloping. The intermediary faces default risk from floating rate payer in the initial part of the swap, while fixed rate payer is more likely to default in the later stages of the swap deal. The intermediary must take appropriate steps to contain this risk as it serves as counterparty to both the parties in the swap deal.

Valuing Currency Swap

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

$$Vs = S \times Vf - Vd$$

The initial pricing of the swap is set such that the present values of foreign and domestic currency cash flows are equal, and the value of swap is zero. The most common currency swaps involve exchange of principal in the beginning, periodic payment of interest on predetermined interest rates at predetermined intervals, and re-exchange of principal at the end of the swap contract. We have to value these cash flows to know the worth of the swap deal any time subsequent to the contract, as spot rates as well as risk-free rate change.

Any change in the term structure of interest rates in either of the currencies involved or in the exchange rates causes disequilibrium in cash flows, and imparts value to the swap.

How the value of a currency swap is determined can be seen through a simple example. Let us assume that Firm A has entered into a five-year swap where it receives Indian rupee at 8% and pays US dollar at 40/s annually on the exchange of principal amount of US $100 lakh when the exchange rate was Rs 45 per $. Assuming a flat term structure of interest the value of the swap at its initiation is zero as can be seen from Table.

The initial value of the swap is zero as one would expect because no deal would take place if any of the party believes receiving less and paying more in the given interest rate and exchange rate scenario. Firms receiving and paying rupee/dollar must feel equivalence in both the currencies at the current interest rates and exchange rates so as to enter into a swap deal.

Initial Value of Swap

Rs (in lakh)

Year	Rs Interest and Principal	US $ Interest and Principal	PV (Rs) Discounted at 8%	PV (Us $) Discounted at 4%
1	360	4	333.33	3.85
2	360	4	308.64	3.70
3	360	4	285.78	3.56
4	360	4	264.61	3.42
5	360	4	245.01	3.29
5	4500	100	3,062.62	82.19
Total			4,500.00	100
Equivalent domestic currency @ Rs 45/$				4500
Swap Value				0

Structure of swap dealing for risk management

Swaps came into being to overcome the regulatory controls over capital flows across borders when MNCs resorted to mutual parallel loans to fund their operations overseas.

Later, when capital controls were removed they developed into full blown financial products.

Swap may be defined as exchange of series of cash flows, based on a parameter, at periodic intervals for a fixed period. When the cash flow is based on interest rates it is called interest rate swap. When exchange of cash flow is based on exchange rates it is called currency swap. In an interest rate swap one leg of cash flow is based on fixed interest rate on a notional principal, while the other leg of the cash flow, called floating leg, is based on a market-based floating rate. No principal is exchanged either at initiation or conclusion of swap. Only differential of the cash flow is exchanged.

Interest rate swap can alter the complexion of nature of liability or asset from fixed rate to floating rate or vice versa, without necessity of disturbing the original contract. Interest rate swaps serve as hedging tool against the interest rate risk. Faced with rising interest rates, a firm can alter the liability of a loan on floating rate to fixed rate with swap entered with a bank without disturbing the original loan contract. Besides working as a tool to hedge against the interest rate risk, a swap has potential to save funding cost. This is due to the fact that different firms have unequal credit spreads in fixed and floating markets for borrowing. The differential in the spread, referred to as comparative advantage, can be utilized for the benefit of two firms to reduce borrowing cost.

A swap normally requires exact matching of needs of the two counterparties in terms of amount, maturity, timing, and periodicity of interest payments which are difficult to fulfill and constrain the development of market. Another drawback is that swap give rise to counterparty risk. Banks, by acting as a facilitator, provide the much needed depth to the swap markets. They also fill the gaps in matching needs and act as counterparties to a swap transaction. The ready market of swaps provided by banks also makes entry and exit from swap easier.

Currency swaps have same applications as that of interest rate swap. They can be used to transform the assets/liabilities from one currency to another, hedge against exchange rate risk and reduce funding cost for MNCs raising funds in different currencies. Unlike interest rate swaps where no principal is exchanged, in currency swaps the principal amount is exchanged at initiation of swap and re-exchanged upon its termination. During the swap the interest rates, either fixed or floating, are exchanged in two different currencies.

At the initiation of swap the value of the swap is always zero as the present values of the two opposite legs are equal. The value of the swap is determined on the basis of interest rate scenario in interest rate swaps. While the cash flow of the fixed leg is known in advance, the payments on the floating legs are decided only one period in advance and are reset at periodic intervals. Changing interest rate scenario creates value. For valuation the swap may be either treated as pair of fixed rate and floating

rate bonds or as series of forward agreements. The value of swap would be dependent upon the term structure of interest rates.

Besides interest rate and currency swaps, many other swaps are possible. When commodity price decides the cash flows it is called commodity swap. Equity returns decide the cash flows in equity swaps. Innovations in the field of swaps are continuous and newer products are being developed from time to time. Being an OTC product the modifications in the terms and conditions of the swaps are aplenty.

Solved Problems

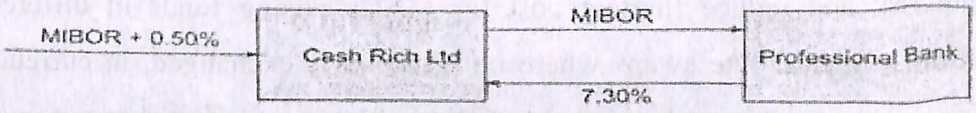
1. **Changing Nature of Asset from Floating to Fixed Rate**

Cash Rich Ltd (CRL) has invested Rs 50 crore in market linked securities providing it a current return of 8% with current MIBOR of 7.50°Io. Of late, yield in the market have started falling adversely affecting the income of CRL. It needs to protect the same. Professional Bank Ltd, CRL's banker has offered a 3-year MIBOR based swap with rates at 7.30%-7.40%. Should CRL accept the swap what income can it lock-in for next 3 years?

What would be the advantage of the swap? Depict the swap arrangement.

Solution

CRL has current income at 50 bps above MIBOR currently at 7.50%. Since MIBOR is likely to fall, it is advisable for them to accept the swap with the bank. The swap arrangement is depicted below (see Figure).



CRL can receive fixed rate and pay MIBOR. The bid rate of swap (7.30%) would be applicable.

The income for CRL would be = MIBOR + 0.50% + 7.30% - MIBOR = 7.80%.

By entering swap with the bank CRL may transform the asset from floating rate to fixed rate. In case MIBOR falls to less than 7.30% CRL would have the benefit of the swap.

By entering the swap CRL does not need to alter its investment portfolio.

...(End)...

Printed at Calicut University Press