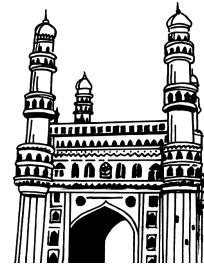**Rahul's** ✔
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UNIT I	**Introduction to Risk Management:** Risk Management Overview - Types of Risks -Impact of risk on organizations- scope of risk management- Risk Management Levels, Risk management process - risk models- Risk identification and measurement.

1.1 RISK

Q1. What is Risk ?

Ans : (Dec.-19)

Risk is uncertainty that a future event with a favourable outcome will occur. In other words, risk is the probability that an investment will not perform as expected and the investor will lose the money invested in the project. All business decisions and opportunities are based on this concept that future performance and returns are uncertain and rely on many uncontrollable variables.

Risk is inherent in any investment. Risk may relate to loss of capital, delay in repayment of capital, non-payment of return or variability of returns. The risk of an investment is determined by the investments, maturity period, repayment capacity, nature of return commitment and so on.

Risk implies future uncertainty about deviation from expected earnings or expected outcome. Risk measures the uncertainty that an investor is willing to take to realize a gain from an investment.

Total Risk

= General Risk + Specific Risk

= Market Risk + Issuer Risk

= Systematic Risk + Non Systematic Risk

Definitions of Risk

(a) "Risk is condition in which there is a possibility of an adverse deviation from a desired outcome that is expected or hoped so far."

- Emmett J. Vaughan

(b) "Risk may be defined as combinations of hazards measured by probability."

- Irving Fisher

(c) "The possible loss of something of value."

- Blomkvist

(d) "Risk is the probability of an event combined with the magnitude of the losses and gains that it will entail."

- Douglas

(e) "Risk allows for a number of possible outcomes, not all of which are bad."

- Merkhofer

Q2. What are the causes of Risk ?

Ans :

Causes of Risk

There are a number of factors which cause risk in the investments. Various factors influencing risk are business failure, market fluctuations, change in the interest rate inflation in the economy, fluctuations in exchange rates changes in the political situation etc.

➢ Wrong method of investment

➢ Wrong timing of investment

➢ Wrong quantity of investment

➢ Interest rate risk

➢ Nature of investment instruments

➢ Nature of industry in which the company is operating

➢ Creditworthiness of the issuer

- Maturity period or length of investment
- Terms of lending
- National and International factors
- Natural calamities etc.

Q3. What are the characterises of Risk ?

Ans :

The following are the basic characteristics of Risk :

(a) Risk is related to loss of value

(b) Risk can be financial or non financial

(c) Risk reduces the return; hence there is a strong relationship between risk and return

(d) Risk can be identified and measured

(e) The risk is probabilistic and generic.

(f) Risks in financial markets are events that are likely to happen.

(g) Risks are ascertainable, although not always quantifiable.

(h) Risk has a direct relationship with return, i.e., higher the risk higher the return and vice versa.

(i) Risk is associated with every business activity. It is more prominent and pronounced in respect of financial sector in general and banks in particular.
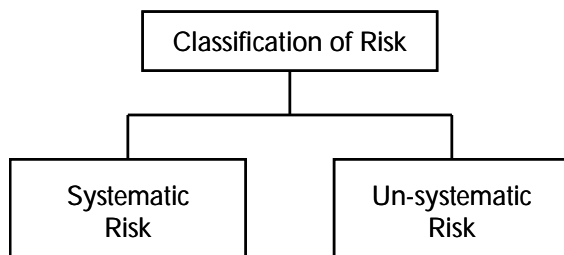
1.1.1 Types of Risks

Q4. Explain the various types of Risk.

Ans :   (Dec.-19, May-19)

Types of Risks

Risk may be classified into :

```
              Classification of Risk
                       |
          ┌────────────┴────────────┐
      Systematic                Un-systematic
        Risk                        Risk
```

(a) Systematic Risk : Systematic risk is the risk that affects a security or portfolio due to its relationship with the market. Systematic risk is also called market risk, aggregate risk, or undiversifiable risk.

Systematic risk can't be reduced through portfolio diversification. Since this risk is associated with overall market sentiment rather than performance of few stocks. Systematic risk results from forces which can't be controlled by a firm. Systematic risk is measured with beta coefficient. It represents the security's volatility relative to that of an average security.

(b) Non - Systematic Risk or Un-Systematic Risk : Variability in a security total return not related to overall market variability is called unsystematic (non market) risk. This risk is unique to a particular security and is associated with such factors as business, and financial risk, as well as liquidity risk. Although all securities tend to have some non systematic risk, it is generally connected with common stocks. Un-systematic risk is also called as Specific Risk.

Q5. Explain the various types of Systematic Risk ?

Ans :   (Dec.-19, May-19)

The various types of Systematic Risks are :

- Interest Rate Risk
- Market Risk
- Purchasing Power Risk (or) Inflation Risk
- Regulatory Risk

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  ┌───────────────────┐
  │  Systematic Risk   │
  └─────────┬─────────┘
            │
            ├──────┤ Interest Rate Risk │
            │
            ├──────┤ Market Risk │
            │
            ├──────┤ Purchasing Power Risk │
            │
            └──────┤ Regulatory Risk │
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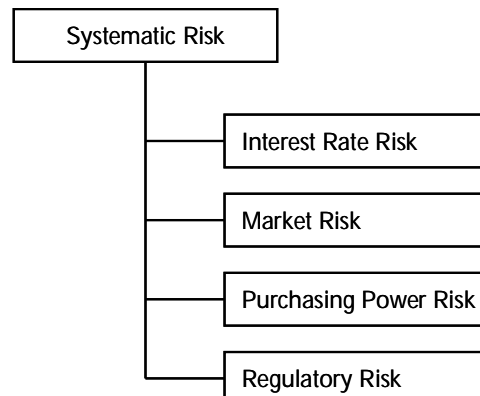
(a) **Interest Rate Risk :** The variability in a security return resulting from changes in the level of interest rates is referred to as interest rate risk. Such changes generally affect securities inversely, that is other things being equal, security price move inversely to interest rate.

(b) **Market Risk :** The variability in returns resulting from fluctuations in overall market that is, the agree get stock market is referred to as market risk. Market risk includes a wide range of factors exogenous to securities themselves, like recession, wars, structural changes in the economy, and changes in consumer preference. The risk of going down with the market movement is known as market risk.

(c) **Purchasing Power Risk (or) Inflation Risk :** Inflation in the economy also influences the risk inherent in investment. It may also result in the return from investment not matching the rate of increase in general price level (inflation). The change in the inflation rate also changes the consumption pattern and hence investment return carries an additional risk. This risk is related to interest rate risk, since interest rate generally rises as inflation increases, because lenders demands additional inflation premium to compensate for the loss of purchasing power.

(d) **Regulatory Risk :** Regulatory risk is the risk that regulations affecting financial conditions will be introduced or that existing regulations will be enforced more severely than in the past.

Q6. **Explain the various types of Unsystematic Risk.**

Ans :   (Dec.-19, May-19)

Various types of unsystematic risks are as follows :
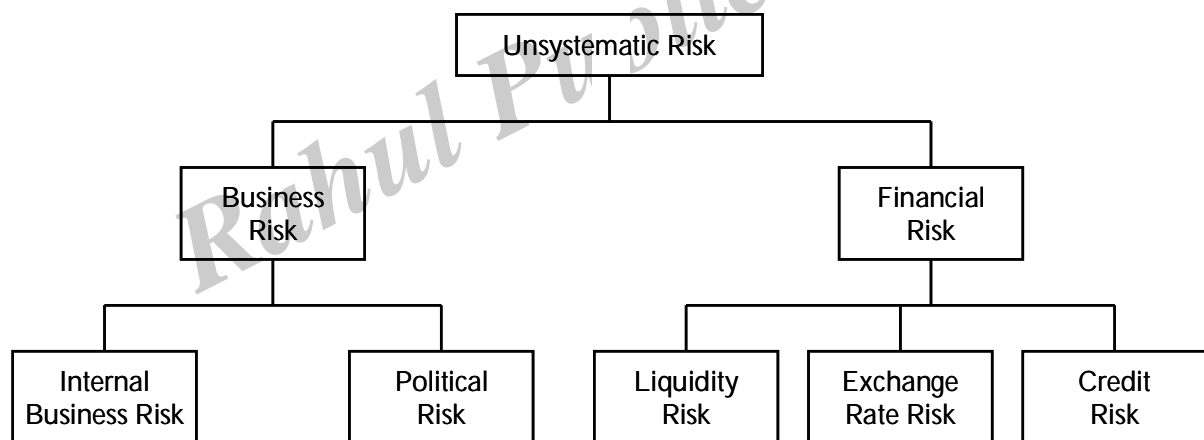
(a) **Business Risk :** The changes that take place in an industry and the environment causes risk for the company in earning the operational revenue creates business risk.

    (i) **Internal Business Risk :** Internal business risk is associated with the operational efficiency of the firm. The operational efficiency differs from company to company.

    (ii) **Political Risk :** Political risk also referred, as country risk is the risk caused due to change in government policies that affects business prospects there by return to the investors. Policy changes in the tax structure, concession and levy of duty to products, relaxation or tightening of foreign trade relations etc. carry a risk component that changes the return pattern of the business.

(b) **Financial Risk :** The use of debt financing by the company to finance a larger proportion of assets causes larger variability in returns to the investors in the faces of different business situation. During prosperity the investors get higher return than the average return the company earns, but during distress investors faces possibility of vary low return or in the worst case erosion of capital which causes the financial risk. The larger the proportion of assets finance by debt (as opposed to equity) the larger the variability of returns thus lager the financial risk.

(i) **Liquidity Risk :** An investment that can be bought or sold quickly without significant price concession is considered to be liquid. The more uncertainty about the time element and the price concession the greater the liquidity risks. The liquidity risk is the risk associated with the particular secondary market in which a security trades.

(ii) **Exchange Rate Risk :** The change in the exchange rate causes a change in the value of foreign holdings, foreign trade, and the profitability of the firms, there by returns to the investors. The exchange rate risk is applicable mainly to the companies who operate oversees. The exchange rate risk is nothing but the variability in the return on security caused by currencies fluctuation.

(iii) **Credit Risk :** Credit risk is the possibility that customers who have been granted credit will either fail to pay when payment is due, or will delay payment and take longer credit than agreed.

Q7. What are the differences between Systematic Risk and Unsystematic Risk ?

Ans :

BASIS FOR COMPARISON	SYSTEMATIC RISK	UNSYSTEMATIC RISK
Meaning	Systematic risk refers to the hazard which is associated with the market or market segment as a whole.	Unsystematic risk refers to the risk associated with a particular security, company or industry.
Nature	Uncontrollable	Controllable
Factors	External factors	Internal factors
Affects	Large number of securities in the market.	Only particular company.
Types	Interest risk, market risk and purchasing power risk.	Business risk and financial risk
Protection	Asset allocation	Portfolio diversification

Q8.   Explain how risk can be measured ?

Ans :

Risk may be measured in the following way :

1.   Risk Adjusted Discount Rate Method : This method calls for adjusting the discount rate to reflect the degree of the risk of the project. The risk adjusted discount rate is based on the presumption that investors expect a higher rate of return on risky projects as compared to less risky projects.

The rate requires determination of

(i)   Risk Free Rates : Risk free rate is the rate at which the future cash inflows should be discounted.

(ii)   Risk Premium Rate : Risk premium rate is the extra return expected by the investor over the normal rate.

The adjusted discount rate is a composite discount rate. It takes into account both time and risk factors.

2.   Sensitivity Analysis: The future is not certain and involves uncertainties and risk, the cost and benefits projected over the lifetime of the project may turn out to be different. This deviation has an important bearing on the selection of a project. Sensitivity analysis is a simulation technique in which key variables are changes and the resulting change in the rate of return is observed. Some of the key variables are cost, prices, project life, market share, etc.

3.   Probability Theory Approach : Another method for dealing with risks is to estimate the value for a result. Each value of prospective result is assigned a probability. Here one has to see a range of possible cash flows from the most optimistic to the most pessimistic for each pertinent year. Probability means the likelihood of happening an event. It may be objective or subjective. An objective probability is based on a large number of observations under independent and identical conditions repeated over a

period of time. A subjective probability is based on personal judgement. In capital budgeting decisions the probabilities are of a subjective type since they are based on a single event.

4.   Standard Deviation : Subjective judgment of the decision makers plays a crucial role in practice to resolve the problem which may turn out to be imprecise or biased. There is no precise way to find the probabilities of different outcomes. This limitation is overcome by adoption of standard deviation approach. The standard deviation is defined as the square root of the mean of the squared deviations of all the items from the mean and it is usual to denote it by the small Greek "Sigma", 'σ'. In the case of capital budgeting, this measure is used to compare the variability of possible cash flows of different projects from their respective mean or expected values.

5.   Coefficient of Variation : Standard deviation is expressed in the units of the original distribution and is called absolute measure of dispersion. Therefore, absolute measure must be reduced to a form which is free from the original unit of measurement. This can be done by expressing it in relation to the average from which variation is measured. This measure of relative variation is obtained by dividing the absolute measure by that average and is called a coefficient of variation.

1.1.2 Impact of Risk in an Organisation

Q9.   Explain the Impact of Risk in an on organisation.

Ans :

Risk is the main cause of uncertainty in any organisation. Thus, companies increasingly focus more on identifying risks and managing them before they even affect the business. The ability to manage risk will help companies act more confidently on future business decisions. Their knowledge of the

risks they are facing will give them various options on how to deal with potential problems.

Risk can come from both internal and external sources. The external risks are those that are not in direct control of the management. These include political issues, exchange rates, interest rates, and so on. Internal risks, on the other hand, include non-compliance or information breaches, among several others.

Risk management is important in an organisation because without it, a firm cannot possibly define its objectives for the future. If a company defines objectives without taking the risks into consideration, chances are that they will lose direction once any of these risks hit home.

In recent years, many companies have added risk management departments to their team.

The role of this team is to identify risks, come up with strategies to guard against these risks, to execute these strategies, and to motivate all members of the company to cooperate in these strategies. Larger organisations generally face more risks, so their risk management strategies also need to be more sophisticated. Also, the risk management team is responsible for assessing each risk and determining which of them are critical for the business.

The critical risks are those that could have an adverse impact on the business; these should then be given importance and should be prioritized. The whole goal of risk management is to make sure that the company only takes the risks that will help it achieve its primary objectives while keeping all other risks under control.

1.2 RISK MANAGEMENT - OVERVIEW

Q10. What is Risk Management ?

Ans :

Risk management is a process that identifies loss exposures faced by an organization and selects the most appropriate techniques for treating such exposures. Because the term "risk" is ambiguous

and has different meanings, many risk managers use the term "loss exposure" to identify potential losses. A loss exposure is any situation or circumstance in which a loss is possible, regardless of whether a loss occurs.

Risk management is an integrated process of delineating specific areas or risk, developing a comprehensive plan, integrating the plan, and conducting ongoing evaluation.

Risk management is a process of thinking systematically about all possible risks, problems or disasters before they happen and setting up procedures that will avoid the risk, or minimize its impact, or cope with its impact. It is basically setting up a process where you can identify the risk and set up a strategy to control or deal with it.

Q11. Define risk management explain the activities of risk management.

Ans :

Risk management is a process that identifies loss exposures faced by an organization and selects the most appropriate techniques for treating such exposures. Because the term "risk" is ambiguous and has different meanings, many risk managers use the term "loss exposure" to identify potential losses. A loss exposure is any situation or circumstance in which a loss is possible, regardless of whether a loss occurs.

Examples of loss exposures include manufacturing plants that may be damaged in an earthquake or flood, defective products that may result in lawsuits against the company, and the possible theft of company property because of inadequate security. In the past, risk managers generally considered only pure loss exposures faced by the firm.

However, newer forms of risk management are emerging that consider both pure and speculative loss exposures faced by the firm. Risk management is an integrated process of delineating specific areas or risk, developing a comprehensive plan, integrating the plan, and conducting ongoing evaluation.

Activities of Risk Management

The three activities are :

1. **Identification of Risk** : Identification of risk or discovering the source(s) from which a potential risk may arise,

2. **Measuring Risk :** Measuring risk or evaluating the impact on an individual or an organization in the event of a potential risk occurring.

3. **Managing and controlling risk** : Managing and controlling risk or selecting the most effective method(s) to deal with a potential risk.

These three components have, in turn, many sub-components. These all must be reviewed and analysed when a risk management exercise is undertaken. Guiding the farmer in making a review and analysis, and formulating a risk management strategy, are the subjects of the following sections.

Q12. Explain the various objectives of Risk Management.

Ans :

Risk management should not be confused with insurance management. Risk management is broader concept and includes all techniques for treating loss exposures, in addition to insurance. These objectives can be classified follows :

(A) Preloss Objective : Following are the objectives before the loss.

   (i) Reduction in worry and fear : The risk management should be able to reduce anxiety and fear in the mind of the likely exposed unit and should be able to enhance value without constraints on operating activities,

   (ii) Economy : This means that the firm should prepare for potential losses in the most economical way. This preparation involves an analysis of the cost safety programs, insurance premium paid and the costs assonated with the deferent techniques for handling losses.

   (iii) Meeting legal obligations : The next objective is to meet any legal obligations. Risk managers must see that all these obligations are met or not.

For example : Government Regulation may require a firm to install safely devices to protect workers from harm, to dispose hazardous waste materials property etc..

(B) Post Loss Objective : Following are the objective of risk management after a loss occurs.

   (i) Survival : The most important post loss objective is survival of the firm. If a loss occurs, the firm cannot be totally shut down. The firm should be able to resume the operations or at least partial operations within some reasonable time period so that the firm will survive in the market.

   (ii) Continued operation : Even if a loss occurs, the firms mainly service provider should be able to continue their operations,. For example, public utility firms such as airlines, banks, bakeries and dories must continued to operate even after a loss. Otherwise business will be lost to competitors.

   (iii) Stability of earning : The next post loss objective is stability in earning. If the firm continues to operate, then there will be a stability in the earning of the firm. The firm will have to face substantial additional expenses to achieve this goal. The firm can shift their operation to another location.

   (iv) Continued Growth : After the stability is earning the company can show a continuous growth. It can develop new products and enter into new markets. They can acquire or merge with another company. The risk manager must consider the effect that a loss will have on the firm's ability to grow.

(v) **Optimizing Social Effects :** The objective of social responsibility of risk management is to minimize the effects that a loss will have on other person and on socially. A severe loss can adversely affect employees, suppliers, creditors and the community in general.

For example, a severe loss that shut down a plant in a small town for an extended period can cause considerable economic distress in the town.

Q13. Explain Need of Risk Management.

Ans :

1. The need for risk management has been evolved with the globalization as the main focus of risk management revolves around the profit margins.

2. If the margins are very low, then there is a need to manage the risk. Therefore, CEOs of all the companies and banks/financial institutions who have failed desperately have started focussing on risk management.

3. The basic purpose of risk management is to obtain sufficient returns through effective risk management, helps the organizations to maximize their wealth. Especially, it is very essential for the banks and financial institutions to focus, since its influence is spread on worldwide and thus could give rise to disputes between the institutions.

4. Risk is an unavoidable factor especially in business. In financial institutions, it seems like business and risk are two sides of the same coin. Hence, it is very essential to hold business and risk together.

5. Institutions need to be structured in a systematic order because the limited liability corporations have engaged in dividing the management and ownership.

6. The management comprises of top level people like executive directors and functional managers who control and safeguard the stakeholder of the company.

7. In every financial organization, there is a need to manage risk because the products and number of transactions which have been traded have started to increase day-by-day. Due to the participation of derivatives, individuals in every organization need to trade at various levels by thoroughly analyzing the risk to achieve adequate profits.

1.2.1 Scope of Risk Management

Q14. Explain the scope of risk management.

Ans :   **(Imp.)**

Scope of Risk Management

1. **Detection of Risks :** Detection of risks involves identifying the threats and vulnerabilities which can affect the organization's assets. It is essential to have experience for identification of risks as they can originate from random sources and don't follow a fixed pattern. Detection is often the toughest part as risks can often be overlooked.

2. **Analysis of Risk :** Analysis of risk deals with collection and calculation of data regarding risk exposure. It is essential for the company to take appropriate decisions and manage risks. Accurate analysis of the risk helps in implementing more effective solutions.

3. **Control of Risk :** Control of risk deals with making decisions after monitoring the surroundings in order to ensure that the older threats and vulnerabilities are effectively countered.

Q15. Explain the importance of Risk Management.

Ans :

The importance of risk management can be explained as follows :

1. A firm prepare itself for meeting the unforeseen losses must of the future in the most economical manner. This requires the effective management of risk which involves analyzing of the various safety programs such

as, examining whether the insurance premium is being paid, cost of safety programs and so on.

2. Now-a-days the firms are basically emphasizing on the wealth maximization for shareholders. Which is consistent with their preferences. This requires the effectively managing the risks and ensuring adequate/ appropriate.

3. There are certain losses which results into greater worry and fear on the part of risk manager and on the important executives. Thus, risk management assists in reducing the anxiety of the managers.

    Example : The disastrous lawsuit arising, from a defective product would result in greater anxiety when compared to small loss of due to fire.

4. The complexity of products and the various number of transactions are increasing day by day. There also exists various firms which trades their entire capital daily. This involves greater risk to the firms in the terms of its capital and also with respect to its survival.

5. Risk management ensures the survival of the firm after the occurrence of loss this means of a firm can start atleast few operation within the reasonable time.

6. The increased globalization has also emphasized the importance of risk management as its main focus revolves around profit margins. In-case the margins are low, then arises the need to manage the risk effectively.

7. As the main objective of risk management is to acquire adequate profits, the firms are benefitted by maximizing their wealth.

8. Specifically in business, risk cannot be avoided and in financial institutions, the business and risk are like two sides of a coin. Thus its becomes very important to hold the business and risk together.

9. In-order to reduce the impact of risk, every firm is required to analyse the risk and follow certain policies and procedures so as to determine and control the risk.

Q16. Explain the methods of handling risks.

Ans :

1. Risk Control

    A. Avoidance

    B. Loss Control

2. Risk Financing

    A. Retention

    B. Noninsurance Transfers

    C. Insurance

1. Risk Control : Risk control is the best method of managing risk and usually the least expensive. Risk control involves avoiding the risk entirely or mitigating the risk by lowering the probability and magnitude of losses. Many risks cannot be avoided, but almost all risks can be mitigated through the use of loss control. Nonetheless, even losses from mitigated risks can be expensive, so both people and businesses usually transfer some of that risk to 3rd parties.

(a) Risk Avoidance : Risk avoidance is the elimination of risk. You can avoid the risk of a loss in the stock market by not buying or shorting stocks; the risk of a venereal disease can be avoided by not having sex, or the risk of divorce, by not marrying; the risk of having car trouble, by not having a car. Many manufacturers avoid legal risk by not manufacturing particular products.

(b) Loss control : Loss Control can either be effected through loss prevention, by reducing the probability of risk, or loss reduction, by minimizing the loss. Loss prevention requires identifying the factors that increase the likelihood of a loss, then either eliminating the factors or minimizing their effect. For instance, speeding and driving drunk greatly increase auto accidents. Not driving after drinking alcohol is a method of loss prevention that reduces the probability

of an accident. Driving slower is an example of both loss prevention and loss reduction, since it both reduces the probability of an accident and, if an accident does occur, it reduces the magnitude of the losses, since accidents at slower speeds generally cause less damage. Salvage operations may also reduce the cost of the loss.

2. **Risk Financing :** Risk financing focuses on methods for paying for losses, which is necessary because not all losses can be prevented. Risk financing is accomplished by retaining the risk, and for some risks, some or most of the cost of potential losses is transferred to 3rd parties, usually insurance companies. Although insurance is a major means of lowering the cost of losses, all people and businesses retain risk to some extent, even for insured losses, because most forms of insurance have deductibles, and some have copayments.

    (a) Risk Retention : Risk Retention is handling the unavoidable or unavoided risk internally, either because insurance cannot be purchased or it is too expensive for the risk, or because it is much more cost-effective to handle the risk internally. Usually, retained risks occur with greater frequency, but have a lower severity. An insurance deductible is a common example of risk retention to save money, since a deductible is a limited risk that can save money on insurance premiums for larger risks. Businesses actively retain many risks.

    Passive risk retention is retaining risk because the risk is unknown or because the risk taker either does not know the risk or considers it a lesser risk than it actually is. For instance, smoking cigarettes can be considered a form of passive risk retention, since many people smoke without knowing the many risks of disease, and, of the risks they do know, they don't think it will happen to them. Another example is speeding. Many people think they can handle speed, and that, therefore, there is no risk.

    (b) Non-Insurance Transfer : Risk can also be managed by noninsurance transfers of risk. The 3 major forms of noninsurance risk transfer are by contract, hedging, and, for business risks, by incorporating. A common way to transfer risk by contract is by purchasing the warranty extension that many retailers sell for the items that they sell.

    (c) Insurance is another major method that most people, businesses, and other organizations can use to transfer pure risks, by paying a premium to an insurance company in exchange for a payment of a possible large loss. By using the law of large numbers, an insurance company can estimate fairly reliably the amount of loss for a given number of customers within a specific time.

An insurance company can pay for losses because it pools and invests the premiums of many subscribers to pay the few who will have significant losses. Not every pure risk is insurable by private insurance companies.

1.2.2 Principles of Risk Management

Q17. Explain the various principles of risk management.

Ans :   **(Imp.)**

Various organizations have laid down principles for risk management. There are risk management principles by International standardization Organization and by Project Management Body of Knowledge.

The various principles are :

1. **Organizational Context :** Every organization is affected to varying degrees by various factors in its environment. For example, an organization may be immune to change in import duty whereas a different organization operating in the same industry and environment may be at a severe risk.

    There are also marked differences in communication channels, internal culture and risk management procedures. The risk management should therefore be able to add value and be an integral part of the organizational process.

2. **Involvement of Stakeholders :** The risk management process should involve the stakeholders at each and every step of decision making. They should remain aware of even the smallest decision made. It is further in the interest of the organization to understand the role the stakeholders can play at each step.

3. **Organizational Objectives :** When dealing with a risk it is important to keep the organizational objectives in mind. The risk management process should explicitly address the uncertainty. This calls for being systematic and structured and keeping the big picture in mind.

4. **Reporting :** In risk management communication is the key. The authenticity of the information has to be ascertained. Decisions should be made on best available information and there should be transparency and visibility regarding the same.

5. **Roles and Responsibilities :** Risk Management has to be transparent and inclusive. It should take into account the human factors and ensure that each one knows it roles at each stage of the risk management process.

6. **Support Structure:** Support structure underlines the importance of the risk management team. The team members have to be dynamic, diligent and responsive to change. Each and every member should understand his intervention at each stage of the project management life-cycle.

7. **Early Warning Indicators:** Keep track of early signs of a risk translating into an active problem. This is achieved through continual communication by one and all at each level. It is also important to enable and empower each to deal with the threat at his/her level.

8. **Review Cycle:** Keep evaluating inputs at each step of the risk management process - Identify, assess, respond and review. The observations are markedly different in each cycle. Identify reasonable interventions and remove unnecessary ones.

9. **Supportive Culture:** Brainstorm and enable a culture of questioning, discussing. This will motivate people to participate more.

10. **Continual Improvement:** Be capable of improving and enhancing your risk management strategies and tactics.

Q18. Explain the rationale for risk management.

Ans :

The rationales for risk aversion can usefully be segmented into four categories:

(a) Managerial Self Interest

(b) The Non-Linearity of Taxes

(c) The Cost of Financial Distress

(d) The Existence of Capital Market Imperfections

(a) **Managerial Self Interest :** Managers have limited ability to diversify their own personal wealth position, associated with stock holdings and the capitalization of their career earnings associated with their own employment position. Therefore, they prefer stability to volatility because, other things equal, such stability improves their own utility, at little or no expense to other stakeholders.

(b)   The Non-Linearity of Taxes : Beyond managerial motives, firm level performance and market value may be directly associated with volatility for a number of other reasons. The first is the nature of the tax code, which both historically and internationally is highly non-linear. By reducing the effective long term average tax rate, activities which reduce the volatility in reported earnings will enhance shareholder value.

(c)   The Cost of Financial Distress : Firms may also be concerned about volatility of earnings because of the consequences of severely negative deviations from expected value and their implications for corporate viability.

1.2.3 Risk Management Levels

Q19. Explain the levels of risk management.

Ans :

The risk management process operates on three levels. Although it would be preferable to perform an in-depth application of risk management for every operation or task, the time and resources may not always be available. The three levels are as follow:

(i)   Time – Critical : Time-critical risk management is an "on the run" mental or verbal review of the situation using the basic risk management process without necessarily recording the information. This time-critical process of risk management is employed by personnel to consider risk while making decisions in a time-compressed situation. This level of risk management is used during the execution phase of training or operations as well as in planning and execution during crisis responses. It is also the most easily applied level of risk management in off-duty situations. It is particularly helpful for choosing the appropriate course of action when an unplanned event occurs during execution of a planned operation or daily routine.

(ii)   Deliberate : Deliberate Risk Management is the application of the complete process. It primarily uses experience and brainstorming to identify risks, hazards and develops controls and is therefore most effective when done in a group. Examples of deliberate applications include the planning of upcoming operations, review of standard operating, maintenance, or training procedures, and damage control or disaster response planning.

(iii) Strategic : This is the deliberate process with more thorough hazard identification and risk assessment involving research of available data, use of diagram and analysis tools, formal testing, or long term tracking of the risks associated with the system or operation (normally with assistance from technical experts). It is used to study the hazards and their associated risks in a complex operation or system, or one in which the hazards are not well understood. Examples of strategic applications include the long-term planning of complex operations, introduction of new equipment, materials and operational, development of tactics and training curricula, high risk facility construction and major system overhaul or repair. Strategic risk management should be used on high priority or high visibility risks.

1.2.4 Process of Risk Management

Q20. Outline the Process of Risk Management.

Ans :   (Sep.-20, Dec.-19, May-19)

Risk management is the process of identification, analysis and control of those risks. Risk management involves like following steps.

1.   Defining the Objective of Risk Management : The First step in the risk management is to define the objective. Risk management is widely used by corporations, small employers, farmers, government bodies and even by individuals. Different risky

situations result in deferent kind of losses. Loss from accident is significantly differ from loss from firm when risk managers deal with there risks, they must have certain objectives, produce and post loss.

2. **Identifying Potential Losses :** The next step is to identify the potential loss exposures. Risk managers must have the knowledge about the firm, the market in which it operates, the legal, social, economical and political environment in which it operates the firm's financial background and also the business mechanism. Then the risk may cause a major loss for the organization. Property loss, liability loss, business income lose, death or disability, retirement or unemployment, robbery and etc. are some of the major loss exposures using some sources of flowcharts, financial statements, on-site physical inspection and interaction with exports.

3. **Evaluating the Potential Losses :** Next step as to evaluate and measure the impact of the losses. This step involves an estimation of the potential frequency and security of losses. Loss frequency refers to the probable number of losses that may occur during some given time period. Loss servile refers to the probable size of the losses.

   Once the frequency and security of each type of loss exposures are estimated, various loss exposures can be ranked according to their relative importance. Because a loss exposure with high potential is much more important than an exposure with small loss potential. Also the estimation of frequency and security of loss will help the risk manager to select most appropriate each exposure.

4. **Selecting Appropriate Techniques for Losses :** The next step in the risk management process is to select the most appropriate technique for treating loss exposures. These techniques can be broadly classified as risk control and risk financing.

(a) **Risk Control :** Risk control is a technique in which no monetary compensation is involved. Loss controls are those actions which reduce the expected cost of losses by reducing the frequency and severity of losses major risk control techniques involve the following:-

   (i)   Avoidance

   (ii) Loss prevention

   (iii) Loss reduction

(b) **Risk Financing :** Risk financing refers to the manner in which the risk control measures that have been implemented shall be financed. It refers to techniques that provide for the funding of losses offer they occur. Major risk-financing techniques include the following:

   (i)   Risk retention

   (ii) Non-insurance transfers

   (iii) Commercial insurance

5. **Implementing and Reviewing the Programme :** To have an effective risk management programme, a risk management policy statement is necessary. This statement outlines the risk management objectives of the firm as well as the company policy with respect to the treatment of loss exposures. In addition to this, a risk treatment manual can be developed. This manual describes the details of the program. It is a very useful tool for training new employees of the firm. This manual also includes important information's such as procedures to follow in an emergency. The risk manager should have cooperation with other financial departments like marketing, production, finance, hr, etc..

   Finally, the risk management programme must be periodically reviewed and evaluated to determine whether the objectives are being attained. Risk management costs, safety programs must be carefully monitored. Loss records must be periodically examined to detect any changes in frequency and severity.

Q21. Explain the benefits of Risk Management.

Ans :

➢ The pre-loss and post - loss risk management objectives are more easily attainable.

➢ The cost of risk is reduced, which may increase the company's profits. The cost of risk is a risk management tool that measures certain costs. These costs include premiums paid, retained losses, outside risk management services, financial guarantees, internal administrative costs, and taxes, fees, and certain other expenses.

➢ Because the adverse financial impact of pure loss exposures is reduced, a firm may be able to enact an enterprise risk management program that treats both pure and speculative loss exposures.

➢ Society also benefits since both direct and indirect (consequential) losses are reduced.

1.3 RISK MODELS

Q22. Explain the various risk models.

Ans :   (Sep.-20)

Risk modeling is the process of determining how much risk (measured in volatility) is present in a particular business, investment, or series of cash flows. The process also includes assessing which independent variables make the greatest impact on dependent variables in a model. Financial analysts will attempt to model risk as a means of comparing the attractiveness of different investment opportunities.

1. **Covariance Matrix Model :** If analysts want to assess their risk, they could use the covariance matrix model, which utilizes historical data to determine price movements for two stocks. The model assumes two

directional prices: positive (same direction) and negative (opposite direction).

However, most investment professionals suggest investing in stocks that do not move in the same direction to minimize risk and maximize profit. Stocks having opposite directions are referred to as having negative covariance. Anthony says that the covariance matrix model can be calculated by using a spreadsheet application or software. Then they move on to review the multi-factor model.

2. **Multi-Factor Model :** The multi-factor model employs several factors to explain changes in market conditions or prices for an individual security or portfolio. Factors vary based on the investment strategist choices, but any numerical data used in the multi-factor model are based on historical prices, not predicted prices.

1.3.1 Risk Identification and Measurement

Q23. What are the risk identification and measurement ?

Ans :   (Dec.-19)

1. **Identification :** Beginning with the proposal to commence the creation of an insurance product, acquire a financial instrument, change the operating process, as well upon the occurrence of any other event which potentially results in a risk. The identification process takes place until the expiry of the liabilities, receivables or activities related to the given risk. Identification of risk consists in the identification of actual and potential sources of risk, which are later analysed in terms of significance.

2. **Measurement and evaluation of risk :** Depending on the characteristics of the given risk type and the level of its significance. Risk

is measured by specialised units. The risk unit in each company is responsible for the development of tools and measurement of risk in terms of risk appetite, risk profile and tolerance limits.

3.   **Monitoring and control of risk :** consist of ongoing analysis of deviations from benchmarks, i.e. limits, thresholds, plans, prior period values as well as recommendations and guidance issued, conducted by dedicated units;

4.   **Reporting :** it allows for effective communication on risk and supports risk management on various decision-making levels;

5.   **Management Actions :** Management Actions including i.a. risk avoidance, risk transfer, risk mitigation, determination of risk appetite, risk level acceptance as well as supporting tools, such as limits, reinsurance programs as well as underwriting policy reviews.

Short Question and Answers

1.   What is Risk ?

Ans :

Risk is uncertainty that a future event with a favourable outcome will occur. In other words, risk is the probability that an investment will not perform as expected and the investor will lose the money invested in the project. All business decisions and opportunities are based on this concept that future performance and returns are uncertain and rely on many uncontrollable variables.

Risk is inherent in any investment. Risk may relate to loss of capital, delay in repayment of capital, non-payment of return or variability of returns. The risk of an investment is determined by the investments, maturity period, repayment capacity, nature of return commitment and so on.

Risk implies future uncertainty about deviation from expected earnings or expected outcome. Risk measures the uncertainty that an investor is willing to take to realize a gain from an investment.

Total Risk = General Risk + Specific Risk

          = Market Risk + Issuer Risk

          = Systematic Risk + Non Systematic
                                Risk

Definitions of Risk

(a)   "Risk is condition in which there is a possibility of an adverse deviation from a desired outcome that is expected or hoped so far."

                              - **Emmett J. Vaughan**

(b)   "Risk may be defined as combinations of hazards measured by probability."

                                  - **Irving Fisher**

2.   What is Risk Modeling ?

Ans :

Risk modeling is the process of determining how much risk (measured in volatility) is present in a particular business, investment, or series of cash flows. The process also includes assessing which independent variables make the greatest impact on dependent variables in a model. Financial analysts will attempt to model risk as a means of comparing the attractiveness of different investment opportunities.

Risk modeling uses a variety of techniques including market risk, value at risk (VaR), historical simulation (HS), or extreme value theory (EVT) in order to analyze a portfolio and make forecasts of the likely losses that would be incurred for a variety of risks. Such risks are typically grouped into credit risk, liquidity risk, market risk, and operational risk categories.

Risk modeling is required under the Basel II proposal for all the major international banking institutions by the various national depository institution regulators. In the past, risk analysis was done qualitatively but now with the advent of powerful computing software, quantitative risk analysis can be done quickly and effortlessly.

Risk Models can be considered to be a kind of financial models which primarily help in predicting the possibility and magnitude of impact of unfavorable events on the financial outcomes for any entity, portfolio, business or individual.

3.   What is Multi-Factor Model ?

Ans :

The multi-factor model employs several factors to explain changes in market conditions or prices for an individual security or portfolio. Factors vary based on the investment strategist choices, but any numerical data used in the multi-factor model are based on historical prices, not predicted prices.

A multi-factor model is a financial model that employs multiple factors in its calculations to explain market phenomena and/or equilibrium asset prices. The multi-factor model can be used to explain either an individual security or a portfolio of securities. It

does so by comparing two or more factors to analyze relationships between variables and the resulting performance.

Multifactor models permit a nuanced view of risk that is more granular than the single-factor approach allows. Multifactor models describe the return on an asset in terms of the risk of the asset with respect to a set of factors. Such models generally include systematic factors, which explain the average returns of a large number of risky assets. Such factors represent priced risk—risk for which investors require an additional return for bearing. Multifactor models have applications to return attribution, risk attribution, portfolio construction, and strategic investment decisions.

4. What is Risk Retention ?

Ans :

Risk Retention is handling the unavoidable or unavoided risk internally, either because insurance cannot be purchased or it is too expensive for the risk, or because it is much more cost-effective to handle the risk internally. Usually, retained risks occur with greater frequency, but have a lower severity. An insurance deductible is a common example of risk retention to save money, since a deductible is a limited risk that can save money on insurance premiums for larger risks. Businesses actively retain many risks.

Risk Retention It is nothing than presuming that going to incur certain losses on a particular issue but at the same time is not willing to transfer such risks to another party.

Risk retention and a contingency fund should be a major part of any business plan no matter how small the company. A risk retention sometimes is well worth the potential savings in insurance costs. Proper planning will make a company run much more smoothly and be able to handle difficulties with a minimum of grief.

5. Define Risk Financing

Ans :

Risk financing focuses on methods for paying for losses, which is necessary because not all losses can be prevented. Risk financing is accomplished by retaining the risk, and for some risks, some or most of the cost of potential losses is transferred to 3rd parties, usually insurance companies. Although insurance is a major means of lowering the cost of losses, all people and businesses retain risk to some extent, even for insured losses, because most forms of insurance have deductibles, and some have copayments. Risk financing is concerned with providing funds to cover the financial effect of unexpected losses experienced by a firm.

Risk financing comprises a set of measures designed to shift the mobilisation of funds away from ad hoc efforts in the wake of a crisis, and towards a risk-informed strategy to secure access to funds in advance of anticipated crisis events, effectively smoothing the financial impact of post-crisis response and recovery over time. Risk financing mechanisms include savings and reserves, access to credit and market-mediated risk transfer products such as insurance and catastrophe bonds

6. Define Risk Management

Ans :

Risk management is a process that identifies loss exposures faced by an organization and selects the most appropriate techniques for treating such exposures. Because the term "risk" is ambiguous and has different meanings, many risk managers use the term "loss exposure" to identify potential losses. A loss exposure is any situation or circumstance in which a loss is possible, regardless of whether a loss occurs.

Risk management is the process of identifying any potential threats that may occur during the investment process and doing anything possible to mitigate or eliminate those dangers.

Risk Management is nothing but managing risk means a method of analyzing possible risk in a portfolio and diminishing it through diversification or other means.

Examples of loss exposures include manufacturing plants that may be damaged in an earthquake or flood, defective products that may result in lawsuits against the company, and the possible theft of company property because of

inadequate security. In the past, risk managers generally considered only pure loss exposures faced by the firm.

7.   What is Covariance Matrix Model ?

Ans :

Covariance Matrix Model also known as the parametric method, is a risk management technique for calculating the value at risk (VaR) of a portfolio of assets. The value at risk is a statistical risk management technique measuring the maximum loss that an investment portfolio is likely to face within a specified time frame with a certain degree of confidence. The variance-covariance method used to calculate the value at risk identifies the mean, or expected value, and standard deviation of an investment portfolio.

The parametric method, also known as the variance-covariance method, is a risk management technique for calculating the value at risk (VaR) of a portfolio of assets. The value at risk is a statistical risk management technique measuring the maximum loss that an investment portfolio is likely to face within a specified time frame with a certain degree of confidence. The variance-covariance method used to calculate the value at risk identifies the mean, or expected value, and standard deviation of an investment portfolio.

The parametric method looks at the price movements of investments over a look-back period and uses probability theory to compute a portfolio's maximum loss. The variance-covariance method for the value at risk calculates the standard deviation of price movements of an investment or security. Assuming stock price returns and volatility follow a normal distribution, the maximum loss within the specified confidence level is calculated.

UNIT II

Risk Management and Measurement: Risk Management Tools, Regulatory Framework - Capital Adequacy requirements - interest rate risk, liquidity risk, Market risk, credit risk, exchange rate risk, Value at Risk (VaR), Cash Flow at Risk (CaR).

2.1 RISK MANAGEMENT TOOLS

Q1. Explain the various risk management tools.

Ans :

Risk Management Models

A project manager must consider different risk management models based on project type as it is not same for all projects. Some generally used models are GANTT, PERT, PRINCE, CCPM and CMMI. A project manager should be capable of creating a new model while planning the project and make evaluation of risk. Risk management modeling is done at the planning stage by taking into account major problems in the project and measures to reduce them. Hence, risk management model is a discipline which requires evaluation of various factors to quantify the risk.

Risk Management Methods

The main objective of risk management is to control the risk because it is an unavoidable factor in any organization. Hence, in organizations wherever there is a return there exists a risk.

In simple form,

| Higher expectation of rewards | → | Higher level of risk | → | Higher returns |
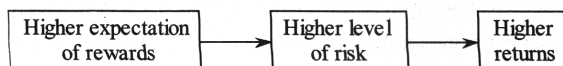
Figure

If the returns are higher then only it is advisable to face high level of risk. Risk is borne by everyone irrespective of whether they are individuals, corporates or society. The following are the various methods and approaches to reduce risk,
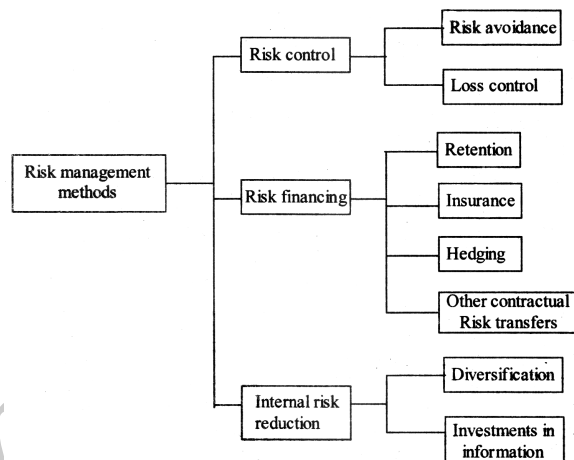
Figure

1. Risk Control

Risk can be controlled by two ways. They are,

(i) Risk avoidance

(ii) Loss control.

i) Risk Avoidance

Risk avoidance means not getting involved in any such activities which contains risk.

Example

If a person is not married then he can avoid the risk of taking divorce.

ii) Loss Control

Loss control focuses on two activities i.e., frequency and severity of losses to reduce risk. Hence, it has two major objectives, loss prevention and loss reduction.

Loss prevention concentrates on controlling the frequency of losses i.e., it tries to prevent the regular loss from occurring.

Example: Accidents can be reduced by driving carefully and safely.

Loss reduction pays attention to reduce the severity (size) of losses when an event occurs.

Example : A community's warning system can reduce the number of injuries and deaths from an approaching cyclone.

2. **Risk Financing/Loss Financing**

When the funds have been acquired to cover the incurred losses then it is termed as loss or risk financing. There are four methods to cover the financing loss.

(i) **Retention**

Sometimes it becomes very difficult to reduce the loss of risk. Under such circumstances, any business firm tends to hold a part or the whole of a given risk. Risk retention can be either active or passive.

Active Retention

Active retention means the loss of that particular risk is known in advance but as it is highly expensive to cover the loss of risk, it simply holds and pays for it.

Example

A business firm may deliberately hold or retain the risk of petty thefts by employees or the spoilage of perishable goods.

Passive Retention

It refers to that particular situation where the firm failing to identify the risk due to ignorance and laziness. Passive retention is very dangerous in nature. It becomes instrumental in destroying the firm financially.

(ii) **Insurance**

When the business firms cover their losses by insuring with the insurer, the process is said to be an insurance. The business firms initially pay premium to the insurer to insure and the insurer in consideration provides funds for the losses incurred. In this manner, firms try to reduce their risk by transferring certain amount of risk and the insurer tries to reduce his amount of risk through diversification (investment in portfolios).

(iii) **Hedging**

Hedging means covering the risk or loss through derivatives (financial instrument). The various strategies to reduce risk by derivatives are forwards, future options and swaps. With the help of these strategies, losses are covered, which are caused due to the changes in prices like commodities, interest rates, foreign exchange rates etc.

Example

Suppose a firm carrys out the business of cashew nuts with its suppliers. In such situation, both the parties (suppliers as well as the firm) faces the risk due to price fluctuations in future to reduce such risk, both the parties hedge themselves against price variations by entering into forward contract where a certain price is already decided.

(iv) **Other Contractual Risk Transfers**

In this approach, a firm transfers its risk to the other parties who are willing to take up the risk and in return they charge a certain amount. These contracts are termed as hold-harmless agreements.

3. **Internal Risk Reduction**

Risk can be reduced internally through two major forms,

(i) **Diversification**

Risk can be reduced internally by diversifying or spreading the different business activities. Here, it follows a policy "Do not put all the eggs in one basket".

(ii) Investment in Information

Gathering the information about their related business ensures the businessman to have a clear idea about their performance of business when compared with market. Therefore, certain investment must be made in gathering the information which helps them to predict the future cash flows accurately in comparison with the expected cash flows.

2.2 REGULATORY FRAMEWORK OF RISK MANAGEMENT

Q2. Explain about regulatory framework of risk management in India.

Ans :   **(Dec.-19, May-19)**

Regulatory framework of risk managements are :

1. Risk identification
2. Risk measurement
3. Risk mitigation
4. Risk reporting & monitoring
5. Risk governance

1. Risk Identification

The first step in identifying the risks a company faces is to define the risk universe. The risk universe is simply a list of all possible risks. Examples include IT risk, operational risk, regulatory risk, legal risk, political risk, strategic risk and credit risk. After listing all possible risks, the company can then select the risks to which it is exposed and categorize them into core and non-core risks. Core risks are those that the company must take in order to drive performance and long-term growth. Non-core risks are often not essential and can be minimized or eliminated completely.

2. Risk Measurement

Risk measurement provides information on the quantum of either a specific risk exposure or an aggregate risk exposure, and the probability of a loss occurring due to those exposures. When measuring specific risk exposure it is important to consider the effect of that risk on the overall risk profile of the organization. Some risks may provide diversification benefits while others may not. Another important consideration is the ability to measure an exposure. Some risks may be easier to measure than others.

3. Risk Mitigation

Having categorized and measured its risks, a company can then decide on which risks to eliminate or minimize, and how much of its core risks to retain. Risk mitigation can be achieved through an outright sale of assets or liabilities, buying insurance, hedging with derivatives or diversification.

4. Risk Reporting & Monitoring

It is important to report regularly on specific and aggregate risk measures in order to ensure that risk levels remain at an optimal level. Financial institutions that trade daily will produce daily risk reports. Other institutions may require less frequent reporting.

5. Risk Governance

Risk governance is the process that ensures all company employees perform their duties in accordance with the risk management framework. Risk governance involves defining the roles of all employees, segregating duties and assigning authority to individuals, committees and the board for approval of core risks, risk limits, exceptions to limits and risk reports, and also for general oversight.

2.3 CAPITAL ADEQUACY REQUIREMENTS

Q3. Write Capital about Adequacy Norms.

Ans : (Dec.-19)

A capital Adequacy requirement also known as regulatory capital or capital requirement is the amount of capital a bank or other financial institution has to hold as required by its financial regulator. This is usually expressed as a capital adequacy ratio of equity that must be held as a percentage of risk-weighted assets. These requirements are put into place to ensure that these institutions do not take on excess leverage and become insolvent. Capital requirements govern the ratio of equity to debt, recorded on the liabilities and equity side of a firm's balance sheet. They should not be confused with reserve requirements, which govern the assets side of a bank's balance sheet—in particular, the proportion of its assets it must hold in cash or highly-liquid assets.

Regulators endeavour to ensure that financial institutions, banks and investment firms have enough capital to ensure their businesses remain stable. This measure not only protects depositors within the industry but also the larger economy as failures of institutions, such as banks, can have wider-scale repercussions.

'Capital Adequacy' is therefore the statutory minimum capital reserve that a financial institution or investment firm must have available and regulatory capital adequacy provisions thus require relevant firms to maintain these minimum levels of capital, calculated as a percentage of its risk weighted assets. Often Capital Adequacy is referred to as the required Regulatory Capital of a firm.

Capital adequacy requirements are based on a minimum ratio of capital to risk-weighted assets. For assets that are essentially risk free, such as Treasuries, the ratio is 0%. For risky assets, the ratio can be greater than 100%. If a bank buys $1 million worth of assets with a risk rating of 100%, then the bank must hold $1 million of capital to cover the risk of those assets. On the other hand, if a bank invests $1 million in Treasuries, which have a risk rating of 0%, then no additional capital must be maintained for that asset.

Q4. Explain the need for Minimum Capital Requirement.

Ans :

The capital which banks hold with themselves as required by financial regulator is known as minimum capital requirement. Banks exposed to various types of risks while granting loans and advances to various sectors. In order to absorb any losses which banks face from its business, it is imperative that banks should have sufficient capital. If banks have adequate capital, then it can protect its depositors from unforeseen contingencies as well promotes the stability and efficiency of financial systems.

Q5. What are the components of Capital Adequacy Requirements?

Ans :

Components of Capital

Tier I capital

It an important component of regulatory capital. It consists of share capital (paid up capital), statutory reserves and other disclosed free reserves (minus goodwill, if any). Tier I items are perceived to be of the highest quality because of their availability to cover losses, if any, are not compromised. In simple terms this is the core capital of the bank and more or less remains homogeneous across countries. The Tier I capital therefore is internationally comparable.

Tier II capital

It is also known as supplementary capital. It consists of undisclosed reserves, asset revaluation reserves, general provisions, hybrid debt capital instruments and subordinated debt. Tier II items

qualify as regulatory capital to the extent that they can be used to absorb losses arising from a bank's activities. The loss absorption capacity of Tier II capital is somewhat compromised because being supplementary it can be used mainly in the event of winding up. Thus it provides lesser degree of protection to the depositors.

Tier III capital

It is the capital issued to meet only the market risk capital charge in accordance with prescribed criteria of RBI. These risks may arise due to changes in interest rate, exchange rate, equity prices, commodity prices, etc.

2.4 INTEREST RATE RISK

Q6. What is Interest Rate Risk ?

Ans :

Interest Rate Risk is the risk that an investment's value will change due to a change in the absolute level of interest rates, the spread between two rates, in the shape of the yield curve or in any other interest rate relationship. This type of risk affects the value of bonds more directly than stocks and is a significant risk to all bondholders. As interest rates rise, bond prices fall – and vice versa.

Interest rate risk that interest rate changes will affect the financial well-being of an entity. This includes changes in interest rates adversely affecting the value and liquidity of fixed or floating rate exposures. In addition to bond prices, interest rate fluctuations also directly affect stock prices, foreign exchange rates and economic growth.

Interest rate risk has received increased attention as an important source of corporate risk, as interest rate movements may affect present and future cash flows of the company. Internal hedging strategies for managing interest rate risk involve matching cash flows or assets and liabilities to create natural hedges against interest rates. These work well for financial service companies such as banks which operate a centralised treasury system.

Q7. What are the various approaches/types for measuring Interest Rate Risk.

Ans :

To hedge the interest rate, the banking system is complied by deregulation of interest rates and operational flexibility in pricing of assets and liabilities of the banks. The interest rate risk is the risk wherein the market rates affect the bank's financial condition. The changes in interest rates imposes vast impact on the functioning of the banks. The changes in interest rates have an immediate impact on the earnings of the banks.

Variation in market rates affects off-balance sheet position and the changing interest rates on banks MVE (Market Value of Equity). The banks and financial institutions measure ALM interest rate risk on the basis of following reasons.

(i)   For establishing the amount of economic capital.

(ii) For reducing the risks.

The banks uses the following approaches for measuring ALM interest rate risk.

1. **Gap Analysis**

Gap analysis is found to be one of the most suitable methods for measuring interest rate risk. By using this method, maturity gap is determined for a given period of time. While calculating maturity gap, it takes into consideration both fixed and floating assets and liabilities that tends to mature in the same period.

The bank which has a positive gap will see the interest income rise if market interest rate rises as more assets than liabilities will contribute this increase. The bank will be benefited by falling rates and will face loss by rising rates with a negative gap.

A simple maturity gap measure, calculates a sequence of periodic maturity gaps, like series of three months gaps for five years. The maturity gap method has the advantage of a greater accuracy.

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For estimating how net interest income will react : after reducing the measure of interest rate exposure by one number, the concept of duration was developed.

When discounted cash flows are used as weights, the duration analysis provides the weighted average time for repricing. The difference between duration of assets and liabilities is a "duration gap". The bank gets more sensitivity due to the changes in the market rates because of the larger duration gap.

Duration gap is stated to be accurate when the term structure of interest rates shifts in parallel are known in advance.

2. Rate-shift Scenario

The change in interest rates resulted into rate-shift scenario which is used for capturing customer behaviour.

For instance, if it is expected that the rates will rise to 2% then what will be the bank cash flow. If there will be increase in rates then there will be fluctuations in mortgage prepayments, prime lending rates and a consequent decline in the sanctioned loan.

So, the net present value is calculated for the new cash flows by using new rates. It helps in leading to the changes in expected earnings and expected value in different scenarios of interest rates.

3. Simulation Method

Bank's financial position, asset values, earnings or net incomes, influenced by several risks, are examined under simulation technique.

Simulation technique is performed in two environments.

(i) Static Simulation : In static environment the on-balance sheet and off-balance sheet positions of current period are valued.

(ii) Dynamic Simulation : The dynamic simulation creates complete hypothesis about the future act of interest rates and sudden changes in the operations of the banks. Depending upon the user's need the output of simulation can be in various forms.

Simulation technique provides as

(a) Current and expected periodic gaps

(b) Duration gaps

(c) Balance sheet and income statements

(d) Performance measures

(e) Budget and financial reports

Simulation technique helps in setting the known risk exposure in various interest rates and balance sheet scenarios.

Thus, based on the available data, information technology and technical expertise, the ALM interest rate risk can be ascertained by using the above approaches (i.e., duration or gap analysis or simulation technique).

4. Duration Analysis

Duration analysis considers the time value of money for the cash flows to determine the gap. It focuses on the price risk and reinvestment risk at the time of managing the interest rate exposure. Duration analysis manages these two risks by analysing the affect of changes in the rates on the market value of the assets and liabilities and Net Interest Margins (NIM) by using the duration. After determining the duration, the affect of rate changes on NIM and market value of assets and liabilities of the banks can be analysed by calculating the gap for the portfolio of assets and liabilities.

Duration analysis or gap can be calculated as,

$$D_s \times S = (D_A \times A) - (D_L \times L)$$

Where,

D_S = Duration gap/duration of surplus.

D_A = Duration of assets

D_L = Duration of liabilities

A = Assets

L = Liabilities

S = Surplus/gap

Whereas,

L = A – S

Thus, the duration gap is defined as the composite duration of liabilities and the multiple of the difference between composite duration of assets and the composite duration of liabilities and the asset - surplus ratio. Once the duration of the surplus is determined, the market value of the asset/liability needs to be calculated by the formula,

Change in the market value

$$= \frac{-\Delta(\Delta x) \times (\text{Current market value})}{(1 + i)}$$

Where,

D = Assets/liabilities duration

Δx = Variations in interest rates

i = Current interest rate.

Finally, the new market value (of assets and liabilities) can be computed by using the formula,

New market value = Original value + Change in market value

5. Hedging with Derivatives

A derivative is a type of financial instrument whose value is derived from the value of an underlying asset. Derivatives are also used for managing interest rate risk. The following are some of the major derivatives which are used to manage interest rate risk.

(i)   Forward rate agreements

(ii)   Interest caps, floors and collars

(iii) Interest rate swaps

(iv)   Interest rate futures.

Q8. Explain the Management Of Interest Rate Risk.

Ans :

Interest Rate Risk is seen when there exist fluctuations in the interest rates of the country which is found to be more sensitive towards the assets and liabilities of the bank. The interest rate risk is tolerated by the bank by considering it as not being accepted unexpectedly.

An organization offering financial services has to take risk, but it confirms that the risk taken should be managed without difficulty. It also takes sufficient care that the risk taken should not get converted into any other unwanted risk.

The various types of interest rate risk caused in an organization offering financial services are :

1. Rate Level Risk

In a rate level risk, the market conditions and regulatory intervention over a given period of time occupies a profound effect on restricting of interest rate risk.

2. Volatility Risk

In this risk the holder of an option is revealed on the basis of uncertain volatility security. The mix of assets or liabilities and long run implications of interest rates are used for deciding the short-term changes. The effect on cash flow and profits will cause high volatile market and this causes the volatility risk.

3. Prepayment Risk

The risk is related with improper return of principal on a fixed income security. The prepayment risk is caused due to changes in interest rates at payment of interest and installments of loans. The reinvestment of intermediate cash flows at lower rates due to the fluctuation in interest rates causes reinvestment risk.

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4. Call/Put Risk

The funds, which can be raised by issuing securities, include call/put options. Call option is provided by the issuer and put option by the investor. Risk arises when the interest rate fluctuates. The call option is exercised in decreasing rate scenario where put option is exercised in increasing rate scenario.

5. Reinvestment Risk

Reinvestment risk is the risk that is associated with the intermediate cash flows arises due to the payment of interest, loan installments etc. Due to interest rate fluctuations, such intermediate cash flows needs to be reinvested but at a lower rate of interest it yields lower returns.

6. Basis Risk

Basis risk arises when there exists mismatch between the benchmark rates. Different benchmark rates are used when the cost of liabilities and the yields of assets aren't linked to the single system of floating rates.

7. Real Interest Rate Risk

When the variations in the nominal interest rates would not be comparable with the variations in inflation, then only the real interest on the cost of liabilities and the yields of assets can be computed.

The nominal interest rate minus the inflation rate is the real interest rate. If the inflation rate over the duration of loan is not determined initially then the volatility in inflation represents risk for both borrower and lender.

The real interest rate risk affects the incomes/expenses, value of assets/liabilities, and the market value.

2.5 LIQUIDITY RISK

Q9. What is Liquidity Risk and Explain the various types of Liquidity Risk.

Ans :   **(Dec.-19)**

Liquidity risk is a financial risk that for a certain period of time a given financial asset, security or commodity cannot be traded quickly enough in the market without impacting the market price. Funding or cash flow risk: risk that an entity will encounter difficulty in realising assets or otherwise raising funds to meet commitments associated with financial instruments.

Liquidity risk is the risk that a company or bank may be unable to meet short term financial demands. This usually occurs due to the inability to convert a security or hard asset to cash without a loss of capital and/or income in the process.

Liquidity risk management requires mapping of cash flows for short as well as long period, which is the basis for strategic planning. Liquidity risk management is essential in banks and nbfc, because matching of cash flow determine the profitability. If there is idle fund, there is a cost. If there is shortage , borrowing from the market is expensive. So by mapping for short and long period of source and use of fund, it is ascertained that in which bucket there could be shortage.

Types of Liquidity Risk

(a) Funding Risk

Funding Liquidity Risk is defined as the inability to obtain funds to meet cash flow obligations. For banks, funding liquidity risk is crucial. This arises from the need to replace net outflows due to unanticipated withdrawal/non-renewal of deposits (wholesale and retail).

(b)   Time Risk

Time risk arises from the need to compensate for nonreceipt of expected inflows of funds i.e., performing assets turning into non-performing assets.

(c)   Call Risk

Call risk arises due to crystallisation of contingent liabilities. It may also arise when a bank may not be able to undertake profitable business opportunities when it arises.

Q10. Explain the causes of Liquidity Risk.

Ans :

1.   Liquidity risk arises from situations in which a party interested in trading an asset cannot do it because nobody in the market wants to trade for that asset.

2.   Liquidity risk becomes particularly important to parties who are about to hold or currently hold an asset, since it affects their ability to trade.

3.   Manifestation of liquidity risk is very different from a drop of price to zero. In case of a drop of an asset's price to zero, the market is saying that the asset is worthless.

4.   Liquidity risk is financial risk due to uncertain liquidity. An institution might lose liquidity if its credit rating falls, it experiences sudden unexpected cash outflows, or some other event causes counterparties to avoid trading with or lending to the institution. A firm is also exposed to liquidity risk if markets on which it depends are subject to loss of liquidity.

5.   Liquidity risk also tends to compound other risks. If a trading organization has a position in an illiquid asset, its limited ability to liquidate that position at short notice will compound its market risk.

Q11. Discuss how the liquidity risk is managed.

Ans :

Liquidity Risk

When a firm is not able to purchase or sell a particular product within a short duration of time, being its value unchanged, then it is called as 'liquidity risk'. To run the business smoothly it is very important for any firm to acquire liquid funds whenever they are required.

Liquidity risk management refers to the availability of cash flows i.e., both inflows and outflows and the bank's ability to match the maturity of liabilities with demand of customers for cash. Liquidity risk arises when the bank is not able to produce cash to meet with any decrease in liabilities or increase in the value of assets.

It relates with cause and effect relationship that exist between the assets and the liabilities. Further the decisions of investment and finance both in long ran and short run influence the equilibrium position of the bank with respect to assets and liabilities which in turn have an impact on its liquidity position. In such situations, the banks usually follow two approaches to control and manage its liquidity position. They are:

1.   Fundamental approach

2.   Technical approach.

1.   Fundamental Approach

In this approach, the bank manages to control the liquidity position and tries to tackle the liquidity risk by keeping its asset-liability position at an equilibrium.

To control the liquidity risk under the fundamental approach two methods are used. They are :

(i)   Asset Management

Asset management manages liquidity risk by holding near-cash assets that can be easily

convertible to cash whenever required. Asset management is subjected to liquidity requirements which can be met from primary and secondary reserves. Primary reserves refers to the savings of cash required to handle the statutory cash reserve requirements and different operating needs.

Secondary reserves consist of assets purposely held to meet the liquidity requirements. These reserves consist of assets which are highly liquid in nature. Banks make use of these secondary reserves to meet the obligations of credit disbursals, deposit withdrawals, adverse clearing balances etc.

(ii) Liability Management

Liability management deals with the sources of funds. Under this, the bank achieves the liquidity position by borrowing funds when the need arises up. Banks usually invest in long term securities. They send a lending proposal, though it does not possess any surplus cash only with an intention to raise external funds from a varied sources.

2. Technical Approach

The technical approach aims to protect the liquidity position of the bank in the short run. Managing liquidity in the short run is associated with cash outflows arising due to day-to-day business transactions. Technical approach consist of two more sub-approaches to analyze the liquidity position in the short run. They are :

(i) Working Funds Approach

According to the working funds approach, the liquidity position is known depending on the volume of working funds possessed by the bank, as the availability of working funds shows the total resource possessed by the bank to carry out its business operations. Liquidity is given as a percentage to total working funds. This percentage will be computed based on the historical performance of bank. The working funds, are owned funds, deposits and float funds.
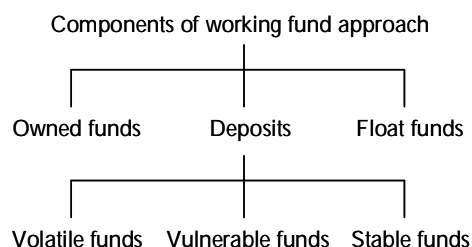
Components of working fund approach

Figure: Components of Working Fund Approach

i) Owned Funds

Owned funds are the owner's fund or capital that have been characterized by negligible liquidity.

ii) Deposits

Deposits under working funds are classified based on the period of their maturity. They are :

a) Volatile Funds : Volatile funds are the short deposits which are compulsorily withdrawn on the date for which liquidity has been forecasted. For example: 30 day's deposits, 90 day's deposits, 180 day's deposits etc.

b) Vulnerable Funds: The funds that are withdrawn during the planning period are called vulnerable funds. For example: Savings deposits.

c) Stable Funds: These funds face the least probability to be withdrawn during the planning period. Thus, the liquidity level has to be maintained. To match the stable maturity, funds can also be less than the above two types of funds.

iii) Float Funds

Float funds are the third type of working fund. These are same like the volatile funds. Float funds are the most liquid funds used by the banks. For example : DD's, Banker's cheques etc.

2.6 MARKET RISK

Q12. What is Market Risk? Explain the various types of Market Risk.

Ans :

Variation in prices sparked off due to real social, political and economic events is referred to as market risk. Market risk arises out of changes in demand and supply pressures in the market following the changing flow of news or expectations. Apart from this, the subjective factors like psychology and sentiments of investors also cause some market fluctuations and uncontrollable risk.

Market risk is the possibility of an investor experiencing losses due to factors that affect the overall performance of the financial markets in which he or she is involved. Market risk, also called "systematic risk," cannot be eliminated through diversification, though it can be hedged against.

Market risk is the risk that the value of an investment will decrease due to changes in market factors. These factors will have an impact on the overall performance on the financial markets and can only be reduced by diversification into assets that are not correlated with the market – such as certain alternative asset classes.

Market risk contrasts with specific risk, also known as business risk or unsystematic risk, which is tied directly with a market sector or the performance of a particular company. In other words, market risk refers to the overall economy or securities markets, while specific risk involves only a part.

Definition of Market Risk

Market risk as the risk of losses on-and-off balance sheet positions that occur as a result of adverse movements in market prices. "From a regulatory perspective, market risk stems from all the positions included in banks' trading book as well as from commodity and foreign exchange risk positions in the whole balance sheet,"

Types of Market Risk

1. **Equity Risks :** An equity risk is the market risks associated with positions in equity markets. The risk associated with stock prices. In many cases, stocks have higher associated risks than other investment classes such as government bonds. Some types of equities such as small cap stocks traded on emerging markets can be extremely volatile.

2. **Fixed Income Risks :** The risks associated with positions in fixed-income instruments and interest sensitive instruments.

3. **FX Risks :** Risks associated with foreign and cross-currency positions. Exchange rates can change rapidly as they are affected by a wide range of political and economic conditions. Many businesses have exposure to interest rates both in terms of costs and revenue sources. As a result, changes in exchange rates can lead to volatility in a company's margins and profitability. Exchange rates also directly impact the value of foreign assets such as property.

4. **Commodity Risks :** Commodity risk refers to the uncertainties of future market values and of the size of the future income, caused by the fluctuation in the prices of commodities. The prices of commodities such as grains or fuels can be volatile in the short term. Commodity prices can also follow long cycles meaning that prices can remain elevated or depressed for extended periods of time. As a result, commodity price volatility is a key risk to industries that directly produce commodities or that use them as an input.

Q13. What are the types of hedging to management of market risk ?

Ans :

(a) Delta Hedging

One of the building blocks of derivatives theory is delta hedging. This is the theoretically perfect elimination of all risk by using a very clever hedge between the option and its underlying. Delta hedging exploits the perfect correlation between the changes in the option value and the changes in the stock price. This is an example of 'dynamic' hedging; the hedge must be continually monitored and frequently adjusted by the sale or purchase of the underlying asset. Because of the frequent rehedging, any dynamic hedging strategy is going to result in losses due to transaction costs. In some markets this can be very important.

The 'underlying' in a delta-hedged portfolio could be a traded asset, a stock for example, or it could be another random quantity that determines a price such as a risk of default. If two instruments depending on the same risk of default, can calculate the sensitivities, the deltas, of their prices to this quantity and then buy the two instruments in amounts inversely proportional to these deltas (one long, one short). This is also delta hedging.

(a) Gamma Hedging:
To reduce the size of each re-hedge and/or to increase the time between re-hedges, and thus reduce costs, the technique of gamma hedging is often employed. A portfolio that is delta hedged is insensitive to movements in the underlying as long as those movements are quite small. There is a small error in this due to the convexity of the portfolio with respect to the underlying. Gamma hedging is a more accurate form of hedging that theoretically eliminates these second-order effects. Typically, one hedges one, exotic, say, contract with a vanilla contract and the underlying. The quantities of the vanilla and the underlying are chosen so as to make both the portfolio delta and the portfolio gamma instantaneously zero.

(b) Vega hedging:
The prices and hedging strategies are only as good as the model for the underlying. The key parameter that determines the value of a contract is the volatility of the underlying asset. Unfortunately, this is a very difficult parameter to measure. Nor is it usually a constant as assumed in the simple theories. Obviously, the value of a contract depends on this parameter, and so to ensure that a portfolio value is insensitive to this parameter we can vega hedge.

This means that we hedge one option with both the underlying and another option in such a way that both the delta and the vega, the sensitivity of the portfolio value to volatility, are zero. This is often quite satisfactory in practice but is usually theoretically inconsistent; we should not use a constant volatility (basic Black-Scholes) model to calculate sensitivities to parameters that are assumed not to vary.

The distinction between variables (underlying asset price and time) and parameters (volatility, dividend yield, interest rate) is extremely important here. It is justifiable to rely on sensitivities of prices to variables, but usually not sensitivity to parameters. To get around this problem it is possible to independently model volatility, etc., as variables themselves. In such a way it is possible to build up a consistent theory.

Q14. What are the advantages and limitations of Hedging.

Ans :

Advantages of Hedging

Following are the various advantages of Hedging :

➢ Futures and options are very good short-term risk-minimizing strategy for long-term traders and investors.

➢ Hedging tools can also be used for locking the profit.

➢ Hedging enables traders to survive hard market periods.

➢ Successful hedging gives the trader protection against commodity price changes, inflation, currency exchange rate changes, interest rate changes, etc.

➢ Hedging can also save time as the long-term trader is not required to monitor/adjust his portfolio with daily market volatility.

➢ Hedging using options provide the trader an opportunity to practice complex options trading strategies to maximize his return.

Disadvantages of Hedging

Following are the disadvantages of Hedging

➢ Hedging involves cost that can eat up the profit.

➢ Risk and reward are often proportional to one other; thus reducing risk means reducing profits.

➢ For most short-term traders, e.g.: for a day trader, hedging is a difficult strategy to follow.

➢ If the market is performing well or moving sidewise, then hedging offer little benefits.

➢ Trading of options or futures often demand higher account requirements like more capital or balance.

➢ Hedging is a precise trading strategy and successful hedging requires good trading skills and experience.

2.7 CREDIT RISK OR DEFAULT RISK

Q15. What is Credit Risk ? and explain the various types Credit Risk.

Ans :

A credit risk is the risk of default on a debt that may arise from a borrower failing to make required payments. In the first resort, the risk is that of the lender and includes lost principal and interest, disruption to cash flows, and increased collection costs. The loss may be complete or partial. In an efficient market, higher levels of credit risk will be associated with higher borrowing costs. Because of this, measures of borrowing costs such as yield spread scan be used to infer credit risk levels based on assessments by market participants.

Credit risk is the possibility of a loss arising from a credit event, such as deterioration in the financial condition of a borrower that causes an asset (including off-balance sheet transactions) to lose value or become worthless. Overseas credits also include an element of country risk, which is closely related to credit risk. This is the risk of loss caused by changes in foreign exchange, or political or economic situations.

Credit Risk depends on both external and internal factors.

The internal factors include

1. Deficiency in credit policy and administration of loan portfolio.

2. Deficiency in appraising borrower's financial position prior to lending.

3. Excessive dependence on collaterals.

4. Bank's failure in post-sanction follow-up, etc.

The major external factors

1. The state of economy

2. Swings in commodity price, foreign exchange rates and interest rates, etc.

Types of Credit Risk

A credit risk can be of the following types:

➢ **Credit Default Risk**

The risk of loss arising from a debtor being unlikely to pay its loan obligations in full or the debtor is more than 90 days past due on any material credit obligation; default risk may impact all credit-sensitive transactions, including loans, securities and derivatives.

➢ **Concentration Risk**

The risk associated with any single exposure or group of exposures with the potential to produce large enough losses to threaten a bank's core operations. It may arise in the form of single name concentration or industry concentration.

➢ **Country Risk**

The risk of loss arising from a sovereign state freezing foreign currency payments (transfer/ conversion risk) or when it defaults on its obligations (sovereign risk); this type of risk is prominently associated with the country's macroeconomic performance and its political stability.

Q16. Credit Risk can't be avoided but has to be managed by applying various risk mitigating processes. Explain.

Ans :

1. Banks should assess the credit worthiness of the borrower before sanctioning loan i.e., credit rating of the borrower should be done beforehand. Credit rating is main tool of measuring credit risk and it also facilitates pricing the loan.

    By applying a regular evaluation and rating system of all investment opportunities, banks can reduce its credit risk as it can get vital information of the inherent weaknesses of the account.

2. Banks should fix prudential limits on various aspects of credit – benchmarking Current Ratio, Debt Equity Ratio, Debt Service Coverage Ratio, Profitability Ratio etc.

3. There should be maximum limit exposure for single/ group borrower.

4. There should be provision for flexibility to allow variations for very special circumstances.

5. Alertness on the part of operating staff at all stages of credit dispensation – appraisal, disbursement, review/ renewal, post sanction follow-up can also be useful for avoiding credit risk.

2.8 EXCHANGE RATE RISK

Q17. What is Exchange Rate Risk?
Ans :

Foreign exchange risk describes the risk that an investment's value may change due to changes in the value of two different currencies. It is also known as currency risk, FX risk and exchange-rate risk. Foreign exchange risk sometimes also refers to risk an investor faces when they need to close out a long or short position in a foreign currency and do so at a loss due to fluctuations in exchange rates.

Exchange-rate risk, also called currency risk, is the risk that changes in the relative value of certain currencies will reduce the value of investments denominated in a foreign currency.

When investing in foreign countries, it's important to consider the fact that currency exchange rates can change the price of the asset as well. Foreign exchange risk (or exchange rate risk) applies to all financial instruments that are in a currency other than your domestic currency.

Example : If you live in the U.S. and invest in a Canadian stock in Canadian dollars, even if the share value appreciates, you may lose money if the Canadian dollar depreciates in relation to the U.S. dollar.

Exchange rate risk is the possibility that changes in currency exchange rates may affect the value of assets or financial transactions. It is common for exchange rates to be reasonably volatile as they are impacted by a broad range of political and economic events.

Q18. Discuss about the measurement of Exchange Rate Risk.

Ans :

Measurement of exchange rate risk is an important part of exchange rate risk management decisions of a firm which is carried out after identifying the types of exchange rate risk a firm may face in future. It is difficult to measure currency risk relating to translation and economic risk. Value-at- risk model is widely used and defined as maximum loss for a given risk for specific time period with Z% confidence.

Var methodology facilitate firms in measuring different types of risk but it does not explain the outcomes of exposure for (100 – z)% point of confidence. It does not explain the maximum loss with 100% confidence, so firms set up operational limits like stop loss orders or nominal amounts along with VaR limits to have maximum coverage.

Calculation of Value-at-Risk

Firms use VaR measure of exchange rate risk to forecast the level of risk in foreign exchange position emerging from activities of firm. There are 3 parameters on which calculations of VaR relies.

➢ Holding period i.e time period for which foreign exchange position is planned to be held.

➢ Confidence level at which firm plan to make estimations

➢ Unit of currency used for denomination of the VaR.

VaR can be calculated by implementing any of the following models.

(a) Historical Simulation

It believes that currency returns on firms foreign exchange position will be same as past distribution.

(b) Variance-Covariance Model

It believes that currency return on total foreign exchange position of firm will be normally distributed and changes in value of foreign exchange position is based on currency returns.

(c) Monte Carlo Simulation

It believes that currency returns of the future will be randomly distributed.

Historical simulation is the simple way of calculating risk. It involves management of firm's current foreign exchange position across historical exchange rate changes to distribute losses in the value of foreign exchange position. It does not consider normal distribution of currency returns and documented these returns as leptokurtic. It requires large database and computed intensively.

Variance-covariance model involves quick calculation but include restrictive assumptions of normal distribution of currency returns and line combination of total foreign exchange position.

Monte Carlo simulation comprises of main components analysis of variance-covariance model continued by random simulation of the components. It can manage any underlying distribution and accurately evaluate VaR where there is non-linear currency factors in foreign exchange position but it is computationally intensive process.

Q19. What are the various types of Foreign Exchange Risk.

Ans :

(a) Transaction Risk

The risk that changes in exchange rates during the time it takes to settle a cross-border contract will adversely affect the profit of a party to the transaction. Accounting Dictionary defines transaction risk as "The risk that future cash transactions will be affected by changing exchange rates."

(b)   Open Position Risk

Exchange control guidelines in India requires banks to maintain at the close of every working day a square position in currencies.

➢ Practically, it is not possible to maintain a square position as the aggregate customer transactions will not result in marketable lots.

➢ Some open position, either overbought or oversold is unavoidable in the very nature of foreign exchange operations.

➢ Exchange control does not altogether prohibit banks keeping positions during the course of a day.

➢ It may happen that a dealer may be expecting the dollar to weaken during the day might square the deal later.

➢ The banks make profit out of such open positions which is a deliberate attempt. But, such uncovered positions may result into a loss.

➢ Measures to mitigate open position risk.

➢ Limits on intra-day open positions in each currency.

➢ Limits on overnight open positions in each currency.

➢ A limit on aggregate open position for all currencies taken together,

➢ A turnover limit on a total daily transaction volume for all currencies.

(c)   Mismatch Maturity Risks

Risk that, due to differences in maturities of the long and positions in a cross hedge, the value of the risk offsetting positions will fail to move in concert.

➢ It is possible that no seller/counterparty might be available.

➢ The bank has the problem of first finding out the seller who will agree to sell the required forex at the required rate on the agreed date.

➢ If the rate of overdraft is costlier than the rate payable to customer, the bank incurs a loss.

(d)   Credit or Settlement Risks

➢ Can arise when a counterparty whether a customer or a bank, fails to meet his obligation and the resulting open position has to be covered at the going rate. If the rates have moved against the bank, a loss can result.

➢ Can arise if a bank has discounted the bills under L/C of ABC Ban. On the maturity, the L/C opening bank fails. The Bank incurs a loss.

(e)   Sovereign Risk

Arises if a country suddenly suspends or imposes a moratorium on foreign payments because of balance of payments or other problems.

➢ Arises when banks deal with other banks in other countries.

➢ Also arises on account of large exposures on any country which is in some trouble – then the bank that has exposure may incur a huge loss.

(f)   Operational Risks

Operational risk is the risk of direct or indirect loss resulting from inadequate or failed internal procedures, people and systems, or from external events. Operational risk for foreign exchange, in particular, involves problems with processing, product pricing, and valuation. These problems can result from a variety of causes, including natural disasters, which can cause the loss of a primary trading site or a change in the financial details of the trade or settlement instructions on a Forex transaction. Operational risk may also emanate from poor planning and procedures, inadequate systems, failure to properly supervise staff defective controls, fraud, and human error.

2.9 VALUE AT RISK

Q20. Define Value at Risk. (Dec.-19)

Ans :

Value at Risk (VAR) is a measurement technique that estimates the risk of an investment. In other words, VAR is a statistical technique that measures the amount of potential loss that could happen in a portfolio of investment over a period of time. Value at Risk gives the probability of losing more than a given amount on a given portfolio over a period of time.

Value at risk (VaR) is a popular method for risk measurement. VaR calculates the probability of an investment generating a loss, during a given time period and against a given level of confidence. It gives investors an indication of the level of risk they take with a certain investment. This can help them decide whether the possible gain is worth the potential maximum loss. VaR can be calculated for either one asset, a portfolio of multiple assets of an entire firm.

Value at risk (VaR) estimates the minimum loss that a party would expect to experience with a given probability over a specified period of time. Using the complementary probability (i.e., 100 percent minus the given probability stated as a percent), VaR can be expressed as a maximum loss at a given confidence level. VaR users must make decisions regarding appropriate time periods, confidence intervals, and specific VaR methodologies.

Q21. Explain the features of VAR.

Ans :

The following are the features of VAR

➢ VaR is probability based and allows the users to interpret possible losses for various confidence levels.

➢ It is a consistent measurement of financial risk as it uses the possible dollar loss metric enabling the analysts to make direct comparisons across different portfolios, assets or even business lines.

➢ VaR is calculated based on a common time horizon, and thus, allows for possible losses to be quantified for a particular period.

Q22. What are the Advantages and Limitations of Value at Risk (VAR).

Ans :

1. Easy to understand

Value at Risk is a single number that indicates the extent of risk in a given portfolio. Value at Risk is either measured in price unites or in form of percentage. This makes the interpretation and understanding of VAR easier.

2. Applicability

Value at Risk is applicable to all the assets in various portfolios. Value at Risk is applicable to bonds, shares, derivatives, currencies or any other asset with a price. Thus, VAR can be easily used by different banks and financial institutions to measure the profitability and risk of different assets, and allocate risk based on VAR.

3. Universal

As the Value at Risk figure is used by everyone it can be considered as a standard in buying, selling or recommending assets.

Limitations of Value at Risk

1. Large Portfolios

Calculation of Value at Risk for a portfolio not only requires one to calculate the risk and return of the asset but also the correlations between them. Thus, the greater the number or diversity of assets in a portfolio, calculating VAR will be difficult.

2.   The Difference in Methods

The different approaches in calculating VAR can lead to different results with the same portfolio.

3.   Assumptions

Calculation of VAR requires one to make assumptions as inputs. If assumptions are not good or are wrong, the VAR figure will also be wrong.

Q23. Explain the steps for calculation of VAR.

Ans :

In general the VAR calculation follows five steps :

1.   Identification of portfolio positions for calculation of Value at Risk

2.   Identification of risk factors affecting valuation of positions.

3.   Assignment of probabilities (or statistical distribution) to possible risk factors values.

4.   Creation of pricing functions for positions as a function of values of risk factors.

5.   Calculation of Value at Risk (VaR)

Q24. Explain the various methods used for calculating VAR.

Ans :

Methods Used for Calculating VAR

1.   Historical Method

It is the simplest method for calculating Value at Risk. In the historical method, market data for the last 250 days is taken to calculate the percentage change for each risk factor on each day. Each percentage change is then calculated with current market value to present 250 scenarios for future value. For each of the scenarios, the portfolio is valued using full non-linear pricing models. The third worst day selected is assumed to be 99% VAR.

$$\text{Value at Risk} = v_m \, \frac{v_i}{v_{i-1}}$$

v_i is number of variables on day i m is the number of days for which historical data is taken

The historical method estimates VaR from data on a portfolio's performance during a historical period. The returns are ranked, and VaR is obtained by determining the return that is exceeded in a negative sense 5 percent or 1 percent (depending on the user's choice) of the time. The historical method has the advantage of being simple and not requiring the assumption of a normal distribution. Its disadvantage is that accurate historical time-series information is not always easily available, particularly for instruments such as bonds and options, which behave differently at different points in their life spans.

2.   Parametric Method

It is also known as the variance-covariance method. This method assumes a normal distribution in returns. In other words, under this method, two factors are to be estimated, an expected return and a standard deviation. This method is best suited to risk measurement problems where the distributions are known and reliably estimated. This method is unreliable when the sample size is small.

The analytical or variance–covariance method can be used to determine VaR under the assumption that returns are normally distributed by subtracting a multiple of the standard deviation from the expected return, where the multiple is determined by the desired probability level. The advantage of the method is its simplicity. Its disadvantages are that returns are not normally distributed in any reliable sense and that the method

does not work well when portfolios contain options and other derivatives.

Let loss be 'l' for a portfolio 'p' with 'n' number of instruments.

$$l_p = l_1 + l_2 + l_3 + ... + l_n$$

$$\sigma_p^2 = \sigma_1^2 + \sigma_2^2 + \sigma_3^2 + ...$$

$$+ \sigma_n^2 + \rho_{1,2,3,...n} \, \sigma_1 \, \sigma_2 \, \sigma_3 \, ..., \sigma_n$$

where

σ_p^2 = Standard deviation of the loss on portfolio

σ_1^2 = Loss form instrument 1

$\rho_{1,2,3,...,n}$ = Correlation between losses 1 to n

3. Monte Carlo Method

Under this method, Value at Risk is calculated by randomly creating a number of scenarios for future rates using non-linear pricing models to estimate the change in the value of each scenario, and then calculating the VAR according to the worst losses. The method is suitable to a great range of risk measurement problems, especially when dealing with complicated factors. This method assumes that there is a known probability distribution for risk factors.

The Monte Carlo Method creates simulations to calculate the VaR. A risk manager will perform a number of simulations, each simulation with different input variables. These variables may range from level of volatility, initial price, correlation estimates. These numerous simulations will generate different outcomes which appear in a similar fashion to that of the other methods. It will result in a graph which shows

the number each return is realized in the simulation.

Monte Carlo simulation estimates VaR by generating random returns and determining the 5 percent or 1 percent (depending on the user's choice) worst outcomes. It has the advantages that it does not require a normal distribution and can handle complex relationships among risks.

4. Marginal Value at Risk (MVAR)

It is the amount of additional risk that is added due to a new investment in the portfolio. MVAR helps fund managers to understand the change in a portfolio due to subtraction or addition of a particular investment. An investment may individually have a high Value at Risk, but if it is negatively correlated with the portfolio, it may contribute a much lower amount of VAR to the portfolio than its original amount.

5. Incremental Value at Risk

It is the amount of uncertainty added to a portfolio or subtracted from a portfolio due to buying or selling of an investment. Incremental VAR is calculated by taking into consideration the portfolio's standard deviation and rate of return and the individual investment's rate of return and the portfolio share.

6. Conditional Value at Risk (CVAR)

It is also known as the expected shortfall, average value at risk, tail VAR, mean excess loss or mean shortfall. CVAR is an extension of VAR. CVAR helps to calculate the average of the losses that occur beyond the Value at Risk point in a distribution. The smaller the CVAR, the better it is.

Q25. Explain how the firm's risk is managed by measuring it with the techniques of VaR or CaR.

Ans :

When firms experience an increase in their cost of measuring risk using VaR and CaR measures, it can increase its value by lowering its cost of risk for a given desired level of profits. There are essentially three approaches for doing this,

1. Decreasing the Cost of Risk for a given Level of VaR or CaR

The financial firms focus on the value of the firm, a decline in the value of the firm will lead to an increase in the default risk and the loss of customers. The firms credit risk or default risk is inversely proportional to the equity capital as it renders funds that can meet the needs of the customers in the event that the firm's traded assets lose value. A firm can reduce the cost of VaR and CaR by raising equity capital to save cash and to reduce the debt. This enables the firm to continue its investment planning.

To raise equity in a manner that it reduces the firm's risk, the earning of the equity should be invested to reduce the CaR. CaR is expensive as it results sometimes in worst and negative cash flows, which makes the position of the firm to be restricted in financial terms. To reduce this, the financial slack of a firm which is the unutilized borrowing capacity of the firm, should be more to limit the financial constraints that a firm might face. This also reduces the CaR's cost and the shortfall of cash can be balanced using the financial slack.

2. Lower Risk through Project Selection

A firm can reduce the risk through a proper choice of the projects that provide higher returns, but such projects usually involve high risk. Firms should diversify its business as a way of managing their risk. Diversification proves to be costly when it deals with purchasing financial assets. Firms should enter into those projects that are relevant with the existing projects. It is observed that diversification involves less cost and it is within the reach of the firm.

3. Derivatives and Financial Instruments to Manager Risk

The above two approaches involve considerable risk and cost, but in this third approach the financial instruments are very much useful as they have less cost. The reason behind this is due to less transaction cost associated with the trading of financial instruments. Trading of such instrument is even more cheaper in liquid market specially in spot foreign exchange market and results into 2 outcomes. Firstly, it reduces the risk by increasing the value of the firm and secondly, by designing the project to protect the firm from the risk. Many firms face the risk of moral hazard; it is a risk that comes when any one party takes elicit actions against the other party, that in turn affects the value of the contract. Moreover, the use of derivatives can be reduced by eventually buying it in the market.

PROBLEMS

1. ABC limited has invested 1,000 million portfolio over 2 years period at 95% confidential level. The standard deviation of the rate of return is 20% per annum. You are required to measure VaR (Reporting worst loss).

Sol :

Standard deviation of the stock of ABC limited,

$$= 20\% \text{ per annum}$$

i.e., $\alpha = 0.20$

Confidence interval = 95% which represents that about 5% of the stock of ABC limited is at risk.

From the normal distribution table, 95% confidence interval assumes a value of 1.646. For the calculation of VaR, the first step is to determine the range which is calculated by using a formula,

Range = Standard deviation x Table value of 95% confidence interval

= 0.20 × 1.646

Range = 0.3292

Time horizon adjustment

$= \sqrt{\text{Number of trading days}}$

Standard number of trading days in an year = 254 days

= 2 years

∴ Time horizon adjustment

$= \sqrt{254 \times 2}$

$= \sqrt{508}$ days

= 22.54

∴ Determination of VaR with 95% confidence

Interval = Range × Time horizon adjustment × Value of a portfolio

= 0.3292 × 22.54 × 1000 million

= ` 7420.168 million.

2. **The daily return of a portfolio follows a normal distributions with a mean of ` 2,000 and a standard deviation of ` 1000. You are required to calculate the VaR number at 99% confidence level.**

Sol :

Given,

Mean = Rs. 2,000

σ = Rs. 1,000

∴ VaR(99%) = Z(99%) × Mean

= Z (99%) 5 σ – Mean

∴ $Z(99\%) = \dfrac{2.32 + 2.33}{2} = 2.33$

∴ VaR(99%) = 2.33 x 1000 - 2000

= 2330 - 2000 = 330

∴ VaR = 330.

3. **A co has a position in bonds worth Rs. 6 million the modified duration is 5.2 years. Assume that only parallel shifts in the yield carve take place and that S.D of the daily yield change (when yield is measured in %) Is 0.09 use the duration model to estimate the 20 day 90% VaR for the Bonds.**

Sol :

The above case is related to single assets investment the total value of investment in Bonds = 60 lakhs i.e., (6 million).

    S.D measure is = 0.09 % (or) 0.0009

    duration period = 5.2 years.

S.D of Daily change in value of the Bond = D.B σ_y

  $\Rightarrow$ 5.2 × 60 lacks × 0.009

  $\Rightarrow$ Rs. 28080

$$\boxed{\text{20 day value at Risk} \Rightarrow 1-\text{day VaR}.\sqrt{N}}$$

        N = 20 days

    1 – day = 1 – 0.9 i.e., (90%)

$\Rightarrow$ 0.1

    Table value for 0.1 = 1.28

    VaR = Rs. 28080

$\Rightarrow$ 20 day value at risk = 1.28 × 28080 × $\sqrt{20}$

$\Rightarrow$ 20 day value at risk $\Rightarrow$ Rs. 160739/-

4.   **Consider a position consisting of a Rs. 3 lac investment in gold and Rs. 5 lac investment in silver suppose that the daily volatilities of these two assets are 1.8% and 1.2% rep., and that the coefficients of co-relation b/w there returns is 0.6 what is the 10 day 97.5% value at risk for the portfolio by how which does diversification reduce the VaR [Two Assets].**

Sol :

The above situation relating to the two assets to calculate S.D of daily change in value of portfolio combined S.D is required it is calculated as below:

    Rs in (000) (units)

Combined S.D

$$\sigma_{x+y} = \sqrt{(\sigma_x)^2(wx)^2 + (\sigma_y)^2(wy)^2 + 2.wx.wy.r_{xy}\sigma_x.\sigma_y}$$

$$\boxed{\begin{array}{l} x = \text{Gold} \\ y = \text{Silver} \end{array}}$$

  W_x = Investment in Gold = 300

  W_y = Investment in Silver = 500

$$\sigma_{x+y} = \sqrt{(1.8)^2(300)^2 + (1.2)^2(500)^2 + 2.300.500 \times .6 \times 1.8 \times 1.2}$$

$$\Rightarrow \sqrt{3.24 \times 90.000 \times 1.44 \times 250,000 + 388800}$$

$$\Rightarrow \sqrt{291600 + 360.000 + 388800}$$

$$\Rightarrow \sqrt{1040,400}$$

$$\sigma_{x+y} \Rightarrow \frac{1020 / -}{100}$$

$$\sigma_{x+y} \Rightarrow 10.2$$

The value of assets for 1 day risk is cal as below

$$\boxed{N - \text{day VaR} - 1 - \text{day VaR}.\sqrt{N}}$$

$$\Rightarrow \quad 10.2$$

$$97.5\% \quad \Rightarrow \quad 0.975$$

So,

$$\Rightarrow \quad N - \text{day VaR}$$

$$\Rightarrow \quad 1 - 0.975$$

$$\Rightarrow \quad 0.025$$

Table Value $\Rightarrow$ 1.96

for 0.025

Value at Risk

10 day VaR $\Rightarrow 1.96 \times 10.2 \times \sqrt{10}$

$$\Rightarrow 63.22$$

in (Rs) = 63,220

10 day Risk Portfolio value = Rs. 63220/-

Individual assets risk value is cal as below.

1. **For Gold Investment**

$\Rightarrow$ 10 – day 97.5% VaR $\Rightarrow$ (Investment × S.D) × 1.96 × $\sqrt{10}$

$\Rightarrow$ 10 – day 97.5% VaR = (300 × 1.8%) × 1.96 × 3.16

$\Rightarrow$ 5400 × 1.96 × 3.16227766

$\Rightarrow$ Rs. 33445/- i.e., (33470)

2. **For Silver Investment**

$\Rightarrow$ 10 – day 97.5% VaR = (Invt × S.D) × 1.96 × $\sqrt{10}$

$\Rightarrow$ (500.000 × 1.2%) × 1.96 × 3.16

$\Rightarrow$ 6000 $\times$ 1.96 $\times$ 3.16227766.

$\Rightarrow$ Rs. 37162/- i.e., (37188)

Diversification $\Rightarrow$ **Benefit Total of two assets value (–) portfolio value at risk**

So, (33470 + 37188) – 63220

$\Rightarrow$ 7438/-

2.9.1 Stress Testing

Q26. Explain the concept of Stress Testing.

Ans :

Stress Testing

Stress testing is a simple form of scenario analysis. Rather than consider the evolution of risk factors over several time steps, stress testing considers changes in risk factors over a single time step. That horizon is usually a single trading day, but stress testing can be considered over longer horizons - a week, two weeks, a quarter or even a year. Usually, stress testing is used to assess market risk, and that is the application this article focuses on. However, any scenario analysis that employs a single time step may be referred to as a stress test.

Used for market risk, a single scenario consists of projected values for applicable risk factors at the end of the horizon. Based on these values, a portfolio is marked-to-market. The result is compared with the portfolio's current market value, and the portfolio loss is calculated as the difference between the two.

Scenarios can be constructed in an ad hoc manner. If management is concerned about the effect of an inverted yield curve or a breakdown in a specific correlation, a scenario can be constructed specifically to assess that eventuality.

Stress testing can also be systematized. A firm may specify certain fixed scenarios (defined in terms of percent changes in applicable risk factors) and then perform periodic stress testing with those scenarios. In this manner, a firm might present stress test results in its daily risk report. Such stress scenarios may be hypothetical, perhaps reflecting contin-gencies that are a recurring concern of management. They can also be historically based. With that approach, stress scenarios may reflect the percentage changes in risk factors experienced during selected historical periods of market turmoil - stock market crashes, currency devaluations, etc.

Stress testing has much in common with value-at-risk (VaR). Both assess market risk. Both consider the change in market risk over a fixed horizon due to changes in specific risk factors. Indeed, if stress testing is conducted with randomly generated scenarios, the analysis would not be called stress testing. It would be called a Monte Carlo VaR measure.

Q27. Explain various approaches of stress testing.

Ans :

1. **Analyzing Past Events:** Historical event analysis is carried out to assess the affect of drastic events that are recurrent.

2. **Scenario Analysis:** Frameworks are created depending on the incidents and the results of such frameworks are analyzed.

3. **Institutions Scenario Analysis:** Scenarios are arranged depending on the chances of extreme events related to the banks or the other industries.

4. **Scenario of Standard Deviation :** Investigates the events if returns deviate by 4, 5 or 9 standard deviations.

5. **Severe Additional Events and Tail Risk:** Calculates the risk associated with the extreme market moves and the losses that can accrue from it.

6. **Quantitative Analysis of Tail Events:** Assesses the sequence observed in the tail events and uses the outcomes in scenario analysis.

Q28. While computing VaR, How are stress tests useful ? Use your own numerical example.

Ans :

Risk manager, while measuring the risk using Value at Risk (VaR), performs "stress testing". The objective of stress testing is to analyze the affect of unusual and the worst circumstances of the portfolios, irrespective of happening of events in the past. The stress test goes with the strength of the firm to withstand in the worst conditions and then practice changes in the existing strategy.

Uses of Stress Testing

1. It allows the risk manager to rank the economic factors in order of their influence on the portfolio value.

2. Helps to analyze the affects of the economic situation, except that of price changes.

3. Provides better and in-depth identification of the risk and takes necessary steps to protect the business from that risk.

4. It helps in testing the new products under extreme conditions which allows the firm to examine the investment risk before entering into any new business.

5. It can be used to test different types of risk like market risk, derivative risk, operational risk, credit or default risk. Some of the examples includes,

    (i)   The 1999 Brazil crisis

    (ii) The 1990 Nikkei crash

    (iii) The east Asian crisis in 1997

    (iv) The 1998 LTCM crash

    (v)   The crisis in Russia where the exchange rate of Russian ruble fell by 29% in 1998.

    (vi) The U.S equities market faced a crash of 20% in only one day in Oct. 1987 that proposed a reflexive affect on other market.

Example: Consider the following example of stock market crash of 1987. In this example, on 1 October, 1987, an extremely innovative risk-managing company has computed the means and standard deviations of the daily returns on the S & P 500 index to calculate the VaR of a portfolio. The results of such research is given below,

Time Period	Mean	Standard Deviation
1/1/1987 - 30/9/1987	0.001505	0.009840
1/1/1986 - 30/9/1987	0.000952	0.009538
1/1/1983 - 30/0/1987	0.000690	0.008385
1/1/1950 - 30/9/1987	0.000309	0.007841

Additional Information

Apart from the above computation, it has been reported that,

1.   About 4430 days out of 9571 trading days witnessed declined growth in a market, due to which they were ranked from lowest to highest as follows.

Market falls by	Number of days	Percentage of down days
>7%	0	0.0000
6-7%	2	0.0451
5-6%	3	0.0677
4-5%	6	0.1354
3-4%	19	0.4289
2-3%	103	2.3251
1-2%	757	17.0880

From the above numerical figure (or data), following were the findings of the risk management team,

2.   It was found that the market was down by more than 1.60% (4430 x 0.05) on 222 days.

3.   The market was down by more than 2.50% (4430 x 0.01) on 44 days.

4.   3 worst one-day losses took place on May 28, 1962 September 26, 1955 and June 26, 1950 respectively.

5.   The fourth one-day loss was reported on September 11, 1986 (- 4.9%).

For the determination of one-day VaR of firm's portfolio of worth $ 100 million, the risk management team has used the time period ranging between 1st January 1950 to 30th September 1987.

VaR Calculation Method	VaR level	VaR in Dollars
Variance - covariance	5%	- $1,289,845
Variance - covariance	1%	- $1,824,600
Historical simulation	5%	- $1,600,000
Historical simulation	1%	- $2,500,000

After submitting the predicted results, the risk management team went for a one month vacation. But, on 19th October 1987, again market was declined by 22.90%. The team was shocked as their diversified portfolio has end-up in huge losses.

The main question that was moving around was, If the financial asset returns are normally distributed, then what is the probability of observing a market crash like the one which took place on October 19, 1987?

This was because the daily average return was not statistically different from zero, the 22.90% decline forms the standard basis for the calculation of SD from mean as,

$$= \frac{22.90}{0.7841} = 29.205$$

If asset returns were normally distributed, then the 1987 stock market crash would not have taken place. In fact, it has been observed that if the asset returns are distributed normally, then there would have been only 4% occurrence of market decline once in every 5.9 million trading days. Thus, it is important to note that the value at risk concept is designed for "normal" market conditions.

2.9.2 Back Testing

Q29. What is Back Testing ?

Ans :

Back testing is a key component of effective trading-system development. It is accomplished by reconstructing, with historical data, trades that would have occurred in the past using rules defined by a given strategy. The result offers statistics that can be used to gauge the effectiveness of the strategy. Using this data, traders can optimize and improve their strategies, find any technical or theoretical flaws, and gain confidence in their strategy before applying it to the real markets. The underlying theory is that any strategy that worked well in the past is likely to work well in the future, and conversely, any strategy that performed poorly in the past is likely to perform poorly in the future.

The Data and the Tools

Back testing can provide plenty of valuable statistical feedback about a given system. Some universal back testing statistics include:

➤ Net Profit or Loss - Net percentage gain or loss.

➤ Time frame - Past dates in which testing occurred.

➤ Universe - Stocks that were included in the back test.

➤ Volatility measures - Maximum percentage upside and downside.

➤ Averages - Percentage average gain and average loss, average bars held.

➤ Exposure - Percentage of capital invested (or exposed to the market).

➤ Ratios - Wins-to-losses ratio.

➤ Annualized return - Percentage return over a year.

➤ Risk-adjusted return - Percentage return as a function of risk.

Q30. Explain various Important things to remember while back testing.

Ans :

There are many factors traders pay attention to when they are back testing trading strategies. Here is a list of the 10 most important things to remember whiles back testing:

1.   Take into account the broad market trends in the time frame in which a given strategy was tested. For example, if a strategy was only back tested from 1999-2000, it may not fare well in a bear market. It is often a good idea to back test over a long time frame that encompasses several different types of market conditions.

2.   Take into account the universe in which back testing occurred. For example, if a broad market system is tested with a universe consisting of tech stocks, it may fail to do well in different sectors. As a general rule, if a strategy is targeted towards a specific genre of stock, limit the universe to that genre; but, in all other cases, maintain a large universe for testing purposes.

3.   Volatility measures are extremely important to consider in developing a trading system. This is especially true for leveraged accounts, which are subjected to margin calls if their equity drops below a certain point. Traders

should seek to keep volatility low in order to reduce risk and enable easier transition in and out of a given stock.

4. The average number of bars held is also very important to watch when developing a trading system. Although most back testing software includes commission costs in the final calculations, that does not mean you should ignore this statistic. If possible, raising your average number of bars held can reduce commission costs, and improve your overall return.

5. Exposure is a double-edged sword. Increased exposure can lead to higher profits or higher losses, while decreased exposure means lower profits or lower losses. However, in general, it is a good idea to keep exposure below 70% in order to reduce risk and enable easier transition in and out of a given stock.

6. The average-gain/loss statistic, combined with the wins-to-losses ratio, can be useful for determining optimal position sizing and money management using techniques like the Kelly Criterion.

7. Traders can take larger positions and reduce commission costs by increasing their average gains and increasing their wins-to-losses ratio.

8. Annualized return is important because it is used as a tool to benchmark a system's returns against other investment venues. It is important not only to look at the overall annualized return, but also to take into account the increased or decreased risk. This can be done by looking at the risk-adjusted return, which accounts for various risk factors. Before a trading system is adopted, it must outperform all other investment venues at equal or less risk.

9. Back testing customization is extremely important. Many back testing applications have input for commission amounts, round (or fractional) lot sizes, tick sizes, margin requirements, interest rates, slippage assumptions, position-sizing rules, same-bar exit rules, (trailing) stop settings and much more. To get the most accurate back testing results, it is important to tune these settings to mimic the broker that will be used when the system goes live.

10. Back testing can sometimes lead to something known as over-optimization. This is a condition where performance results are tuned so highly to the past that they are no longer as accurate in the future. It is generally a good idea to implement rules that apply to all stocks, or a select set of targeted stocks, and are not optimized to the extent that the rules are no longer understandable by the creator.

Back testing is not always the most accurate way to gauge the effectiveness of a given trading system. Sometimes strategies that performed well in the past fail to do well in the present. Past performance is not indicative of future results. Be sure to paper trade a system that has been successfully back tested before going live to be sure that the strategy still applies in practice.

2.10 CASH FLOW AT RISK

Q31. What is Cash flow at Risk ?

Ans :   *(Sep.-20)*

Cash flow at Risk is also called as Earning at Risk. Cash flow at risk (CFaR) can be defined as the extent to which future cash flows may fall short of expectations as a consequence of changes in market variables. CFaR is an excellent corporate risk measure because it will improve the understanding of the risk dynamics of a business and how that risk profile can change due to price changes, entry of new products or geographies, acquisitions, or new

projects coming into production. It generally focuses on the market risk that impacts the corporate cash flows, ignoring things such as political, operational, environmental and legal risk.

Cash flow at Risk is computed in order to evaluate the impact of interest rate change on earnings. The approach used is a VaR based approach that takes into account non-parallel shifts in the term structure and its impact on the earnings portfolio of the bank. The balance sheet items to be included in the calculation are those which are interest rate sensitive and generate income or expense cash flows. For the purpose of calculation, the book value of cash flows will be taken into account.

Q32. Explain the how the firms risk is managed by measuring with the techniques of VaR or CaR.

Ans :   (Sep.-20)

When firms experience an increase in their cost of measuring risk using VaR and CaR measures, it can increase its value by lowering its cost of risk for a given desired level of profits. There are essentially three approaches for doing this

1. **Decreasing the Cost of Risk for a given Level of VaR or CaR**

    The financial firms focus on the value of the firm, a decline in the value of the firm will lead to an increase in the default risk and the loss of customers. The firms credit risk or default risk is inversely proportional to the equity capital as it renders funds that can meet the needs of the customers in the event that the firm's traded assets lose value. A firm can reduce the cost of VaR and CaR by raising equity capital to save cash and to reduce the debt. This enables the firm to continue its investment planning.

    To raise equity in a manner that it reduces the firm's risk, the earning of the equity should be invested to reduce the CaR. CaR is expensive as it results sometimes in worst

and negative cash flows, which makes the position of the firm to be restricted in financial terms. To reduce this, the financial slack of a firm which is the unutilized borrowing capacity of the firm, should be more to limit the financial constraints that a firm might face. This also reduces the CaR's cost and the shortfall of cash can be balanced using the financial slack.

2. **Lower Risk through Project Selection**

    A firm can reduce the risk through a proper choice of the projects that provide higher returns, but such projects usually involve high risk. Firms should diversify its business as a way of managing their risk. Diversification proves to be costly when it deals with purchasing financial assets. Firms should enter into those projects that are relevant with the existing projects. It is observed that diversification involves less cost and it is within the reach of the firm.

3. **Derivatives and Financial Instruments to Manager Risk**

    The above two approaches involve considerable risk and cost, but in this third approach the financial instruments are very much useful as they have less cost. The reason behind this is due to less transaction cost associated with the trading of financial instruments. Trading of such instrument is even more cheaper in liquid market specially in spot foreign exchange market and results into 2 outcomes.

    Firstly, it reduces the risk by increasing the value of the firm and secondly, by designing the project to protect the firm from the risk. Many firms face the risk of moral hazard; it is a risk that comes when any one party takes elicit actions against the other party, that in turn affects the value of the contract. Moreover, the use of derivatives can be reduced by eventually buying it in the market.

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Q33. Differentiate between Value at Risk and Cash Flow at Risk.

Ans :   **(May-19)**

Following are the differences between Value at Risk (VaR) and Cash Flow at Risk (CaR).

Value at Risk (VaR)	Cash Flow at Risk (CaR)
1. Value at risk is a method used to measure the risk which is first applied to a single transaction and then added to all the transaction to arrive at an orgnisational value.	1. Cash flow at risk is used to find the difference between the expected cash flows and realised cash flows.
2. It is measured by using a a statistical method called 'standard deviation'. A normal measure includes 5% VaR with 1.65 standard deviation from the expected value.	2. It is usually measured at 5% level of significance of a probability (P)%. According to this firms are expected to face lower amount of cash flow short fall.
3. VaR cannot determine the changes in the value of cash flows.	3. CaR is specifically used to know the affect of changes in the value of cash flows.
4. VaR is relevant for financial companies.	4. CaR is more useful for non-financial companies.

Short Question and Answers

1. Capital Adequacy Requirements

Ans :

A capital Adequacy requirement also known as regulatory capital or capital requirement is the amount of capital a bank or other financial institution has to hold as required by its financial regulator. This is usually expressed as a capital adequacy ratio of equity that must be held as a percentage of risk-weighted assets. These requirements are put into place to ensure that these institutions do not take on excess leverage and become insolvent.

Capital requirements govern the ratio of equity to debt, recorded on the liabilities and equity side of a firm's balance sheet. They should not be confused with reserve requirements, which govern the assets side of a bank's balance sheet—in particular, the proportion of its assets it must hold in cash or highly-liquid assets.

Regulators endeavour to ensure that financial institutions, banks and investment firms have enough capital to ensure their businesses remain stable. This measure not only protects depositors within the industry but also the larger economy as failures of institutions, such as banks, can have wider-scale repercussions.

'Capital Adequacy' is therefore the statutory minimum capital reserve that a financial institution or investment firm must have available and regulatory capital adequacy provisions thus require relevant firms to maintain these minimum levels of capital, calculated as a percentage of its risk weighted assets. Often Capital Adequacy is referred to as the required Regulatory Capital of a firm.

2. Interest Rate Risk

Ans :

Interest Rate Risk is the risk that an investment's value will change due to a change in the absolute level of interest rates, the spread between two rates, in the shape of the yield curve or in any other interest rate relationship. This type of risk affects the value of bonds more directly than stocks and is a significant risk to all bondholders. As interest rates rise, bond prices fall – and vice versa.

Interest rate risk that interest rate changes will affect the financial wellbeing of an entity. This includes changes in interest rates adversely affecting the value and liquidity of fixed or floating rate exposures. In addition to bond prices, interest rate fluctuations also directly affect stock prices, foreign exchange rates and economic growth.

Interest rate risk has received increased attention as an important source of corporate risk, as interest rate movements may affect present and future cash flows of the company. Internal hedging strategies for managing interest rate risk involve matching cash flows or assets and liabilities to create natural hedges against interest rates. These work well for financial service companies such as banks which operate a centralised treasury system.

3. Liquidity Risk.

Ans :

Liquidity risk is a financial risk that for a certain period of time a given financial asset, security or commodity cannot be traded quickly enough in the market without impacting the market price. Funding or cash flow risk: risk that an entity will encounter difficulty in realising assets or otherwise raising funds to meet commitments associated with financial instruments.

Liquidity risk is the risk that a company or bank may be unable to meet short term financial demands. This usually occurs due to the inability to convert a security or hard asset to cash without a loss of capital and/or income in the process.

Liquidity risk management requires mapping of cash flows for short as well as long period, which is the basis for strategic planning. Liquidity risk management is essential in banks and nbfc, because matching of cash flow determine the profitability. If there is idle fund, there is a cost. If there is shortage , borrowing from the market is expensive. So by

mapping for short and long period of source and use of fund, it is ascertained that in which bucket there could be shortage.

4. Types of Liquidity Risk

Ans :

(a) Funding Risk

Funding Liquidity Risk is defined as the inability to obtain funds to meet cash flow obligations. For banks, funding liquidity risk is crucial. This arises from the need to replace net outflows due to unanticipated withdrawal/ non-renewal of deposits (wholesale and retail).

(b) Time Risk

Time risk arises from the need to compensate for nonreceipt of expected inflows of funds i.e., performing assets turning into non-performing assets.

(c) Call Risk

Call risk arises due to crystallisation of contingent liabilities. It may also arise when a bank may not be able to undertake profitable business opportunities when it arises.

5. Types of Market Risk

Ans :

1. **Equity Risks :** An equity risk is the market risks associated with positions in equity markets. The risk associated with stock prices. In many cases, stocks have higher associated risks than other investment classes such as government bonds. Some types of equities such as small cap stocks traded on emerging markets can be extremely volatile.

2. **Fixed Income Risks :** The risks associated with positions in fixed-income instruments and interest sensitive instruments.

3. **FX Risks :** isks associated with foreign and cross-currency positions. Exchange rates can change rapidly as they are affected by a wide range of political and economic conditions. Many businesses have exposure to interest rates both in terms of costs and revenue sources. As a result, changes in exchange rates

can lead to volatility in a company's margins and profitability. Exchange rates also directly impact the value of foreign assets such as property.

4. **Commodity Risks :** Commodity risk refers to the uncertainties of future market values and of the size of the future income, caused by the fluctuation in the prices of commodities. The prices of commodities such as grains or fuels can be volatile in the short term. Commodity prices can also follow long cycles meaning that prices can remain elevated or depressed for extended periods of time. As a result, commodity price volatility is a key risk to industries that directly produce commodities or that use them as an input.

6. Advantages of Hedging

Ans :

Following are the various advantages of Hedging:

➢ Futures and options are very good short-term risk-minimizing strategy for long-term traders and investors.

➢ Hedging tools can also be used for locking the profit.

➢ Hedging enables traders to survive hard market periods.

➢ Successful hedging gives the trader protection against commodity price changes, inflation, currency exchange rate changes, interest rate changes, etc.

➢ Hedging can also save time as the long-term trader is not required to monitor/adjust his portfolio with daily market volatility.

➢ Hedging using options provide the trader an opportunity to practice complex options trading strategies to maximize his return.

7. Types of Credit Risk

Ans :

A credit risk can be of the following types:

➢ **Credit Default Risk**

The risk of loss arising from a debtor being unlikely to pay its loan obligations in full or

the debtor is more than 90 days past due on any material credit obligation; default risk may impact all credit-sensitive transactions, including loans, securities and derivatives.

> ### Concentration Risk

The risk associated with any single exposure or group of exposures with the potential to produce large enough losses to threaten a bank's core operations. It may arise in the form of single name concentration or industry concentration.

> ### Country Risk

The risk of loss arising from a sovereign state freezing foreign currency payments (transfer/conversion risk) or when it defaults on its obligations (sovereign risk); this type of risk is prominently associated with the country's macroeconomic performance and its political stability.

8.   Value at Risk

Ans :

Value at Risk (VAR) is a measurement technique that estimates the risk of an investment. In other words, VAR is a statistical technique that measures the amount of potential loss that could happen in a portfolio of investment over a period of time. Value at Risk gives the probability of losing more than a given amount on a given portfolio over a period of time.

Value at risk (VaR) is a popular method for risk measurement. VaR calculates the probability of an investment generating a loss, during a given time period and against a given level of confidence. It gives investors an indication of the level of risk they take with a certain investment. This can help them decide whether the possible gain is worth the potential maximum loss. VaR can be calculated for either one asset, a portfolio of multiple assets of an entire firm.

Value at risk (VaR) estimates the minimum loss that a party would expect to experience with a given probability over a specified period of time. Using the complementary probability (i.e., 100 percent minus the given probability stated as a percent), VaR can be expressed as a maximum loss at a given confidence level. VaR users must make decisions regarding appropriate time periods, confidence intervals, and specific VaR methodologies.

9.   Limitations of Value at Risk

Ans :

1.   Large Portfolios

Calculation of Value at Risk for a portfolio not only requires one to calculate the risk and return of the asset but also the correlations between them. Thus, the greater the number or diversity of assets in a portfolio, calculating VAR will be difficult.

2.   The Difference in Methods

The different approaches in calculating VAR can lead to different results with the same portfolio.

3.   Assumptions

Calculation of VAR requires one to make assumptions as inputs. If assumptions are not good or are wrong, the VAR figure will also be wrong.

10.   Stress Testing

Ans :

Stress Testing

Stress testing is a simple form of scenario analysis. Rather than consider the evolution of risk factors over several time steps, stress testing considers changes in risk factors over a single time step. That horizon is usually a single trading day, but stress testing can be considered over longer horizons - a week, two weeks, a quarter or even a year. Usually, stress testing is used to assess market risk, and that is the application this article focuses on. However, any scenario analysis that employs a single time step may be referred to as a stress test.

Used for market risk, a single scenario consists of projected values for applicable risk factors at the end of the horizon. Based on these values, a portfolio is marked-to-market. The result is compared with the portfolio's current market value, and the portfolio loss is calculated as the difference between the two.

Scenarios can be constructed in an ad hoc manner. If management is concerned about the effect of an inverted yield curve or a breakdown in a specific correlation, a scenario can be constructed specifically to assess that eventuality.

Stress testing can also be systematized. A firm may specify certain fixed scenarios (defined in terms of percent changes in applicable risk factors) and then perform periodic stress testing with those scenarios. In this manner, a firm might present stress test results in its daily risk report. Such stress scenarios may be hypothetical, perhaps reflecting contin-gencies that are a recurring concern of management. They can also be historically based. With that approach, stress scenarios may reflect the percentage changes in risk factors experienced during selected historical periods of market turmoil - stock market crashes, currency devaluations, etc.

11. Cash flow at Risk?

Ans :

Cash flow at Risk is also called as Earning at Risk. Cash flow at risk (CFaR) can be defined as the extent to which future cash flows may fall short of expectations as a consequence of changes in market variables.

CFaR is an excellent corporate risk measure because it will improve the understanding of the risk dynamics of a business and how that risk profile can change due to price changes, entry of new products or geographies, acquisitions, or new projects coming into production. It generally focuses on the market risk that impacts the corporate cash flows, ignoring things such as political, operational, environmental and legal risk.

Cash flow at Risk is computed in order to evaluate the impact of interest rate change on earnings. The approach used is a VaR based approach that takes into account non-parallel shifts in the term structure and its impact on the earnings portfolio of the bank. The balance sheet items to be included in the calculation are those which are interest rate sensitive and generate income or expense cash flows. For the purpose of calculation, the book value of cash flows will be taken into account.

12. Differentiate between Value at Risk and Cash Flow at Risk.

Ans :

Following are the differences between Value at Risk (VaR) and Cash Flow at Risk (CaR).

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1. Value at risk is a method used to measure the risk which is first applied to a single transaction and then added to all the transaction to arrive at an orgnisational value.	1. Cash flow at risk is used to find the difference between the expected cash flows and realised cash flows.
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UNIT III

Risk Management Techniques - Forward and Future Contracts: Pricing Forward Contracts, Foreign Currency Forward Contract, Commodity forward contract, Counterparty risk in the forward contract, Future Contracts, Cash Vs Physical Delivery, Pricing Future contracts, The role of expected future spot price, Impact of Financial market imperfections.

3.1 FORWARD CONTRACT

Q1. What is Forward Contract?

Ans :

Forward Contract

A forward contract is a customized contract between two parties, where one party agrees to sell and another party agrees to purchase a specific asset, at a specified price and for a specified period of time and the settlement will take place in the future on a specific date in the future at today's pre-agreed price. These contracts are traded through over-the-counter market not by stock exchange traded and are no standardized contracts, as not traded through stock exchanges. Forward contracts have been in use for thousands of years all over the world because these are customized contracts and there is a possibility to postpone delivery and payment.

Forwards are the oldest of all the derivatives. Forwards are contracts to buy or sell an asset on or before a future date at a price specified today or an agreement between two parties to exchange an agreed quantity of an asset for cash at a certain date in future at a predetermined price specified in that agreement. The promised asset may be currency, commodity, instrument etc.

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

Definition

"A forward contract is a commitment to purchase at a future date a given amount of a commodity or an asset at a price agreed on today."

Example

An Indian company buys Automobile parts from USA with payment of one million dollar due in 90 days. The importer, thus, is short of dollar that is, it owes dollars for future delivery. Suppose present price of dollar is Rs. 48. Over the next 90 days, however, dollar might rise against Rs. 48. The importer can hedge this exchange risk by negotiating a 90 days forward contract with a bank at a price Rs. 50. According to forward contract in 90 days the bank will give importer one million dollar and importer will give the bank 50 million rupees hedging a future payment with forward contract. On the due date importer will make a payment of Rs. 50 million to bank and the bank will pay one million dollar to importer, whatever rate of the dollar is after 90 days. So this is a typical example of forward contract on currency.

Q2. What are the features of Forward Contract.

Ans :

Following are the main features of forwards contracts :

1. Over the Counter Trading (OTC)

These contracts are purely privately arranged agreements and hence, they are not at all standardized ones. They are traded 'over the counter' and not in exchanges. There is much flexibility since the contract can be modified according to the requirements of the parties

to the contract. Parties enter into this kind of contract on the basis of the custom, and hence, it is also called 'customized contract'. The OTC derivative market is the largest market for derivatives, and is largely unregulated with respect to disclosure of information between the parties, since the OTC market is made up of banks and other highly sophisticated parties, such as hedge funds.

2.   No Down Payment

There must be a promise to supply or receive a specified asset at an agreed price at a future date. The contracting parties need not pay any down payment at the time of agreement.

3.   Settlement at Maturity

The important feature of a forward contract is that no money or commodity changes hand when the contract is signed. Invariably, it takes place on the date of maturity only as given in the contract.

4.   Linearity

Another special feature of a forward rate contract is linearity. It means symmetrical gains or losses due to price fluctuation of the underlying asset. When the spot price in future exceeds the contract price, the forward buyer stands to gain. The gain will be equal to spot price minus contract price. If the spot price in future falls below the contract price, he incurs a loss. The gain which one get when the price moves in one direction will be exactly equal to the loss when the price moves in the other direction by the same amount. It means that the loss of the forward buyer is the gain of the forward seller and vive versa.

5.   No Secondary Market

A forward rate contract is a purely private contract, and hence, it cannot be traded on an organized stock exchange. So, there is no secondary market for it.

6.   Necessity of a Third Party

There is a need for an intermediary to enable the parties to enter into a forward rate contract. This intermediary may be any financial institution like bank or any other third party.

7.   Delivery

The delivery of the asset which is the subject matter of the contract is essential on the date of the maturity of the contract.

Q3.   Explain the various types of Forward Contracts.

OR

What are the classifications of Forward Contracts?

Ans :   **(Imp.)**

Types 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.

Other Forward Contracts

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

In forward rate agreement, no actual lending or borrowing is affected. Only it fixes the rate of interest for a futures transaction. At the time of maturity, when the customer actually needs funds, then he has to borrow the funds at the prevailing rate of interest from the market. If the market rate of interest is higher than the FRA interest then the banker will have to pay to the other party (customer) the difference in the interest rate. However, if market interest is lesser than the FRA rate then the customer will have to pay the difference to the banker. This transaction is known as purchase of FRA from the bank.

2. **Range Forwards :** These instruments are very much popular in foreign exchange markets. Under this instrument, instead of quoting a single forward rate, a quotation is given in terms of a range, i.e., a range may be quoted for Indian rupee against US dollar at Rs. 47 to Rs.49. It means there is no single forward rate rather a series of rate ranging from Rs.47 1049 has been quoted. This is also known as flexible forward contracts. At the maturity, if the spot exchange rate is between these two levels, then the actual spot rate is used. On the other hand, if the spot rate rises above the maximum of the range, i.e., Rs. 49 in the present case then the maximum level is used.

Q4. What are the advantages and Limitations of Forward Contract.

Ans :

Merits of Forward Contract

1. They are easy to understand

2. It is a tailor-made contract and is flexible to adjust the needs of both the parties

3. Offers a complete hedge (i.e. delta neutral hedge) and helps in mitigating the risk

4. It can be matched with the time period and cash flows of exposure

5. As it is an over-the-counter (OTC) contract, the price of contracts are not known to others, hence provide a price protection.

6. There are no immediate cash outflows before settlement of the contract but might require an upfront fee i.e. margin

7. It is a tool for speculation

8. Payoffs are symmetrical, meaning thereby, there is a distinction as one party will gain while other making a loss of an equivalent amount

9. There is no daily marking to market requirements as mandatory in futures contract

Demerits of Forward Contract

1.   As it is a private contract, there is no liquidity

2.   Counter party risk of defaulting on the contract is too high

3.   Market of forward contracts is extremely unorganized as it is traded over-the-counter

4.   It may be difficult to find a counter party to enter into a contract.

3.2 PRICING OF FORWARD CONTRACT

Q5.   What is forward pricing.

Ans :

The Forward Price 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.

The forward price is the agreed price of an asset in a forward contract. The price is paid at the time the contract gets matured and asset is delivered to the other party. It should be noted that at this point when the contract is first entered into, no payment is made by any of the party. There is no initial cash flow. The delivery price cannot change as it is fixed in the contract but forward price can change with the spot price. Initially the forward price will be same as the spot price but with the time as the spot price changes the forward price also changes. Forward contract agreed at time 0 (present) to purchase an asset at a future time T.

Forwards are priced using Cost of Carry model, and in such a manner that no arbitrage opportunities exist. Depending on the nature of carry costs associated with the asset and carry return principle, the model is modified. Carry costs include the holding costs for the underlying assets. For commodities, this may refer to warehousing costs, insurance expenses, transportation cost, etc. For financial products, carry costs include financing cost like interest charges on borrowing the cash to take position in the asset. Carry return principle refers to the income generated by the asset. For financial product, carry return may include dividends received on shares.

The major assumptions of Cost of Carry model are:

1.   Markets arc perfect i.e., information flow is instantaneous and freely available, equal borrowing and lending rates and large number of market participants.

2.   The underlying assets arc infinitely divisible. But this may not hold good for all types of commodity assets.

3.   No transaction cost and brokerage fees.

4.   Only one price exists thereby removing the possibility of bid (buying rate) - ask (selling rate) spread.

5.   Absence of any market restrictions such as short selling, margin money, etc.

The Cost of Carry model is given by:

Forward price = spot price + carry cost – carry return

Situation - 1: Asset with No Income

The prominent example of this type of asset, giving no income, is an equity share on non-dividend basis and a deep discount bond. This is the simplest forward contact. Remember, the true price of forward contract is that when no arbitrage opportunities exist.

Situation - 2: Asset providing a known cash Income

The examples for assets, providing known cash income, are bonds promising known coupon rate, securities with known dividend, preference shares, etc. We understand pricing of forwards having these types of underlying assets can be better understood through the following example.

Situation - 3: Asset providing a known Yield

A known yield refers to income expressed as percentage of the asset life, and this yield is known for assets like stock indices. The dividend yield is assumed to be paid continuously as a constant annual rate of y.

In this case, the forward price is as follows:

$$F = S^* e^{(t-y)^* t}$$

Q6. Explain who bears default risk in a forward contract.

Ans :

Default arises if, at maturity, one of the parties fails to fulfill their obligations under the contract. Default risk only matters for the party that is "in the money" at maturity, that is, that stands to profit at the locked-in price in the contract. (If the spot price at maturity is such that a party would lose from performing on the obligation in the contract, counterparty default is not a problem.) Prior to maturity, since either party may finish in-the-money, both parties are exposed to default risk.

Q7. Explain how prices are determined under forward contract.

Ans: (Imp.)

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. 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.

Investment Asset

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

Consumption Assets

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

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.

Example

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.

Q8. What are the Hedging Risks with Forward Contracts.

Ans :

Forward contracts eliminate the uncertainty about future changes in the exchange rate. Companies can plan ahead knowing that, regardless of market changes, they will be able to exchange currencies at a fixed rate.

Exporters can know the exact value of future payments, and importers can anticipate the exact costs of products. Therefore, forwards hedge the risk of exchange rate fluctuations.

Forwards effectively eliminate the risk of potential losses from adverse market movements. However, they also eliminate the possibility of additional profits in the event of favorable movements. If the foreign currency you'll be exchanging depreciates, the contract ensures that you will still receive the same amount of local currency, so there is no risk of losses. However, if the foreign currency appreciates, there will be no additional earnings because you will still receive the same amount.

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3.3 FUTURES CONTRACTS

Q9.   What are Futures Contracts.

Ans :   *(Sep.-20)*

Futures contracts are created and traded on organized futures exchanges. A futures contract obliges its purchaser to buy a given amount of a specified asset at some stated time in the future (known as the delivery date) at the futures price. Similarly, the seller of the contract is obliged to deliver the asset at the futures price. In the futures market less than 2% of the contracts traded involve the actual delivery of the underlying asset. Rather, the buyers of futures contracts usually sell their contracts before the delivery date, thus offsetting ('unwinding') their positions.

The exchange clearinghouse is responsible for settling daily gains and losses (marking to market), guaranteeing the transactions and deliveries. A major advantage of organized exchanges is their ability to manage credit risk. Credit risk is the risk that a holder of an unprofitable futures contract will default.

An investor wishing to buy or sell in the futures market is required to post an initial margin in the form of cash or government securities, a portion of the full price. In marking-to market, the contract is revalue at the end of each day's trading, and gains or losses are computed. Gains increase the value of the margin account and may be withdrawn. If the margin account drops below a certain level, called the maintenance margin, the holder of the futures contract receives a margin call and is required to restore the account to its initial level. If the holder fails to do so, the contract is closed by the broker.

A futures contract is an agreement between two parties to buy or sell an asset at a certain time in the future at a certain price. Futures contracts are special types of forward contracts in the sense that the former are standardised exchange-traded contracts.

Definition

1. "A futures contract is an exchange-traded, standardized, forward-like contract that is marked to the market daily. Futures contract can be used to establish a long (or short) position in the underlying commodity/asset."

2. "Commitment to buy or sell at a specified future settlement date and a designated amount of commodity or a financial asset. It legally binds the two parties to take/make the delivery of commodity at certain point of time in future."

3. "A futures contract is a type of derivative or financial contract in which two parties agree to make a certain transaction on a specified future date at a specified current price. Trading futures contracts are also known as margin trading."

4. A "Futures Contract is an agreement between two anonymous market participants", a seller and a buyer. Here, the seller undertakes to deliver a standardized quantity of a particular financial instrument (or a commodity) at a certain price and a specified future date. On the other hand, the buyer undertakes to accept the goods underlying the futures contract of delivery date. Volume and generic trading futures contracts are standardized

Example

A speculator expects an increase in price of gold from current future prices of Rs. 9000 per 10 gm. The market lot is 1 kg and he buys one lot of future gold (9000 × 100) Rs. 9,00,000. Assuming that there is 10% margin money requirement and 10% increase occur in price of gold. the value of transaction will also increase i.e. Rs. 9900 per 10 gm and total value will be Rs. 9,90,000. In other words, the speculator earns Rs. 90,000.

Q10. What are the features of Future Contract.

Ans :   *(Sep.-20)*

1. **Organised Exchanges :** Unlike forward contracts which are traded in an over-the-counter market, futures are traded on organised exchanges with a designated physical location where trading takes place. This provides a ready, liquid market in which futures can be bought and sold at any time like in a stock market.

2. **Standardisation :** In the case of forward currency contracts, the amount of commodity to be delivered and the maturity date are

negotiated between the buyer and seller and can be tailor-made to buyer's requirements. In a futures contract, both these are standardised by the exchange on which the contract is traded.

3. **Clearing House :** The exchange acts as a clearing house to all contracts struck on the trading floor. For instance, a contract is struck between A and B. Upon entering into the records of the exchange, this is immediately replaced by two contracts, one between A and the clearing house and another between B and the clearing house.

In other words, the exchange interposes itself in every contract and deal, where it is a buyer to every seller and a seller to every buyer. The advantage of this is that A and B do not have to undertake any exercise to investigate each other's creditworthiness. It also guarantees the financial integrity of the market. The exchange enforces delivery for contracts held until maturity and protects itself from default risk by imposing margin requirements on traders and enforcing this through a system called "marking to market".

4. **Margins :** Like all exchanges, only members are allowed to trade in futures contracts on the exchange. Others can use the services of the members as brokers to use this instrument. Thus, an exchange member can trade on his own account as well as on behalf of a client. A subset of the members is the "clearing members" or members of the clearing house and non- clearing members must clear all their transactions through a clearing member.

The exchange requires that a margin must be deposited with the clearing house by a member who enters into a futures contract. The amount of the margin is generally between 2.5% to 10% of the value of the contract but can vary. A member acting on behalf of a client, in turn, requires a margin from the client. The margin can be in the form of cash or securities like treasury bills or bank letters of credit.

5. **Marking to Market :** The exchange uses a system called marking to market where, at the end of each trading session, all outstanding contracts are reprised at the settlement price of that trading session. This would mean that some participants would make a loss while others would stand to gain. The exchange adjusts this by debiting the margin accounts of those members who made a loss and crediting the accounts of those members who have gained.

6. **Actual Delivery is Rare :** In most forward contracts, the commodity is actually delivered by the seller and is accepted by the buyer. Forward contracts are entered into for acquiring or disposing off a commodity in the future for a gain at a price known today.

Q11. What are the important terms in future contract.

Ans :

Standardized Amount

Each futures contract is a standardized quantity, e.g. Rs.100, or Rs.50 per federal futures contract, or 100 ounces per gold contract.

Specific Financial Instrument

The contract specifications define not only the underlying financial instrument – for example, BUND-future or gold, but also its quality such as coupon interest and life of the interest rate of contract, or the purity of the gold.

Certain Price

This is the future contract price that must be paid later for the financial instrument is predetermined.

Future Time

There are 3 or more calendar months a year, during which a possible delivery must take place for each financial instrument. A related futures contract is traded for each of the calendar months.

Q12. What are the functions of Future Contract.

Ans :

Functions of futures markets initially futures were devised as instruments to fight against the risk of future price movements and volatility. 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. The important functions of futures market are described as follows:

1. Hedging Function

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 crop will command.

2. Price Discovery Function

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

3. Financing Function

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

4. Liquidity Function

It is obvious that the main function of the futures market deals with such transactions which are matured on a future date. They are operated on the basis of margins. 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.

This practice ensures honouring of the future deals and hence maintain liquidity. When there is a futures contract between two parties, future exchanges required some money to be deposited by these parties called margins. Each futures exchange is responsible for setting minimum initial margin requirements for all futures contracts. The trader has to deposit and maintain this initial margin into an account as trading account.

5. Price Stabilization Function

Another 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. There is less default risk in case of future contract because the change in the value of a future contract results in a cash flow every day.

Q13. Explain the margins in future contract.

Ans :

To minimize credit risk to the exchange, traders must post a margin or a performance bond, typically 5%-15% of the contract's value. Unlike use of the term margin in equities, this performance bond is not a partial payment used to purchase a security, but simply a good-faith deposit held to cover the day-to-day obligations of maintaining the position.

To minimize counterparty risk to traders, trades executed on regulated futures exchanges are guaranteed by a clearing house. The clearing house becomes the buyer to each seller, and the seller to each buyer, so that in the event of a counterparty default the clearer assumes the risk of loss. This enables traders to transact without performing due diligence on their counterparty.

Margin requirements are waived or reduced in some cases for hedgers who have physical ownership of the covered commodity or spread traders who have offsetting contracts balancing the position.

Clearing Margin

Clearing Margin are financial safeguards to ensure that companies or corporations perform on their customers' open futures and options contracts. Clearing margins are distinct from customer margins that individual buyers and sellers of futures and options contracts are required to deposit with brokers.

Customer Margin

Within the futures industry, financial guarantees required of both buyers and sellers of futures contracts and sellers of options contracts to ensure fulfilment of contract obligations. Futures Commission Merchants are responsible for overseeing customer margin accounts. Margins are determined on the basis of market risk and contract value. Also referred to as performance bond margin.

Initial Margin

Initial margin is the equity required to initiate a futures position. This is a type of performance bond. The maximum exposure is not limited to the amount of the initial margin; however the initial margin requirement is calculated based on the maximum estimated change in contract value within a trading day. Initial margin is set by the exchange.

A futures account is marked to market daily. If the margin drops below the margin maintenance requirement established by the exchange listing the futures, a margin call will be issued to bring the account back up to the required level.

Maintenance Margin

A set minimum margin per outstanding futures contract that a customer must maintain in their margin account.

Margin-equity Ratio

Margin-equity ratio is a term used by speculators, representing the amount of their trading capital that is being held as margin at any particular time. The low margin requirements of futures results in substantial leverage of the investment. However, the exchanges require a minimum amount that varies depending on the contract and the trader. The broker may set the requirement higher, but may not set it lower. A trader, of course, can set it above that, if he does not want to be subject to margin calls.

Performance Bond Margin

The amount of money deposited by both a buyer and seller of a futures contract or an options seller to ensure performance of the term of the contract. Margin in commodities is not a payment of equity or down payment on the commodity itself, but rather it is a security deposit.

Return on Margin (ROM)

Return on margin is often used to judge performance because it represents the gain or loss compared to the exchange's perceived risk as reflected in required margin. ROM may be calculated (realized return) / (initial margin). The Annualized ROM is equal to (ROM+1)(year/trade_duration)-1. For example, if a trader earns 10% on margin in two months, that would be about 77% annualized.

Q14. Explain the different types of future Contract.

Ans :

Types of Financial Futures

(a) **Eurodollar Futures :** Eurodollar futures are U.S. dollars that are deposited outside the country in commercial banks mainly in Europe which are known to settle international transactions. They are not guaranteed by any government but only by the obligation of the bank that is holding them.

(b) **U.S. Treasury Futures :** U.S. Dollars is the reserved currency for most countries, the stability of the dollars allows for treasury futures market and instruments such as treasury bonds and treasury bills.

(c) **Foreign Government Debt Futures :** Most government issue debt that are corresponded to the futures markets that are listed around the world.

(d) **Swap Futures :** This is generally agreements that are between two parties to exchange periodic interest payments.

(e)   Forex Futures : This type of futures is to manage the risks and take advantage of related forex exchange rate fluctuations.

(f)   Single Stock Futures : Most popular futures contracts are related to the equity markets, they are also known as security futures. There are about 10 companies in Malaysia that offer single stock futures. They are Bursa Malaysia Bhd, Air Asia Bhd, AMMB Holdings Bhd, Berjaya Sports Toto Bhd, Genting Bhd, IOI Corporation Bhd, Maxis Communications Bhd, RHB Capital Bhd, Scomi Group Bhd and Telekom Malaysia Bhd.

(g)   Index Futures : Futures that are based on the stock index. In the case of the Kuala Lumpur Composite Index, the index futures will be the FTSE Bursa Malaysia KLCI Futures (FKLI).

Q15. Explain the differences between Forward Contract and Future Contract

Ans :

S.No.	Forward Contract	Future Contract
1.	Forward Contract is an agreement between two parties to buy and sell the underlying asset at a certain price on a future date.	Future contract is a binding contract whereby the parties agree to buy and sell the asset at a fixed price and a future specified date.
2.	Forward contract is a tailor made contract which means they are customized according to the needs of the client.	Future contract is a standardized contract where the conditions relating to quantity, date, and delivery are standardized.
3.	In case of Forward contract ,there is a high counterparty risk as compared to a futures contract.	In case of Future contract ,there is a low counterparty risk as compared to a forward contract.
4.	Forward contracts generally mature by delivering the commodity.	Future contracts may not necessarily mature by delivery of commodity
5.	There is no requirement of collateral in case of forward contract.	Some amount of initial margin is required in case of future contract.
6.	Swap transactions are allowed in forward contract.	Only direct transactions are allowed in futures contract
7.	The purpose of forward contract is to prevent loss through hedging.	The purpose of futures contracts are mainly to have speculative gain.
8.	Forward contract is traded on Over the Counter (OTC) i.e. there is no secondary market for such contracts.	Future Contracts are traded on an Organized securities exchange.
9.	Forward contracts are settled on a maturity date ie; at the end of the contract.	Future contracts are settled on a daily basis, i.e. the profit or losses are settled daily.
10.	Forward contracts are self-regulated.	Futures contracts are regulated by the securities exchange.

3.4 FOREIGN CURRENCY FORWARD CONTRACT

Q16. What is forward exchange contract.

Ans :

A forward exchange contract is an agreement under which a business agrees to buy a certain amount of foreign currency on a specific future date. The purchase is made at a predetermined exchange rate. By entering into this contract, the buyer can protect itself from subsequent fluctuations in a foreign currency's exchange rate. The intent of this contract is to hedge a foreign exchange position in order to avoid a loss, or to speculate on future changes in an exchange rate in order to generate a gain.

Forward exchange rates can be obtained for twelve months into the future; quotes for major currency pairs (such as dollars and euros) can be obtained for as much as five to ten years in the future.

A currency forward is a binding contract in the foreign exchange market that locks in the exchange rate for the purchase or sale of a currency on a future date. A currency forward is essentially a hedging tool that does not involve any upfront payment. The other major benefit of a currency forward is that it can be tailored to a particular amount and delivery period, unlike standardized currency futures.

Currency forward settlement can either be on cash or a delivery basis, provided that the option is mutually acceptable and has been specified beforehand in the contract. Currency forwards are over-the-counter (OTC) instruments, as they do not trade on a centralized exchange, and are also known as "outright forwards."

Definition

A forward exchange Currency contract is "a commitment to exchange (buy or sell) one foreign currency for another at a specified exchange rate, with the exchange taking place on either a specified future date or during a specified future period".

3.5 COMMODITY FORWARD CONTRACT

Q17. What is commodity forward contract?

Ans :

Commodities futures are agreements to buy or sell a raw material at a specific date in the future at a particular price. The contract is for a set amount. The three main areas of commodities are food, energy, and metals. The most popular food futures are for meat, wheat, and sugar. Most energy futures are for oil and gasoline. Metals using futures include gold, silver, and copper.

Commodities are a diverse asset class comprised of various sectors: energy, grains, industrial (base) metals, livestock, precious metals, and softs (cash crops). Each of these sectors has a number of characteristics that are important in determining the supply and demand for each commodity, including ease of storage, geo-politics, and weather.

Buyers of food, energy, and metal use futures contracts to fix the price of the commodity they are purchasing. That reduces their risk that prices will go up. Sellers of these commodities use futures to guarantee they will receive the agreed-upon price. They remove the risk of a price drop.

Commodities trade in physical (spot) markets and in futures and forward markets. Spot markets involve the physical transfer of goods between buyers and sellers; prices in these markets reflect current (or very near term) supply and demand conditions. Global commodity futures markets constitute financial exchanges of standardized futures contracts in which a price is established in the market today for the sale of some defined quantity and quality of a commodity at a future date of delivery; execution of the contract may be focused on cash settlement or physical delivery.

Commodities offer the potential for diversification benefits in a multi-asset class portfolio because of historically low average return correlation with stocks and bonds.

The trade in commodities takes place in either spot markets or futures markets. In spot markets, the commodity trade happens immediately, in exchange for cash or other commodities. In futures markets, buyers and sellers trade a commodity based on a standardised contract. You do not have to compulsorily make or accept deliveries of physical goods here. Trade in futures contracts happens electronically and the contracts can be settled in cash.

A commodity futures contract is an agreement to buy or sell a specific amount of a commodity at a fixed date in the future at a predetermined price. This contract specifies further details, like the quality of the commodity and the delivery location.

Features of Commodity Futures

➢ **Organised :** Commodity futures contracts always trade on an organised exchange. NCDEX and MCX are examples of exchanges in India. NYMEX, LME, and COMEX are some international exchanges.

➢ **Standardised :** Commodity futures contracts are highly standardised. This means the quality, quantity, and delivery date of commodities is predetermined by the exchange on which they are traded.

➢ **Eliminate counter-party risk :** Commodity futures exchanges use clearinghouses to guarantee fulfilment of the terms of the futures contract. This eliminates the risk of default by the other party.

➢ **Facilitate margin trading :** Commodity futures traders do not have to pay the entire value of a contract. They need to deposit a margin that is 5–10% of the contract value. This allows the investor to take larger positions while investing less capital..

➢ **Fair practices :** Government agencies regulate futures markets closely. For example, there is the Forward Markets Commission (FMC) in India and the Commodity Futures Trading Commission (CFTC) in the Unites States. The regulation ensures fair practices in these markets.

➢ **Physical delivery :** The actual delivery of the commodity can take place on expiry of the contract. For physical delivery, the member needs to provide the exchange with prior delivery information. He also needs to complete all delivery-related formalities as specified by the exchange.

Q18. How Commodity futures are affect prices

Ans :

Commodities futures accurately assess the price of raw materials because they trade on an open market. They also forecast the value of the commodity into the future. The values are set by traders and their analysts. They spend all day every day researching their particular commodity. Forecasts instantly incorporate each day's news. For example, if Iran threatens to close the Strait of Hormuz, the commodities prices will change dramatically.

Sometimes commodities futures reflect the emotion of the trader or the market more than supply and demand. Speculators bid up prices to make a profit if a crisis occurs and they anticipate a shortage. When other traders see that the price of a commodity is skyrocketing, they create a bidding war. That drives the price even higher. But the basics of supply and demand haven't changed. When the crisis is over, prices will plummet back to earth.

3.6 COUNTERPARTY RISK IN THE FORWARD CONTRACT, FUTURE CONTRACTS

Q19. What is the counterparty risk on a forward and Future Contract?

Ans :   (Dec.-19)

The counterparty risk on a forward currency contract is the risk that the counterparty fails to meet their obligations. The counterparty on a forward currency contract is generally a large bank with international operations. Because typically no money changes hands at the outset of a forward currency contract, the counterparty risk is limited to the profit

or loss on the contract; it is not the notional value of the contract. The risk that the other party to the contract will not fulfil its contractual obligations is called counterparty risk.

Counterparty risk is the risk to each party of a contract that the counterparty will not live up to its contractual obligations. Counterparty risk is a risk to both parties and should be considered when evaluating a contract.

Varying degrees of counterparty risk exist in all financial transactions. If one party has a higher risk of default, then a premium is usually attached for the other party. In retail and commercial financial transactions, credit reports are often used to determine the counterparty credit risk for lenders to make auto loans, home loans, and business loans to customers. If the borrower has low credit, the creditor charges a higher interest rate premium due to the risk of default on the debt, especially on uncollateralized debt.

Financial investment products such as stocks, options, bonds, and derivatives carry counterparty risk. Bonds are rated by agencies, such as Moody's and Standard and Poor's, from AAA to junk bond category as a gauge of the level of counterparty risk. Bonds with higher counterparty risk offer higher yield premiums. When counterparty risk is minimal, the premiums or interest rates are low, such as with money market funds.

When the counterparty risk is miscalculated and a party defaults, the impending damage can be severe. This was a major cause of the real estate collapse in 2008 following the default of so many collateralized debt obligations (CDO). Mortgages are securitized into CDOs for investment and backed by the underlying assets. The major flaw prior to the economy crash was that subprime and low-quality mortgages composed of many faulty CDOs that were given the same high grade ratings as corporate debt. This allowed for institutional investment, since funds are required to invest only in specific highly rated debt. When borrowers started to default on mortgage payments,

the bubble burst, leaving the investors, banks, and re-insurers on the hook for massive losses.

The presence of an exchange as an intermediary between buyers and sellers helps reduce counterparty risk. Counterparty risk cannot be eliminated completely, however, because there is always a remote chance that the exchange fails to fulfil its own contractual obligations. To protect itself against one of the parties defaulting, the exchange typically requires that parties to the contract deposit funds as collateral. The depositing of funds as collateral is called posting margin.

Example

Assume an investor enters into a forward currency contract today to purchase 1 million Australian dollars (AUD) at an exchange rate of 0.9000 in one month's time. Assume also that in one month the AUD appreciates 1% to 0.9090. In one month the investor is obligated to purchase AUD at 0.9000 (and the counterparty is obligated to sell AUD at this rate). The investor can then sell AUD at 0.9090, pocketing the difference ($909,000 - $900,000 = $9,000). This profit is also the extent of the counterparty risk as, should the counterparty fail to sell AUD at 0.9000, since no money changed hands at the outset of the contract, the investor's $9,000 profit is at risk.

Q20. What is Settlement?

Ans :

Settlement describes how a contract is satisfied at expiration. Some contracts require settlement by physical delivery of the underlying and other contracts allow for or even require cash settlement. If physical delivery to settle is possible, the contract will Key Terms of Derivatives Contracts 348 specify delivery location(s). Contracts with underlying outcomes, such as heating or cooling days, cannot be settled through physical delivery and must be settled in cash. In practice, most derivatives contracts are settled in cash. Forward contracts may settle with physical delivery or cash settlement. Futures contracts are typically settled with cash.

21. How the counterparty risk is diversified.

Ans :

Counterparty risk is the risk to each party of a contract that the counterparty will not live up to its contractual obligations. Counterparty risk is a risk to both parties and should be considered when evaluating a contract.

Counterparty credit risk can be transferred by diversifying and entering contracts with a large number of counterparties with different probabilities of default. For example, a trading party can enter into some of its contracts with an Exchange. This is known as Diversification And Hedging Risk by entering trades with a range of counterparties to reduce the counterparty credit risk. There are several rating agencies such as Fitch And Moody's, S&P etc.that gather valuable information on counterparties to provide counterparty credit ratings.

3.7 CASH AND PHYSICAL DELIVERY

Q22. What is Physical Delivery ?

Ans :

Physical delivery is a term in an options or futures contract which requires the actual underlying asset to be delivered upon the specified delivery date, rather than being traded out with offsetting contracts.

Derivatives contracts are either cash settled or physically delivered on the expiry date of the contract. When a contract is cash settled, the net cash position of the contract on the expiry date is transferred between the buyer and the seller.

With a physical delivery, the underlying asset of the option or derivatives contract is physically delivered on a predetermined delivery date. Let's look at an example of physical delivery.

Most derivatives are not actually exercised, but are traded out before their delivery date. However, physical delivery still occurs with some trades – it is most common with commodities and bonds but can also occur with other financial instruments. Settlement by physical delivery is carried out by clearing brokers or their agents. Promptly after the last day of trading, the regulated

exchange's clearing organization will report a purchase and sale of the underlying asset at the previous day's settlement price. Traders who hold a short position in a physically settled security futures contract to expiration are required to make delivery of the underlying asset. Those who already own the assets may tender them to the appropriate clearing organization. Traders who do not own assets are obligated to purchase them at the current price.

Q23. What is Cash Settlement

Ans :

Under this method, the contract seller does not deliver the underlying asset but transfers the net cash position. Say the buyer of a wheat futures contract is willing to settle the contract in cash, he/she is just required to pay the difference between Spot price and Futures price. However, the purchaser need not take the physical ownership of the wheat. In case of a Futures contract, it is mostly cash settled unlike a forward contract (which is generally settled by physical delivery) since exchange monitors the contract ensuring smooth execution.

Cash Settlement Example – Say you go long on 10 wheat contracts whose current market price is Rs 500 per contract. On contract expiration (assuming it after three months), the price contract went up to Rs 600.

Q24. Explain the differences between Cash and Physical Deliver?

Ans :

Cash Vs Physical Delivery

A futures contract may either be settled through two methods, namely :

1. Physical Delivery

2. Cash Delivery

1. Physical Delivery

Physical delivery is the amount specified of the underlying asset of the contract is delivered by the seller of the contract to the exchange, and by the exchange to the buyers of the contract.

Physical delivery is common with commodities and bonds. In practice, it occurs only on a minority of contracts. Most are cancelled out by purchasing a covering position. Covering position is buying a contract to cancel out an earlier sale (covering a short), or selling a contract to liquidate an earlier purchase (covering a long). This form of settlement involves delivery of contract, and is most popular in commodity futures. The party with the short position (seller) sends a notice of intention to the exchange who then selects a party with outstanding long position to accept the delivery.

Physically settled futures contracts are settled with delivery of the underlying asset on the expiry date of the contract. Usually this is achieved through the assignment of warehousing bills to prevent the direct need for shipping and individual warehouse space requirements, although it is perfectly possible for delivery to be arranged to the relevant location. This naturally requires the bearer to have the necessary facilities for taking stock of the relevant asset, which is understandably a less than convenient arrangement for most traders out to make a buck or two speculating on commodities.

Cash Settlement

Cash payment is made based on the underlying reference rate, such as a short term interest rate index such as Euribor, or the closing value of a stock market index. This is mostly used for settling stock indices futures. Stock indices cannot be delivered physically. This is because that will involve transaction in constituent stocks (underlying the index) in various proportions, which is not practically possible and involves higher transaction cost. On the expiry of the settlement period, the exchange sets the final settlement price equal to the spot price of the asset on that day. For example, suppose an investor takes long position in near month NSE Nifty Futures with delivery price at 2100. On maturity, if the index is at 3200 with near month short futures at 3225, then the investor gains Rs. 100 through cash settlement.

Cash settled futures contracts are settled on their cash equivalent, i.e. the market value of the commodities to which those futures relate. It is then automatically offset against the costs of leverage and the leveraged portion to deliver the remaining profits.

Physical Delivery	Cash Delivery
Physical delivery is a settlement method where you have to make or take delivery of the underlying asset at the expiration of the futures contract.	Cash settlement is a settlement method used in certain futures contracts where you don't have to make or take delivery of the underlying asset at the expiration of the futures contract.
Physical delivery is specified in futures contract where the underlying asset is a physical commodity.	Mostly cash settlement is for futures contract that has non-physical asset as underlying asset.
At the end of the contract the holder of the position will either have to deliver the physical commodity if short or take delivery if long.	At the end of the contract the holder of the position is simply debited or credited the difference between their entry price and the final settlement.
In case of physical delivery, the holder of the contract will either have to take the commodity from the exchange or produce the commodity.	Cash settlement does not involve any delivery of asset, but just net cash is settled on contract expiration.
Examples: Crude Palm Oil Futures (FCPO), Soybean Futures (ZS) or NYBOT Cotton Futures (CT) are all specify for physical delivery.	**Examples :** Index futures such as FBM KLCI Futures (FKLI), Mini Hang Seng Index Futures (MHI) or CME S&P 500 Futures (SP) are all cash settled.

3.8 PRICING FUTURE CONTRACTS

Q25. Write a note on pricing Future contracts.

Ans :

When the underlying commodity is available in plenty then the prices can be determined with the help of arbitrage process but if supply is limited or still not existing then the prices cannot be determined with the help of arbitrage method. In this case the movement of market forces i.e. demand and supply determine the future price.

Arbitrage

Buying in one market (say, spot market) and simultaneously selling in another market (say, futures market) to make risk free profits when there is substantial mismatch between two prices is called arbitrage. Arbitrage is described as risk free because participants are not speculating on market movements. Instead, they bet on the mis-pricing of a share/asset that has happened between two related markets.

Q26. Explain the different types of Arbitrage

Ans :

Types of Arbitrage

While arbitrage usually refers to trading opportunities in financial markets, there are also other types of arbitrage opportunities covering other tradable markets. Those include risk arbitrage, retail arbitrage, convertible arbitrage, negative arbitrage and statistical arbitrage.

1. Risk Arbitrage

This type of arbitrage is also called merger arbitrage, as it involves the buying of stocks in the process of a merger & acquisition. Risk arbitrage is a popular strategy among hedge funds, which buy the target's stocks and short-sell the stocks of the acquirer.

2. Retail Arbitrage

Just like on financial markets, arbitrage can also be performed with usual retail products from your favourite supermarket. Take a look

at eBay for example, and you'll find hundreds of products bought in China and sold online at a higher price on a different market.

3. Convertible Arbitrage

Another popular arbitrage strategy, convertible arbitrage involves buying a convertible security and short-selling its underlying stock.

4. Negative Arbitrage

Negative arbitrage refers to the opportunity lost when the interest rate that a borrower pays on its debt (a bond issuer, for example) is higher than the interest rate at which those funds are invested.

5. Statistical Arbitrage

Also known as stat arb, is an arbitrage technique that involves complex statistical models to find trading opportunities among financial instruments with different market prices. Those models are usually based on mean-reverting strategies and require significant computational power.

Q27. What are Arbitrage and explain its assumptions.

Ans :

Arbitrage is the process of simultaneous buying and selling of an asset from different platforms, exchanges or locations to cash in on the price difference (usually small in percentage terms). While getting into an arbitrage trade, the quantity of the underlying asset bought and sold should be the same. Only the price difference is captured as the net pay-off from the trade.

Arbitrage is basically buying a security in one market and simultaneously selling it in another market at a higher price, profiting from the temporary difference in prices. This is considered risk-free profit for the investor/trader.

➢ The theory is based on the principle of capital market efficiency and hence assumes all market participants trade with the intention of profit maximization

➢ It assumes no arbitrage exists and if it occurs participants will engage to benefit out of it and bring back the market to equilibrium levels.

➢ It assumes markets are frictionless, i.e. there are no transaction costs, no taxes, short selling is possible and an infinite number of securities is available.

Q28. What are the advantages and limitations of Arbitrage theory.

Ans :

Advantages of Arbitrage Theory

➢ APT model is a multi-factor model. So, the expected return is calculated taking into account various factors and their sensitivities that might affect the stock price movement. Thus, it allows the selection of factors that affect the stock price largely and specifically.

➢ APT model is based on arbitrage-free pricing or market equilibrium assumptions which to a certain extent result in a fair expectation of the rate of return on the risky asset.

➢ The apt-based multi-factor model places emphasis on the covariance between asset returns and exogenous factors, unlike CAPM. CAPM places emphasis on the covariance between asset returns and endogenous factors.

➢ The APT model works better in multi-period cases as against CAPM which is suitable for single period cases only.

➢ APT can be applied to the cost of capital and capital budgeting decisions.

➢ The APT model does not require any assumption about the empirical distribution of the asset returns, unlike CAPM which assumes that stock returns follow a normal distribution and thus APT a less restrictive model.

Limitations of Arbitrage Theory

➢ The model requires a short listing of factors that impact the stock under consideration. Finding and listing all factors can be a difficult task and runs a risk of some or the other factor being ignored. Also, the risk of accidental correlations may exist which may cause a factor to become substantial impact provider or vice versa.

➢ The expected returns for each of these factors will have to be arrived at, which depending on the nature of the factor, may or may not be easily available always.

➢ The model requires calculating sensitivities of each factor which again can be an arduous task and may not be practically feasible.

➢ The factors that affect the stock price for a particular stock may change over a period of time. Moreover, the sensitivities associated may also undergo shifts which need to be continuously monitored making it very difficult to calculate and maintain.

3.9 THE ROLE OF EXPECTED FUTURE SPOT PRICE

Q29. Explain the role of expected future spot price.

Ans :

The market's average opinion about what the spot price of an asset will be at a specific time in the future. This is usually based on the returns investors require on an investment in the asset underlying a futures contract. In turn, these returns depend on the systematic risk of an investment. When the return from the underlying asset is uncorrelated with the broader stock market, the futures price can be viewed as an unbiased estimate of the expected future spot price. If the return is positively correlated with the broader market, the asset underlying the futures contract has positive systematic risk, and the futures price is lower than the expected future spot price. This situation is known as normal backwardation.

Contango is a market condition where the futures price of a commodity is higher than the expected future spot price. Buyers and sellers want to know how the prices of their contracts will evolve over time. A market is in contango when the futures price is higher than the predicted future spot price. Contango predicts falling prices. A market in normal backwardation involves futures prices that are lower than the expected future spot price, predicting rising prices.

The commodity spot price is decomposed into long-term and short-term components, while the futures price is decomposed into expected future spot price and risk premium. Under this model, information from the whole futures curve could be utilized to improve forecasting accuracy of the spot price.

Q30. Explain the different types of future Prices and Expectations.

Ans :

The following are the different types of Theories

Risk Neutral Theory

Risk neutral is a mindset where an investor is indifferent to risk when making an investment decision. The risk-neutral investor places himself in the middle of the risk spectrum, represented by risk-seeking investors at one end and risk-averse investors at the other. Risk-neutral measures have extensive application in the pricing of derivatives.

A risk-neutral is deciding between two investments, with one being a high-growth technology company that is not yet profitable but has seen large capital gains in the short term. The other company, similar to Disney, is a mature firm with stable earnings, profits, and dividends but does not provide the upside potential of the tech stock.

Normal Backwardness Theory

Normal backwardation, also sometimes called backwardation, is the market condition wherein the price of a commodities' forward or futures contract is trading below the expected spot price at contract maturity.

Normal backwardation is when the futures price is below the expected future spot price. This is desirable for speculators who are net long in their positions: they want the futures price to increase. So, normal backwardation is when the futures prices are increasing.

Backwardation relates to the price of a futures contract and the contract's time to expire. As the contract approaches expiration, the futures contract trades at a higher price compared to when the contract was further away from expiration. This is because the spot price is above the futures price, and the contract and spot price must eventually converge, so the future's price rises toward the spot price.

Backwardation favours those who are net long, since futures prices are increasing toward the spot price. Assume you can buy a one-year oil contract today for $50, but the expected spot price one year from now is $60. That is backwardation, since the price futures price will move toward the spot price. The expected future spot price is always changing, as is the price of the future's contract, based on fundamentals, trading positioning, and supply and demand of the underlying asset.

A backwardation starts when the difference between the forward price and the spot price is less than the cost of carry (when the forward price is less than the spot plus carry), or when there can be no delivery arbitrage because the asset is not currently available for purchase.

Benefits of Backwardation

1. The primary cause of backwardation in the commodities' futures market is a shortage of the commodity in the spot market.

2. Since futures prices are below spot prices, investors who are net long the commodity benefit from the increase in futures prices over time as the futures price and spot price converge.

3. A futures market experiencing backwardation is beneficial to speculators and short-term traders who wish to gain from arbitrage. The reason that futures prices and the spot price converge is that if they don't there is a riskless profit to be made between the two prices.

Contango Theory

Contango is a situation where the futures price of a commodity is above the expected spot price. Contango refers to a situation where the future spot price is below the current price, and people are willing to pay more for a commodity at some point in the future than the actual expected price of the commodity. This may be due to people's desire to pay a premium to have the commodity in the future rather than paying the costs of storage and the carry costs of buying the commodity today.

The contango should not exceed the cost of carry, because producers and consumers can compare the futures contract price against the spot price plus storage, and choose the better one. Arbitrageurs can sell one and buy the other for a theoretically risk-free profit.

Contango is a potential trap for unwary investors. Exchange-traded funds (ETFs) provide an opportunity for small investors to participate in commodity futures markets, which is tempting in periods of low interest rates.

A contango is normal for a non-perishable commodity that has a cost of carry. Such costs include warehousing fees and interest forgone on money tied up (or the time-value-of money, etc.), less income from leasing out the commodity if possible.

Example

Assume an investor goes along with a futures contract at $100. The contract is due in one year. If the expected future spot price is $70, the market is in contango, and the futures price will have to fall (unless the future spot price changes) to converge with the expected future spot price.

Effect of Contango Theory

Investors who are long commodities that are experiencing contango tend to lose money when the futures contracts expire. Therefore, investors who wish to stay long in these commodities would have to buy contracts at higher prices, which would cause a negative roll yield. For example, assume an investor is long one futures contract, which expires in six months, on a commodity experiencing contango at a price of $19, when the commodity is currently trading at $12. Assume six months have passed and the futures contract fell to $17 and the spot price increased to $14. The investor wishes to stay long by rolling his futures contracts and purchases one futures contract for $25, expiring in three months. The investor would experience losses from rolling the futures contract to the next month at a higher price.

3.10 IMPACT OF FINANCIAL MARKET IMPERFECTIONS

Q31. Explain the impact of Financial market imperfections.

Ans :   (Dec.-19, May-19)

In order to fulfill the needs of stakeholders it is indispensable for a firm to put in the amount available in those projects having positive net present value and cost effective activities, invest the amount in present day which is bound to bring growth in near future. The payment attain will be definitely greater than the present amount. For future survival and better flourishing chance, it's inevitable to invest today to reap fruitful monetary and the activities whose costs are comparatively low.

With perfect information as the interest rate increases, expected return to the lender increases as the lender charges the borrower more for the lending service. However, with imperfect information there is also an indirect opposite effect. As the interest rate rises, the possibility of selecting riskier borrowers increases as the cost increases less for them as they may not pay it back. Hence, as the interest rate goes up, the return to the lender decreases only considering the adverse selection effect. Considering these two opposite effects, the lender may determine the interest rate to maximize the rate of return so it does not necessarily clear the market. In that situation, some individuals cannot obtain any credit at the existing market interest rate although they are willingly to pay the market value. Hence, we see credit rationing as a result of imperfection in capital markets.

Credit rationing does not just caused from asymmetric information but also from limited enforcement in case of default. There are also costs

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used for law enforcement in order to get back the funds and in most of the case there is also possibility of not taking back at all if it was an unsecured loan. The problem of credit rationing arises most if the creditor does not have anything to provide as collateral. Even if he/she is a trustworthy person and would use the funds for good investment project and able to pay back his/her debt, the lender may not lend him/her so it leads to inefficient allocation of resources.

Problems

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

Ans :

Forward price $F = 30_e^{0.06 \times 05} = $ ` 30.90

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

                                $= (30.90 - 28)$

                                $= $ ` $2.90 - 0.09 = 2.8^*$ (app.).

2. **Consider a stock currently worth $ 100 per share with the risk-free interest rate 2% per annum. The futures price for a 1-year contract is worth $104. Show that there exists an arbitrage opportunity by entering into a short position in this futures contract.**

Ans :

At current time t = 0, a speculator can borrow $ 100 from the hank, buy the stock and short a futures contract.

At delivery time T = 1 year, the outstanding loan is now worth $100^{e0.02 \times 1} = $ \$102.02. By delivering the stock to the long contract holder and receiving $104, the speculator can make a riskless profit of $104 – $102.02 = $ 1.98.

3. **Let the current stock price be $75 with the risk-free interest rate 2.5% per annum. Assume the futures price for a 1-year contract is worth $74. Show that there exists an arbitrage opportunity by entering into a long position in this futures contract.**

Ans :

At current time t = 0, a speculator can short sell the stock, invest the proceeds in a bank account at the risk-free rate and then long a futures contract.

At time T = 1 year, the amount of money in the bank will grow to $75e^{0.025 \times 1} = $ \$76.89. After paying for the futures contract which is priced at $74, the speculator can then return the stock to its owner. Thus, the speculator can make a riskless profit of $76.89 – $74 = $2.89.

4. **An investor wishes to enter into 10 stock index futures contracts where the value of a contract is $250 times the level of the index at the start of the contract and each index point movement represents a gain or a loss of $250 per contract. The stock index at the start of the contract is 1,000 points and the initial margin deposite is 10% of the total futures contract value.**

Let the continuously compounded interest rate be 5% which can be earned on the margin balance and the maintenance margin be 85% of the initial margin deposit. Suppose the investor position is marked on a weekly basis. What does the maximum stock index need to be in order for the investor to receive a margin call on week 1.

Ans :

At the start of the contract the total futures contract value is $\$250 \times 1,000 \times 10 = \$2,500,000$ and the initial margin deposit is $\$250,000 \times \dfrac{10}{100} = \$250,000$. The maintenance margin is therefore $\$250,000 \times \dfrac{85}{100} = \$187,500$.

To describe the movment of the stock index for week 1.

Week	Closing stock Index	Weekly Change	Marking-to-Market	Margin Balance	Variation Margin
0	1000	0	0	$250,000	0
1	x	x – 1000	$2,500 x(x – 1000)	$250,000 + $2,500 x(x – 1000)	$187,500

Thus, in order to invoke a margin call e can set

$$2500(x - 1000) + 250,000 = 187,500$$

$$x = 975.$$

Therefore, if the stock index were to fall to values below 975 points then a margin call will be issued on week 1.

5. **Suppose an asset is currently worth $20 and the 6-month futures price of this asset is $22.50. By assuming the stock docs not pay any dividends and the risk-free interest rate is the same for all maturities, calculate the I-year futures price of this asset.**

Ans :

By definition the futures price is

$$F(t, T) = S_t e^{r(T-t)}$$

where t is the time of the start of the contract. T is the delivery time, S_t is the spot price at time t and r is the risk-free interest rate.

By setting $t = 0$, $S_0 = \$20$ and $T_1 = 0.5$ years we have

$$F(0, T_1) = S_0 e^{rT_1} = \$22.50.$$

Hence,

$$r = 2 \log \left(\frac{22.50}{20} \right) = 2 \log 1.125$$

Therefore, for a 1-year futures price, $T_2 = 1$ year

$$F(0, T_2) = S_0 e^{rT_2} = \$20 e^{2\log 1.25 \times 1} = \$25.31$$

6. **Let the current stock price be $30 with two dividend payments in 6 months and 9 months from today of $1.50 and $1.80, respectively. The continuously compounded risk-free interest rate is 5% per annum. Find the price of a 1-year futures contract.**

Ans :

Let $S_0 = \$30$, $t_1 = \dfrac{6}{12} = 0.5$ years, $t_2 = \dfrac{9}{12} = 0.75$ years, $\delta_1 = \$1.50$, $\delta_2 = \$1.80$, $r = 0.05$ and

$T = 1$ year.

Therefore, the price of a 1-year futures contract is

$$F(0,\ T) = S_0 e^{rT} - \delta_1 e^{r(T - t_1)} - \delta_2 e^{r(T - t_2)}$$

$$= 30 e^{0.05 \times 1} - 1.50 e^{0.05 \times (1 - 0.5)} - 180 e^{0.05 \times (1 - 0.75)}$$

$$= \$28.18.$$

7. **Let the current price of a stock be $12.75 that pays a continuous dividend yield D. Suppose the risk-free interest rate is 6% per annum and the price of a 6-month forward contract is $13.25. Find D.**

Ans :

Let $S_0 = \$12.50$, $r = 0.06$, $T = 0.5$ years and $F(0,\ T) = \$13.25$. Since

$$F(0,\ T) = S_0 e^{(r - D)T},$$

$$12.75 e^{(0.06 - D) \times 0.5} = 13.25$$

$$D = 0.06 - \log\left(\frac{13.25}{12.75}\right) \times \frac{1}{0.5}$$

$$= 0.020395.$$

Hence, the dividend yield is $D = 2.0395\%$ per annum.

Short Question and Answers

1. Forward Contract?

Ans :

A forward contract is a customized contract between two parties, where one party agrees to sell and another party agrees to purchase a specific asset, at a specified price and for a specified period of time and the settlement will take place in the future on a specific date in the future at today's pre-agreed price. These contracts are traded through over-the-counter market not by stock exchange traded and are no standardized contracts, as not traded through stock exchanges. Forward contracts have been in use for thousands of years all over the world because these are customized contracts and there is a possibility to postpone delivery and payment.

Forwards are the oldest of all the derivatives. Forwards are contracts to buy or sell an asset on or before a future date at a price specified today or an agreement between two parties to exchange an agreed quantity of an asset for cash at a certain date in future at a predetermined price specified in that agreement. The promised asset may be currency, commodity, instrument etc.

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

Definition

"A forward contract is a commitment to purchase at a future date a given amount of a commodity or an asset at a price agreed on today."

2. Features of Forward Contract.

Ans :

Following are the main features of forwards contracts :

1. Over the Counter Trading (OTC)

These contracts are purely privately arranged agreements and hence, they are not at all standardized ones. They are traded 'over the counter' and not in exchanges. There is much flexibility since the contract can be modified according to the requirements of the parties to the contract. Parties enter into this kind of contract on the basis of the custom, and hence, it is also called 'customized contract'. The OTC derivative market is the largest market for derivatives, and is largely unregulated with respect to disclosure of information between the parties, since the OTC market is made up of banks and other highly sophisticated parties, such as hedge funds.

2. No Down Payment

There must be a promise to supply or receive a specified asset at an agreed price at a future date. The contracting parties need not pay any down payment at the time of agreement.

3. Settlement at Maturity

The important feature of a forward contract is that no money or commodity changes hand when the contract is signed. Invariably, it takes place on the date of maturity only as given in the contract.

4. Linearity

Another special feature of a forward rate contract is linearity. It means symmetrical gains or losses due to price fluctuation of the underlying asset. When the spot price in future exceeds the contract price, the forward buyer stands to gain. The gain will be equal to spot price minus contract price. If the spot price in future falls below the contract price, he incurs a loss. The gain which one get when the price moves in one direction will be exactly equal to the loss when the price moves in the other direction by the same amount. It means that the loss of the forward buyer is the gain of the forward seller and vive versa.

3. Merits of Forward Contract

Ans :

1. They are easy to understand

2. It is a tailor-made contract and is flexible to adjust the needs of both the parties

3. Offers a complete hedge (i.e. delta neutral hedge) and helps in mitigating the risk

4. It can be matched with the time period and cash flows of exposure

5. As it is an over-the-counter (OTC) contract, the price of contracts are not known to others, hence provide a price protection.

6. There are no immediate cash outflows before settlement of the contract but might require an upfront fee i.e. margin

7. It is a tool for speculation

8. Payoffs are symmetrical, meaning thereby, there is a distinction as one party will gain while other making a loss of an equivalent amount.

4. Futures Contracts

Ans :

Futures contracts are created and traded on organized futures exchanges. A futures contract obliges its purchaser to buy a given amount of a specified asset at some stated time in the future (known as the delivery date) at the futures price. Similarly, the seller of the contract is obliged to deliver the asset at the futures price. In the futures market less than 2% of the contracts traded involve the actual delivery of the underlying asset. Rather, the buyers of futures contracts usually sell their contracts before the delivery date, thus offsetting ('unwinding') their positions.

The exchange clearinghouse is responsible for settling daily gains and losses (marking to market), guaranteeing the transactions and deliveries. A major advantage of organized exchanges is their ability to manage credit risk. Credit risk is the risk that a holder of an unprofitable futures contract will default.

An investor wishing to buy or sell in the futures market is required to post an initial margin in the form of cash or government securities, a portion of the full price. In marking-to market, the contract is revalue at the end of each day's trading, and gains or losses are computed. Gains increase the value of the margin account and may be withdrawn. If the margin account drops below a certain level, called the maintenance margin, the holder of the futures contract receives a margin call and is required to restore the account to its initial level. If the holder fails to do so, the contract is closed by the broker.

A futures contract is an agreement between two parties to buy or sell an asset at a certain time in the future at a certain price. Futures contracts are special types of forward contracts in the sense that the former are standardised exchange-traded contracts.

Definition

1. "A futures contract is an exchange-traded, standardized, forward-like contract that is marked to the market daily. Futures contract can be used to establish a long (or short) position in the underlying commodity/asset."

2. "Commitment to buy or sell at a specified future settlement date and a designated amount of commodity or a financial asset. It legally binds the two parties to take/make the delivery of commodity at certain point of time in future."

5. Types of Financial Futures

Ans :

(a) Eurodollar Futures : Eurodollar futures are U.S. dollars that are deposited outside the country in commercial banks mainly in Europe which are known to settle international transactions. They are not guaranteed by any government but only by the obligation of the bank that is holding them.

(b) U.S. Treasury Futures : U.S. Dollars is the reserved currency for most countries, the stability of the dollars allows for treasury futures market and instruments such as treasury bonds and treasury bills.

(c) **Foreign Government Debt Futures :** Most government issue debt that are corresponded to the futures markets that are listed around the world.

(d) **Swap Futures :** This is generally agreements that are between two parties to exchange periodic interest payments.

(e) **Forex Futures :** This type of futures is to manage the risks and take advantage of related forex exchange rate fluctuations.

6. **Forward exchange contract.**

Ans :

A forward exchange contract is an agreement under which a business agrees to buy a certain amount of foreign currency on a specific future date. The purchase is made at a predeter-mined exchange rate. By entering into this contract, the buyer can protect itself from subsequent fluctuations in a foreign currency's exchange rate. The intent of this contract is to hedge a foreign exchange position in order to avoid a loss, or to speculate on future changes in an exchange rate in order to generate a gain.

Forward exchange rates can be obtained for twelve months into the future; quotes for major currency pairs (such as dollars and euros) can be obtained for as much as five to ten years in the future.

A currency forward is a binding contract in the foreign exchange market that locks in the exchange rate for the purchase or sale of a currency on a future date. A currency forward is essentially a hedging tool that does not involve any upfront payment. The other major benefit of a currency forward is that it can be tailored to a particular amount and delivery period, unlike standardized currency futures.

Currency forward settlement can either be on cash or a delivery basis, provided that the option is mutually acceptable and has been specified beforehand in the contract. Currency forwards are over-the-counter (OTC) instruments, as they do not trade on a centralized exchange, and are also known as "outright forwards."

Definition

A forward exchange Currency contract is "a commitment to exchange (buy or sell) one foreign currency for another at a specified exchange rate, with the exchange taking place on either a specified future date or during a specified future period".

7. **How the counterparty risk is diversified.**

Ans :

Counterparty risk is the risk to each party of a contract that the counterparty will not live up to its contractual obligations. Counterparty risk is a risk to both parties and should be considered when evaluating a contract.

Counterparty credit risk can be transferred by diversifying and entering contracts with a large number of counterparties with different probabilities of default. For example, a trading party can enter into some of its contracts with an Exchange. This is known as Diversification And Hedging Risk by entering trades with a range of counterparties to reduce the counterparty credit risk. There are several rating agencies such as Fitch And Moody's, S &P etc.that gather valuable information on counterparties to provide counterparty credit ratings.

8. Physical Delivery

Ans :

Physical delivery is a term in an options or futures contract which requires the actual underlying asset to be delivered upon the specified delivery date, rather than being traded out with offsetting contracts.

Derivatives contracts are either cash settled or physically delivered on the expiry date of the contract. When a contract is cash settled, the net cash position of the contract on the expiry date is transferred between the buyer and the seller.

With a physical delivery, the underlying asset of the option or derivatives contract is physically delivered on a predetermined delivery date. Let's look at an example of physical delivery.

Most derivatives are not actually exercised, but are traded out before their delivery date. However, physical delivery still occurs with some trades – it is most common with commodities and bonds but can also occur with other financial instruments. Settlement by physical delivery is carried out by clearing brokers or their agents. Promptly after the last day of trading, the regulated exchange's clearing organization will report a purchase and sale of the underlying asset at the previous day's settlement price. Traders who hold a short position in a physically settled security futures contract to expiration are required to make delivery of the underlying asset. Those who already own the assets may tender them to the appropriate clearing organization. Traders who do not own assets are obligated to purchase them at the current price.

9. Advantages of Arbitrage Theory

Ans :

➢ APT model is a multi-factor model. So, the expected return is calculated taking into account various factors and their sensitivities that might affect the stock price movement. Thus, it allows the selection of factors that affect the stock price largely and specifically.

➢ APT model is based on arbitrage-free pricing or market equilibrium assumptions which to a certain extent result in a fair expectation of the rate of return on the risky asset.

➢ The apt-based multi-factor model places emphasis on the covariance between asset returns and exogenous factors, unlike CAPM. CAPM places emphasis on the covariance between asset returns and endogenous factors.

➢ The APT model works better in multi-period cases as against CAPM which is suitable for single period cases only.

➢ APT can be applied to the cost of capital and capital budgeting decisions.

➢ The APT model does not require any assumption about the empirical distribution of the asset returns, unlike CAPM which assumes that stock returns follow a normal distribution and thus APT a less restrictive model.

10.   Limitations of Arbitrage Theory

Ans :

➢   The model requires a short listing of factors that impact the stock under consideration. Finding and listing all factors can be a difficult task and runs a risk of some or the other factor being ignored. Also, the risk of accidental correlations may exist which may cause a factor to become substantial impact provider or vice versa.

➢   The expected returns for each of these factors will have to be arrived at, which depending on the nature of the factor, may or may not be easily available always.

➢   The model requires calculating sensitivities of each factor which again can be an arduous task and may not be practically feasible.

➢   The factors that affect the stock price for a particular stock may change over a period of time. Moreover, the sensitivities associated may also undergo shifts which need to be continuously monitored making it very difficult to calculate and maintain.

Exercise Problems

1. A stock is expected to pay a dividend of Re. 1 per share in 2 months and again in 5 months. The stock price is currently Rs. 50 and the risk-free interest rate is 6% per annum. An investor takes a short position in a six-month forward contract on the stock. What is the stock's forward price?

    [**Ans :** 51.0049]

2. Sivam Securities will need to purchase a security in 75 days It expects the security prices to rise by that time, so it decides to hedge this risk by buying the security forward. The spot price of the asset is Rs. 5,000 if the interest rate is 7.5% p.a. (A/360). Calculate the price of the 75-day and 90-day forward for the security. Which contract should it use for its purpose?

    [**Ans :** 5078.73]

3. Assume that a 6-month forward is contracted at a price of Rs 2,500 three months back and the 3-month forward price today is Rs 3,200. What would be the value of the forward purchase on the forward expiry' date? What will be the value of the contract today? Assume 5% interest rate.

    [**Ans :** 690.30]

4. Suppose that on January 1. price of Tata Motors share is `450 and two parties enter into a forward contract for delivery of 1.000 shares of Tata Motors on April 15 at a price of `460. Find out the profit/loss profile of seller (short position) if the price of fata Motors share turns out to be:

    (a)   `470

    (b)   `400 on April 15.

    [**Ans :** (a) Loss - Rs. 10,000 (b) Profit Rs. 60,000.]

Risk Management Techniques - Options: Structure of Option Market, Types of Options, Option Strategies, exercise price and option values, Principles of Call option Pricing and put option pricing, Put - Call parity theorem, Option values and cash payouts, Option pricing, Arbitrage pricing and the Binomial Model, The Black- Scholes and Mertin Model.

4.1 OPTIONS

Q1. What is option Contract ? Explain the features of option contract?

Ans : (Imp.)

Option contract is a derivative instrument under which a buyer gets the right to buy or sell and a seller undertakes an obligation to sell or buy a given quantity of the underlying asset at a given future date for a payment of Option Premium by the Buyer to the Seller.

An options contract is an agreement between two parties to facilitate a potential transaction on the underlying security at a preset price, referred to as the strike price, prior to the expiration date.

Option contracts are most commonly associated with the financial services industry, where a seller may option the opportunity to purchase stock at a certain price for a set period of time. By accepting a certain amount of money in exchange for this option, the seller has bargained away their right to revoke the offer. It's important to point out, however, that the party buying the option is under no obligation to actually exercise this option and purchase the stock, since he or she only bargained for the option to do so.

Some important features of Options Contract are:

Features of Option Contract
- Highly Flexible
- Down Payment
- Settlement
- Non - Linearity
- No Obligation to By are sell

1. Highly Flexible

On one hand, option contract are highly standardized and so they can be traded only in organized exchanges. Such option instruments cannot be made flexible according to the requirements of the writer as well as the user. On the other hand, there are also privately arranged options which can be traded 'over the counter'. These instruments can be made according to the requirements of the writer and user. Thus, it combines the features of 'futures' as well as 'forward' contracts.

2. Down Payment

The option holder must pay a certain amount called 'premium' for holding the right of exercising the option. This is considered to be the consideration for the contract. If the option holder does not exercise his option, he has to forego this premium. Otherwise, this premium will be deducted from the total payoff in calculating the net payoff due to the option holder.

3. Settlement

No money or commodity or share is exchanged when the contract is written. Generally this option contract terminates either at the time of exercising the option by the option holder or maturity whichever is earlier. So, settlement is made only when the option holder exercises his option. Suppose the option is not exercised till maturity, then the agreement automatically lapses and no settlement is required.

4. Non - Linearity

Unlike futures and forward, an option contract does not posses the property of linearity. It means that the option holder's profit, when the value of the underlying asset moves in one direction is not equal to his loss when its value moves in the opposite direction by the same amount. In short, profits and losses are not symmetrical under an option contract. This can be illustrated by means of an

5. No Obligation to Buy or Sell:
In all option contracts, the option holder has a right to buy or sell an underlying asset. He can exercise this right at any time during the currency of the contract. But, in no case, he is under an obligation to buy or sell. If he does not buy or sell, the contract will be simply lapsed.

Q2. Explain the strcuture of option market.

Ans :

Option

An option is the right but not the obligation to buy or sell something on a specified date at a specified price. In the securities market, an option is a contract between two parties to buy or sell specified number of shares, at a later date, for an agreed price. Three parties are involved in the option trading, i.e., the option seller, buyer, and the broker.

(i) The option seller or writer is a person who grants someone else the option to buy or sell. He receives a premium on its price.

(ii) The option buyer pays a price to the option writer to induce him to write the option.

(iii) The securities broker acts as an agent to find the option buyer and seller and receives a commission or fee for it. The structure of option market is shown in the following figure,
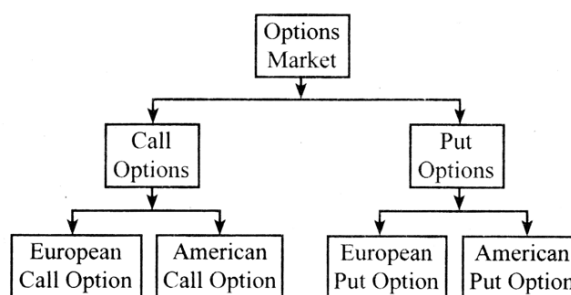

Fig. : Structure of Option Market

Call Option

In call option, buyers are bulls who are optimistic in nature and will be in an assumption of raising the prices in future. Therefore, they buy the shares or takes a long position in advance.

As the call buyer is very much confident that the prices will increase in future, he enters into an option market with the seller by paying a premium amount. Here, seller will be in an opposite illusion that the prices will decrease in future. Call option states that, if the prices increases, the seller has to pay to the buyer and if prices decreases then the buyer will lose his premium amount and automatically the option is expired.

The buyer will gain, if spot price (S) is greater than the strike price *(X)* along with the premium (Q, this means,

Buyer's gain = S – X – C

Suppose a firm purchases a call option at a strike price of ` 200 per share by paying a premium of ` 15 per share. Total number of shares are 10000.

If the spot rate at maturity is ` 225 then the gain to the option buyer or call buyer will be,

$$` (225 – 200 – 15) = ` 10$$

$$\therefore \quad \text{Profit} = 10 \times 10000 = ` 100000$$

This is a fully profit situation. If the spot rate on maturity is ` 210 then the gain to the buyer will be zero, which is a break even point situation. The buyer is said to have a partial loss if the spot rate is between ` 200 and ` 210 because he is losing partial premium amount. Finally, the buyer is said to have a fully loss condition when the spot rate is below ` 200. as he incurs a maximum loss of losing the complete premium.

For option buyers, profits are unlimited and losses are limited to only premium paid by them, whereas sellers get profits in the form of premium which are limited and has to bear unlimited losses (difference between the strike price and spot price).

Put Option

In put option, buyers are bears, who are pessimistic in nature and will assume that the prices will decrease in future. Therefore, he makes a sell position. Put buyer enters into a put option with the seller by paying a premium amount. On the other hand, seller will be in a contrast assumption of increasing the prices in future. In put option, the seller needs to pay to the buyer if prices decrease and if there is an increase in prices, then buyer will lose his premium amount and the option simply expires.

The buyer will gain if spot price (S) is less than the strike price (X) by paying a premium (C) that is,

Buyer's gain = X – S – C

Suppose in put option, strike price of a deal is ` 200 per share by paying a premium of ` 10 per share and the total number of shares are 10000. If the spot price at maturity is at ` 185 then the profit to the buyer will be (200 – 185 – 10) = ` 5 per share.

Profit = 5 × 10,000 = 50,000/-

This is a fully profit situation.

Buyer will break-even when the gain is zero. And it is arrived when the spot rate on maturity is ` 190.

i.e., 200 – 190 – 10 = 0

Partial loss situation is achieved when the spot rate is between 190 and 200 because he is losing partial premium amount.

i.e., (200 – 195) – 10 = 5 – 10 = –5 (loss)

(i.e., 195 is the value between 190 and 200)

And lastly, the buyer is said to have a fully loss condition when the spot rate is more than the strike price with spot price at ` 210 on maturity is,

200 – 210 – 10 = –20

For put buyers, profits are unlimited, i.e., (difference between spot and strike price) and losses are limited (payment of premium). Whereas, for put sellers, profits are limited (premium received) and losses are unlimited (difference between spot and strike price).

American Option

The owner has the right to buy the shares at any time from the inception of the contract until the option expires on the particular period.

European Option

When options are to be exercised strictly, only on the expiration date then it is termed as a European option.

European and American options are no where related with the geographic area. An American option has an edge over the European option as they have traded throughout the world including Europe.

Q3.   What are the differences between American and European Options.

Ans :

	American Option		European Option
1.	Options are exercised on or before the settlement date i.e., either today, tomorrow or at any trading day until the life of the contract. No specific expiration date.	1.	Options are exercised only on the settlement date but not on today, tomorrow or any trading day. Expiration date is specific.
2.	Majority of stock options opt for American options.	2.	European options are less frequently traded when compared to American option.
3.	The price of the option is usually high as it assumes high risk thereby charging high risk premium.	3.	The price of the option is low because it is less risky and charges less risk premium.
4.	Firm, as soon as it realises profits is liable to take delivery of the underlying asset on any day and hence can end the contract.	4.	Even though firm realises profits, is liable to take delivery of the underlying asset only on the expiration date.

4.2 STYLES OF OPTION

Q4.   Explain the various types of Options.

Ans :

Options are classified into three styles:

a)   American Style Option

b)   European Style Option

c)   Capped Option

(a) American Style Option

American Style Option can be exercised by the holder of the option anytime between the purchase date and the expiration date. Usually the holder of an American style call exercises his option whenever the price of the underlying shares exceeds the strike price. American-style options are the options that most individual investors are acquainted with. If you trade options on stocks, like Apple (AAPL), General Electric (GE) or Google (GOOG), you are most likely trading American-style options.

(b) European Style Option

European Style Option can be excercised only on the expiration date by the holder of the option. The expiry and the exercise date coincide with each other. European option refers to contracts that give the investor the right to buy, or sell, an asset at a specific price on a certain date. A European call option provides the investor with the right to purchase an asset, while a put option provides the investor with a right to sell it.

(c) Capped Option

Capped Option have a predetermined cap price which is below the strike price for a put option and above the strike price for a call option. The option is exercised by the holder of option whenever underlying closes at or above (for a call) or at or below (for a put) the cap price.

4.3 COMPONENTS OF OPTIONS

Q5. Explain the components of Option.

Ans : (Dec.-19)

Components of Options

```
                    ┌──────────────────────┐
                    │ Components of Options │
                    └──────────────────────┘
                               │
          ┌────────────────────┼────────────────────┐
    ┌─────────────┐      ┌─────────────┐      ┌───────────────┐
    │ Call Option │      │ Put Option  │      │ Double Option │
    └─────────────┘      └─────────────┘      └───────────────┘
                               │
                    ┌──────────┴──────────┐
            ┌────────────────┐     ┌───────────────┐
            │ Option Premium │     │ Option Market │
            └────────────────┘     └───────────────┘
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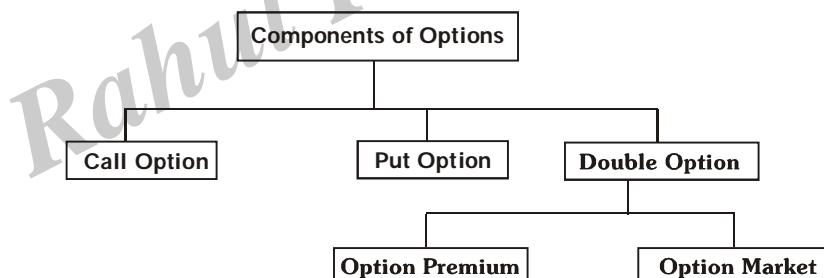
1. Call Option

A call option is one which gives the option holder the right to buy a underlying asset (commodities, foreign exchange, stocks, shares etc.) at a predetermined price called 'exercise price' or strike price on or before a specified date in future. In such a case, the writer of a call option is under an obligation to sell the asset at the specified price; in case he buyer exercises his option to buy. Thus, the obligation to sell arises only when the option is exercised. In short, the owner i.e. the buyer has the right to purchase and the seller has no obligation to sell, a specified number of instruments say shares at a specified price during the time prior to expiry date.

A Call option is a contract that gives the buyer the right to buy 100 shares of an underlying equity at a predetermined price (the strike price) for a preset period of time. The seller of a Call option is obligated to sell the underlying security if the Call buyer exercises his or her option to buy on or before the option expiration date.

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2. **Put Option**

A put option is one which gives the option holder the right to sell an underlying asset at a predetermined price on or before a specified date in future. It means that the writer of a put option is under an obligation to buy the asset at the exercise price provided the option holder exercises his option to sell. In other words, owner or the buyer has the right to sell and the seller has the obligation to buy during a particular period.

3. **Double Option**

A double option is one which gives the option holder both the rights – either to buy or to sell an underlying asset at a predetermined price on or before a specified date in future.

(a) Option Premium: In an option contract, the option writer agrees to buy or sell an underlying asset at a future date for an agreed price from/to the option buyer / seller at his option. This contract, like any other contract must be supported by consideration. The consideration for this contract is a sum of money called 'premium'. The premium is nothing but the price which is required to be paid for the purchase of 'right to buy or sell. The premium, one pays is the maximum amount to which he is exposed in the market, since in any case he can lose more than that amount. Thus, his risk is limited to that extent only. However, his gain potential is unlimited. In the case of a double option, this premium money is also double.

(b) Options Market: Options market refers to the market where option contracts are brought and sold on the options market. The first option market namely the Chicago Board of Options Exchange was set up in 1973. Thereafter, several options markets have been established.

Q6.   What are the difference between Call option and Put Option .

Ans :   **(Imp.)**

Call options and put options are different, but both offer the opportunity to diversify a portfolio and earn another stream of income. However, there is risk involved in options trading. It is imperative to understand the difference between call options and put options to limit that risk.

	Call Option	Put Option
Meaning	It offers the right but not obligation to buy the under-lying asset at a particular date for the pre-decided strike price	It offers the right but not the obliga tion for selling the underlying asset at a particular date for the pre-decided strike price.
Investor Expectations	Rise in the Prices	Fall in the prices
Profitability	The gains can be unlimited since price rise cannot be capped	Gains are limited since price can fall steadily but will stop at Zero.
Permits	Buying the stock	Selling of Stock
Analogies	Considered a security deposit allowing taking a product at a certain fixed price.	It is like an Insurance offering protection against a loss in value.
Option Seller	Has the obligation to sell the underlying asset to the option holder at the strike price.	Has the obligation to buy the underlying asset from the options holder at the strike price.

4.4 OPTION STRATEGIES

Q7.   Explain the various option Strategies

Ans :   (Dec.-19)

Terminology in Trading Basic Options

The various general terms and notations used in trading the options are:

(i)   Current call price denoted by 'c'

(ii)   Current price of put option denoted by 'p'

(iii)   Current price of a stock denoted by S_0

(iv)   Exercise price of an option denoted by k

(v)   Expiration time of an option denoted by 't'

(vi)   Stock price at the time of expiration denoted by 'S_t'

(vii)   Profit from the option trading denoted by 'T_1'

(viii) Number of calls traded is denoted by "N_c"

(ix)   Number of traded puts is denoted by "N_p"

(x)   Number of traded stocks is denoted by "N_s"

Profit Equations

These notations represent the position of option trading.

(i)   If $N_e > 0$, the investor will buy calls, if $N_e < 0$, the investor will sell the call.

(ii)   If $N_p > 0$, the investor will buy the put, if $N_p < 0$, the investor will sell the put.

(iii)   If $N_e > 0$, , the investor will buy the share of stock, if $N_s > 0$, the investor will sell the share of stock.

The equation that determines the profit from the option transactions is as follows.

$$\pi = N_c / N_p \, [max (0, S_T - X \text{ (or) } X - S_T) - C/P]$$

For determining profit one should possess complete information about the N_c, N_p, N_s, position of transaction, price of option, price at the time of expiration.

Call Option

Profit equation for call option trading is,

$$\pi = N_c \, [max (0, S_T - X) - C]$$

For a buyer of a call, the profit equation is,

$$\pi = N_c \, [max (0, S_T - X) - C], \text{ if the number of calls is 1 then the equation will become,}$$

$$\pi = max (0, S_T - X) - C \; [\because N_c = 1]$$

Similarly, the profit for the writer of a call can be determined as,

$$\pi = N_c \, [-max (0, S_T - X) + C] \text{ for single stock option}$$

$$\pi = -max (0, S_T - X) + C \; [\because N_c = -1].$$

Put Option

The profit equation is,

$$\pi = N_p [max(0, X - S_T) - P]$$

The profit for buyer of a put can be determined using,

$$\pi = max(0, X - S_T) - P [\because N_p = 1]$$

The profit for writer of a single put option can be determined as,

$$\pi = -max(0, X - S_r) + P [\because N_p = 1]$$

The profit for a call and put buyer can be determined by deducting the premium amount paid from the amount received from option exercise. Similarly for call and put writer, the profit is given by deducting the amount paid for option exercise from the premium received. After determining the profit of an option exercise, one can obtain total profit by multiplying it with the total number of calls or puts i.e., N_c or N_p.

Stock

For stock transactions, the profit equation is,

$$n = M_s(S_T - S_T).$$

For transaction of one share of stock, the profit for the buyer can be given as,

$$\pi = S_T - S_0 \; [\because N_s = 1]$$

For the transaction of one stock, the profit for short seller is given as,

$$\pi = S_T + S_0 \; [\because N_s = -1]$$

In case of stock transactions determination of profit is simple by deducting the purchase price of

stock from the selling price of the stock (S_T). Similarly, the profit for short seller is given by deducting the repurchase price of stock from selling price of stock.

Different Holding Periods

If an investor holds and the options till the expiration date then he will get the intrinsic value for that option. The investor can hold the option at his own interest before it's expiration, as there is no compulsion to hold it till the expiration. The remaining time value of an option can be determined using any model. Such as BSOM provided the exercise price, position of an option, expiration date, selling price of an option and estimations on variations of return on stock, 't' is the expiration date and t_1, t_2,..., t_n are the time between the purchase date and expire date. If investor want to sell the option at any time i.e., t_1 then the remaining time value will be t — t_v Similarly, if investor want to sell the options at time '7' then the time value remaining will be '0' (t -1). Then the profit at time t_j can be determined as,

$$n = N_c[C(S_t,(t - t_j), X) - C]$$

For put options, the profit will be,

$$\pi = N_p[p(S_t (t - t_j), X) - p]$$

Assumptions

The option strategies are framed based on the following assumptions,

(i)   Dividend payment should not be considered in stock transactions as they may complicate the decision making regarding options.

(ii) The basic assumption h ;re is the option transaction does not involve taxes and transaction costs. Infact, though they do not have a significant effect they have to be considered in the option decision. In case of special effect of taxes and transaction costs one should interpret their on these decisions.

4.4.1 Spreads

Q8.   What is Spread ?

Ans :

Spread

A spread can have several meanings in finance. Basically, however, they all refer to the difference between two prices, rates or yields.

The spread is the gap between the bid and the ask prices of a security or asset, like a stock, bond or commodity. This is known as a bid-ask spread.

A spread is defined as the sale of one or more futures contracts and the purchase of one or more offsetting futures contracts. A spread tracks the difference between the price of whatever it is you are long and whatever it is you are short. Therefore the risk changes from that of price fluctuation to that of the difference between the two sides of the spread.

Spread can also refer to the difference in a trading position – the gap between a short position (that is, selling) in one futures contract or currency and a long position (that is, buying) in another. This is officially known as a spread trade.

In underwriting, the spread can mean the difference between the amount paid to the issuer of a security and the price paid by the investor for that security – that is, the cost an underwriter pays to buy an issue, compared to the price at which the underwriter sells it to the public.

In lending, the spread can also refer to the price a borrower pays above a benchmark yield to get a loan. If the prime interest rate is 3%, for example, and a borrower gets a mortgage charging a 5% rate, the spread is 2%.

Q9.   What are the different types of Spreads?

Ans :

Types of Spreads

Basically, there are 3 different kinds of spreads:

Intramarket Spreads

Officially, Intramarket spreads are created only as calendar spreads. You are long and short futures in the same market, but in different months. An example of an Intramarket spread is that you are Long July Corn and simultaneously Short December Corn.

Intermarket Spreads

An Intermarket spread can be accomplished by going long futures in one market, and short futures of the same month in another market. For example: Short May Wheat and Long May Soybeans. Intermarket spreads can become calendar spreads by using long and short futures in different markets and in different months.

Inter-Exchange Spreads

A less commonly known method of creating spreads is via the use of contracts in similar markets, but on different exchanges. These spreads can be calendar spreads using different months, or they can be spreads in which the same month is used. Although the markets are similar, because the contracts occur on different exchanges they are able to be spread. An example of an Inter-exchange calendar spread would be simultaneously Long July Chicago Board of Trade (CBOT) Wheat, and Short an equal amount of May Kansas City Board of Trade (KCBOT) Wheat. An example of using the same month might be Long December CBOT Wheat and Short December KCBOT Wheat.

Q10. What is Bear Spread and Bull Spread?

Ans :

Bear Spread

A bear spread is an option strategy that will profit when the price of the underlying security declines. The strategy involves the simultaneous purchase and sale of options, where either puts or calls can be used. A trader buying a put bear spread would purchase a put with a higher strike price while simultaneously selling a put with a lower strike price. Likewise, a trader can sell a call with a lower strike price and buy a call with a higher strike price. The options will often have the same expiration date. A bear spread is sometimes called a bear vertical spread, and is in contrast to a bull vertical spread.

Bear spreads can also involve ratios, such as buying one put to sell two or more puts at a lower strike price than the first. Because it is a spread strategy that pays off when the underlying declines, it will lose if the market rises - however, the loss will be capped at the premium paid for the spread.

Example

Assume an investor is bearish on stock XYZ when it is trading at $50 per share and believes the stock price will decrease over the next week. The investor purchases 10 put options with a strike price of $55 and writes 10 put options with a strike price of $45, which expire the next week, for a combined total of $3,500. Therefore, the investor's maximum loss is the amount paid to implement the position, and the maximum profit is limited to the strike price of the long put less the strike price of the short put and the net premium paid. Assuming options have a contract size of 100, the maximum profit of the position is $6,500, or ($55 * 10 * 100) - ($45 * 10 * 100) - $3,500. In this bear put spread, the maximum profit is achieved if stock XYZ trades below the strike price of the short put, or $45. The break-even point of a bear put spread is equivalent to the strike price of the long put option less the net premium paid.

Bull Spread

A bull spread is a bullish, vertical spread options strategy designed to profit from a moderate rise in the price of the underlying security. It's comprised of the simultaneous purchase and sale of either call options or put options with different strike prices but with the same underlying asset and expiration date. Regardless of options type, the lower strike price is bought and the higher strike price is sold.

If the strategy uses call options, it is called a bull call spread. If it uses put options, it is called a bull put spread.

PROBLEMS

1. **The manager of a bond portfolio enters into a European credit spread call option for Company W based on the credit spread widening from its current level of 320 basis points. Suppose that the strike credit spread for the option is 320 basis points and the notional principal amount is $20 million. Suppose also that the risk factor for this issue is 4.**

    (a) **If at the expiration date of this option the credit spread for this issue of Company W is 400 basis points, what is the dollar amount of the payoff?**

    (b) **If at the expiration date of this option the credit spread for this issue of Company W is 200 basis points, what is the dollar amount of the payoff?**

Sol :

(a) When the underlying for a credit spread option is the credit spread for a reference obligation over a referenced benchmark, then the payoff of a call option is as follows:

Credit spread call option payoff = credit spread at exercise – (strike credit spread × notional amount × risk factor).

Inserting in our values, we have:

Credit spread call option payoff = (0.040 – 0.032) × $20,000,000 × 4 = $640,000.

The profit realized from this option is $640,000 less the cost of the option.

(b) Since 200 basis points is less than 320 basis points, the option will expire worthless which is to say $0.

2. **A portfolio manager has a view that the credit spread for the bonds of Zen.com will increase (i.e., widen) to more than the current 450 basis points in one year. How can the manager use a credit spread forward contract to capitalize on this view?**

Sol :

A credit spread forward requires an exchange of payments at the settlement date based on a credit spread. As with a credit spread option, the underlying can be the value of the reference 604 obligation or the credit spread. The payoff depends on the credit spread at the settlement date of the contract. The payoff is positive (i.e., the party receives cash) if the credit spread moves in favour of the party at the settlement date.

The party makes a payment if the credit spread moves against the party at the settlement date. In this problem, the manager has a view that the credit spread will increase (i.e., widen) to more than the current 450 basis points in one year for a reference obligation.

Then the payoff function for this credit spread forward contract would be :

(Credit Spread at Settlement Date – 450) × Notional Amount × Risk Factor.

Assuming that the notional amount is $10 million and the risk factor is 5, and the credit spread at the settlement date is 550 basis points, then the amount that will be received by the portfolio manager is :

(0.055 – 0.045) × $10,000,000 × 5 = $500,000.

Instead, suppose that the credit spread at the settlement date decreased to 390 basis points. The portfolio manager would then have to pay out $300,000 as shown below:

(0.039 – 0.045) × $10,000,000 × 5 = "$300,000.

In general, if a portfolio manager takes a position in a credit spread forward contract to benefit from an increase in the credit spread, then the payoff would be as follows:

(Credit Spread at Settlement Date – Credit Spread in Contract) × Notional Amount × Risk Factor.

For a portfolio manager taking a position that the credit spread will decrease, the payoff is :

(Credit Spread in Contract – Credit Spread Settlement Date) × Notional Amount × Risk Factor.

Q11. Explain the important terms used in Option Contract.

Ans :

Terms used in Option Contract	Buyer/Holder	The Buyer' or 'Holder' of an Option is the person who gets the right to buy or sell an underlying asset by paying an option premium to the Seller/Writer.
	Seller/Writer	The Seller' or 'Writer' of an option is the person who undertakes an obligation to sell/buy the underlying asset as and when the Buyer/Holder exercises his right by receiving an Option Premium from the Buyer or Holder
	Option Premium	Option Premium is the price paid by the Buyer/Holder of an Option to the Seller/Writer of an Option for entering into Option Contract.
	Strike Price/ Exercise Price	Strike Price/Exercise Price is the price at which the Buyer/Holder has the right to buy/sell and the Seller/Writer has an obligation to sell/buy the underlying asset
	Squaring off the Position	**Meaning:** It refers to the process of entering into a Reverse Contract, after entering into an Option Contract in the same series with the same strike price. **Objective :** Its objective is mitigate the loss to the difference in the premium amounts squaring off the position before the Expiry Date **Example :** Mr. X bought a stock option of X Ltd. of Oct. 2012 series (to be expired on 25th Oct 2012) with a strike price of Rs. 250 on 30th July 2012 by paying a premium of Rs. 20 per unit for one market lot of 100 units. He can square off his position by selling a stock option of X Ltd of Oct. 2012 series before Expiry Date (i.e., 25th Oct 2012).

Q12. Discuss in detail about the volatility strategies.

Ans :

Volatility Strategies

The different volatility strategies include,

1. Butterfly spreads

2. Calendar spreads

3. Straddles.

1. Butterfly Spreads

Butterfly spread is also referred to as sandwich spread as it combine both bull and bear spread. A butterfly spread consists of transactions at three prices such as AC, AC_2 and AC_3 where AC, and AC, are the low and high exercise prices of buying a call option respectively and AC, is the exercise price of selling two call options which exist in between AC, and K_r [Nc_n = Number of call at V transactions],

$$N_x = + 1, N_2 = -2, N_3 = 1$$

The profits generated from the butterfly spread is given by,

$$n = [max(0, 5, - AC,) - C,] - [2\ max(0, 5, - AC_2) + 2C_2] + [max(0, 5, - AC_3) - C_3]$$

If $S_t < K_1 < K_2 < K_3$ then, $\pi = -C_1 + 2C_2 - C_3$ ... (1)

If $K_1 < S_t < K_2 < K_3$ then, $\pi = S_t - K_1 - C_1 + 2C_2 - C_3$ ... (2)

If $K_1 < K_2 < K_2 < S_t$ then, $\pi = S_t - K_1 - 2S_t + 2C_2 - C_1 - C_3$

$\Rightarrow -K_1 - C_1 - S_t + 2C_2 - C_3 + 2K_2$ ... (3)

If $K_1 < K_2 < K_3 < S_t$ then, $\pi = -K_1 + 2K_2 - K_3 - C_1 + 2C_2 - C_3$ ... (4)

Profit equation (1) can also be written as $-C_1 + C_2$ and $C_3 - C_3$ of these the value of low price call is higher than that of high price call.

In profit equation (2), the last part $-C_1 + 2C_2 - C_3$ is the net price paid for the butterfly spread and the profit may either be positive or negative i.e., the break even exists at expiration.

$$S_r = 0$$

$$S_r = K_1 + C_1 - 2C_2 + C_3 = 0$$

This implies that the investor will gain profits if $S_t > K_1$, by $(-C_1 + 2C_2 - C_3)$. The profit equation (3) implies that the profit decreases with an increase in the stock price at expiration. The second break even at this stage is,

$$S_t = 2K_2 - K_1 - C_1 + 2C_2 - C3$$

Profit equation (4) implies that profit it the difference betweent he exercise price and the net premium poaid i.e., $K_2 - K_3$ and $K_2 - K_1$ are same.

$$\therefore \quad -C_1 + 2C_2 - C_3 = 0$$

Then the profit equation (4) = (1).

2. Calendar Spread

The option spread in which there exists a difference in the expiration month with similar exercise price is called calendar spread. It is one of the volatility strategies.

Example

An investor purchased a May 120 call and simultaneously sold June 120 call is said to be a calendar spread. It can be represented as May/June 120.

The May/June 120 spread is a short positioned spread and is referred to as selling the spread or credit spread as the cash flows generated from the sale of June call exceeds the cash outflows during the purchase of May call. Similarly June/ May 120 call spread is long positioned and debit spread. It is referred to as buying the spread as the cash outflows of June 120 exceeds the cash inflows of May 120 call. Unlike money spreads and calendar spreads are similar for both call and put options.

It is very difficult to evaluate a calendar spread when compared to money spread. One should hold the option with longer holding period till the expiry of other option with the shortest maturity period. Thus, the longer maturity option will gain, remaining time value i.e., more time value. The difference in the expiration periods or time value determine the profitability in this strategy. However, the profitability doec not solely depends on the time value but also on the investors estimation regarding the stock.

Example : June/May 140 Call

In this spread, the investor purchased June 140 call@ 19/-and sold the May 140 call at 15. June/ May 140 spread is long positioned and is a debit spread. In this case at the shortest holding period t_1 i.e., at May 1, the profit will be very less and at the longest maturity period t_2 i.e., at June 18, the profit will be

high. In calendar spread profitability relies, mostly upon the volatility of the stock than other factors. Before closing the position one should buy back the May call and sell the June call in order to gain high profits as the sale of July call yield high remaining time value when compared to that of buying back the May call.

(i)   If the $S_t = K$ then the 2 calls will have high remaining time value.

(ii)   If $S_t < / < K$ i.e., extremes then the 2 calls will have very low time value which may leads to heavy loss to investors. To avoid this one should buy the May call and sell the June call and thereafter he does not have sufficient time value to buy back the June call.

If $S_t << K$ then the short maturity option will expire and become worthless which in turn reduce the value of the other (long maturity option). This results in loss to investor.

Thus, it is clear that whatever may be the stock price, one should hold the option for a longer period to increase the time value of the options as the price of options increases with the passage of time.
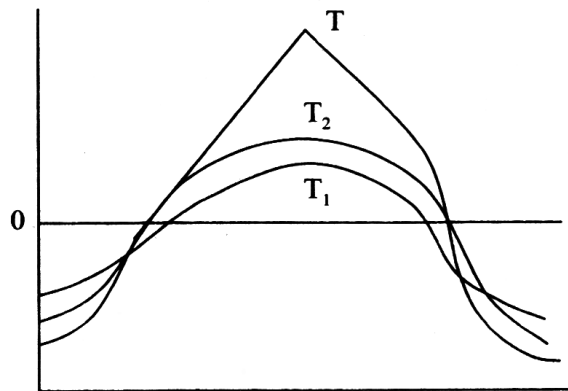
If the stock price is stable then holding long-term options and writing short-term options is considered as a profitable strategy.

3.   Straddles

Straddle is also one of the volatility strategy, straddle is referred to as a combination of options which involves a purchase of put and call at same exercise price and expiration date. During this period, the option holder can gain profits because of change in stock prices i.e., $N_c = 1$, $N_p = 1$.

$\therefore$ The profit at the longer holding period (t) can be determined using,

$\pi = [\max(0, S_t - K) - C] + [\max[0, K - S) - P]$

The profit at different stock prices are,

$\pi = S_t - K - C - P$ if $S_t \geq K$ ...(1)

$\pi = K - S_t - C - P$ if $S_t \geq K$ ...(2)

Till the date of expiry investor can increase the profits with an increase in stock price. In general the call options expires in the money and yields a profit of $S_t - K$ whereas if put option expires out of money then yields a profit of $K - S_t$ There exists a decrease in the profits with a stock price below K. If $S_t = K$ at the expiration data, then both the options become worthless and incur a loss to the trader. The break even for straddle options are,

$S_t - K - C - P = 0$

$S_t = K + C + P$ ... (3)

If $S_t \geq K$

If $S_t < K$, $S = K - C - P$ ... (4)

Break even stock price $= K \pm (C + P)$

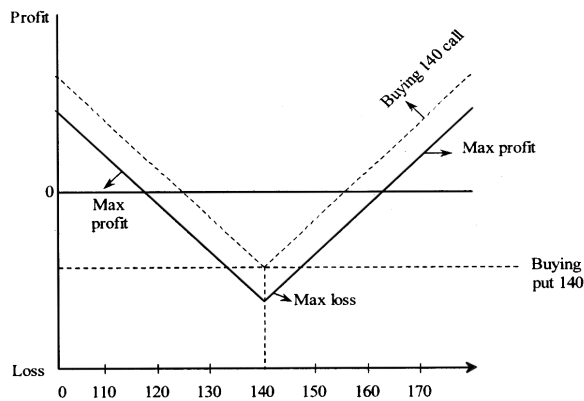The presence of '2' break even represents that the graph is 'V' shaped.

Figure (1)

Too high volatility in stock price may mislead the investors, whereas fairly high stock price benefits the investors. One should carefully evaluate the movement of stock price towards the profits.

Short Straddle

Short straddle is referred to as selling the put and call at a same exercise price and date of expiry. It is also called top straddle/straddle write. An investor can sell a straddle if the stock price is estimated to be stable otherwise he will incur loss. Hence, this strategy is said to be a risky one when compared to other strategies.

Strips and straps

Strips and straps are one of the combination volatile trading option strategies. Strips are the long positioned options in which investors consist of one call and 2 puts with same K and t. Straps are also long positioned options in which investors consist of 1 put and 2 calls with same exercise price and t, to gain profits through a rapid movements in stock price downside.

Strangles

Strangle is similar to straddle except in the strike price. Straddle is a strategy in which an investor buy or sell the options at different strike prices and with same expiration date. Strangles are of two types: long and short. Long straddle is buying the call and put options where selling the options is referred to as short straddle.
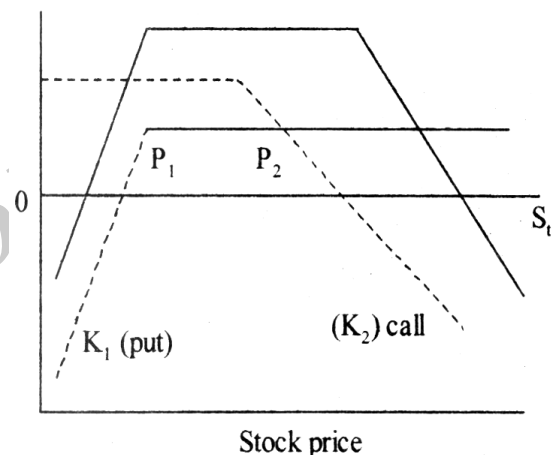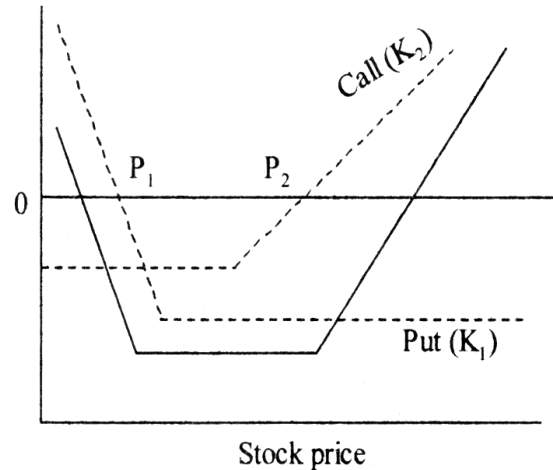
Figure (2)

In the strangles, the both call and put options may be out of the money options or in-type-money options or one is out-of-the-money and other is in-the-money. For buyer there exists an increase in volatility whereas for seller the volatility in the strangle decreases. The profit in the long and short strangle graph, the flat position between the 2 exercise prices. This area is the profit zone for the buyer and loss zone for sellers. In short strangle, the flat area between 2 exercise prices represent the profit zone for sellers and loss zone for buyers. Strangles are not appropriate for the volatility due to change in market expectations. Though the short strangle is popularly used to benefit from the decreased time value at stable stock price they are high risky like short straddle as the loss is infinite.

4.5 EXERCISE PRICE AND OPTION VALUES

Q13. What do you mean by Exercise Price ?

Ans :

The term exercise price refers to the price at which an option contract's securities may be sold or purchased. If the call or put option is "in-the-money," the difference between the exercise price and the market price of the underlying security is the potential profit gained per share.

The exercise price is determined when the options contract is formed. The larger the difference between the current price of the underlying security and the exercise price, the greater the premium required to purchase the option (when first formed).

An **exercise price** is the price at which the holder of a call option has the right, but not the obligation, to purchase 100 shares of a particular underlying stock by the expiration date.

Individuals that invest in options pay close attention to the exercise price, since the difference between this price and the current market price of the underlying securities is what gives the option contract value. A contract that is in-the-money has real value to the investor; this can happen under two conditions:

➢ **Call Options**

If the strike price is below the current market price of the underlying security, the holder can exercise their option and purchase the security at a price that is below market.

➢ **Put Option**

If the strike price is above the current market price of the underlying security, the holder can exercise the option and sell the security at a price that is above market.

4.6 PRINCIPLES OF CALL OPTION PRICING AND PUT OPTION PRICING

Q14. "A call option need not be exercised, its minimum value is zero". Explain.

Ans :   **(Dec.-19)**

A call option is an instrument having limited liability. The call holder will exercise the call when it is beneficial and will not exercise the call when the wealth of the call holder decreases. Thus, the option will not have negative value as the holder is not compelled to exercise it. Hence, the price of the call option can be expressed as,

$$\boxed{C[S_0, X, P] \geq 0}$$

Where,

    C = Price of the call option

    S_0 = Present stock price

    X = The time to expiration

    P = Exercise price.

In case of an American call, a call option has a minimum value of zero which is controlled by a stronger statement, i.e.,

$$\boxed{C_a[S_0, X, P] \geq \max[0, S_0 - P]}$$

The expression Max $[0, S_0, P]$ signifies that the maximum value of two arguments i.e., zero (or) $S_0 - P$ is considered. Intrinsic value is the minimum value of an option. It is sometimes also called as parity value, parity (or) exercise value. This intrinsic value remains positive in case of in-the-money calls and zero for out-the-money calls.

Eor an American call, the intrinsic value is greater than zero (or) difference between the stock price and the exercise price. The intrinsic value is not applicable to European call as it is exercised only on the expiration day.

The major difference between the price and the intrinsic-value is termed as time value (or) speculative value of the call. This can be expressed as,

$$\boxed{C_a[S_0, X, P] - \max[0, S_0 - P]}$$

The willingness of the traders to pay towards the uncertainty of the underlying stock is called as 'time value'.

The difference between the call price and the intrinsic value is called as the time value of an American call.
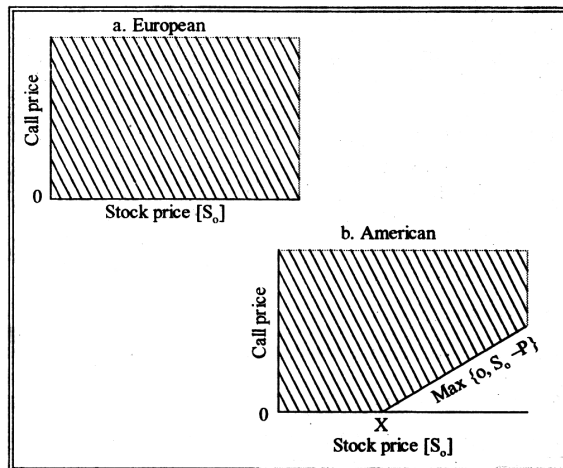

Fig.: Minimum Values of European and American Calls

In the above figure the shaded area represents the call price. The American call price lies in a smaller area when compared to European call price. This implies that the range of potential values is smaller/narrower in case of American call price.

Q15. Explain the various kinds of Option Valuation.

Ans :

In option market, the underlying assets are bought and sold at the exercise price or strike price. But it reality current market price may more or less or equal the strike price.

The following three situations may arises :

1. **In the Money :** If the current market price of the underlying asset exceeds the exercise price in case of a call option or if the current market price falls below the strike price in case of a put option, the option is said to be in the money.

2. **Out of Money :** If the current market price of the underlying asset is less than the exercise price of a call option or if the current market price of underlying assets is more than the strike price in case of a put option, the option is said to be out of money.

3. **At the Money :** The at the money situation arises when the exercise price is equal to the current market price of the underlying asset.

Q16. Define :

(a) **Minimum value of a put**

(b) **Maximum value of a put**

(c) **Value of put at expiry**

Ans :

Majority of the rules of Call options are applicable to options, yet, there are few important variations between them.

The Minimum Value of a Put

A put is defined as an option to sell a stock. The put option must not be exercised as its minimum value is zero. Therefore, a put could never have a negative value and it is expressed as,

Where,

P = Price of put option

S_0 = Current stock price (i.e., today's)

X = Time to expiration

P = Exercise price

An American put can be exercised early. Thus,

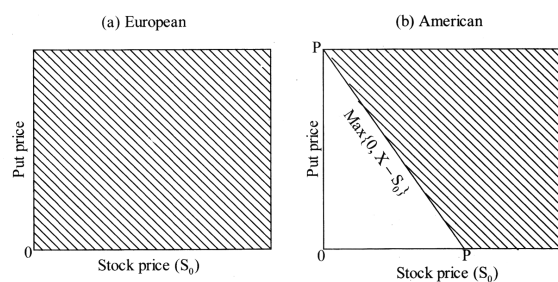$$\boxed{P_a\{S_0, X, P\} \geq Max\{0, P - S_0\}}$$

Figure: Minimum Value of European and American Puts

The price of European put lies in the shaded area of the graph (a) and the price of an American put lies in the shaded area of graph (b).

The value, $\max\{0, P - S_0\}$ is regarded as the put's intrinsic value. An in-the-money put usually has the positive intrinsic value and on the other hand the out-of-the-money put has the zero intrinsic value. Time value is the variation between the put price and the intrinsic value. The time value is also termed as 'speculative value' which is being defined as,

$$\boxed{P_a\{S_{0,}X,P\} - \max\{0, P - S_0\}}$$

The intrinsic value specification i.e., $\max\{0, p - s_0\}$ is not applicable for European puts due to the reason that option should be exercisable for an investor to completely carry.out arbitrage transaction. In fact, it is possible to sell European puts for less than the intrinsic value.

The Maximum Value of a Put

The maximum value of an American put is the exercise price that can be exercised at anytime.

$$\boxed{P_a\{S_{0,}X,P\} \leq P}$$

Maximum value of European put is the present value of the exercise price.

$$\boxed{P_a\{S_{0,}X,P\} \leq P[1 + r]^{-s}}$$
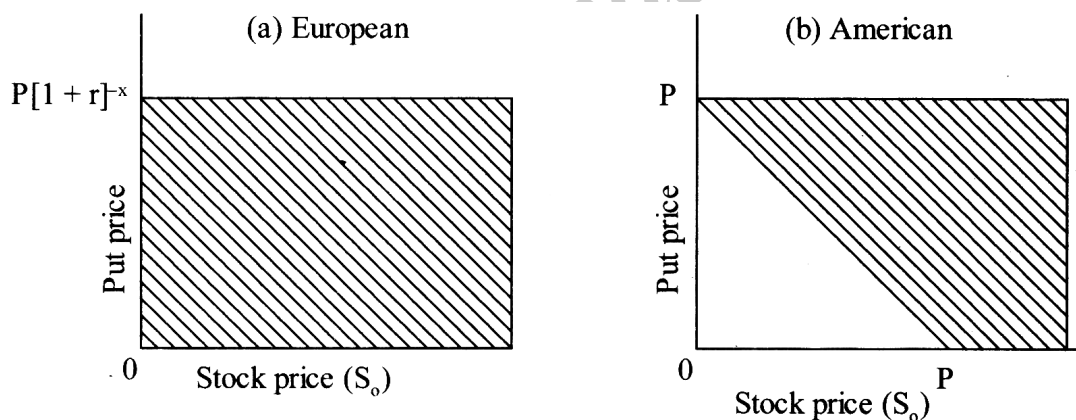
Fig.: Maximum values of European and American Puts

The Value of a Put at Expiration

There would be no time value remaining at the expiration date of the puts. Thus, expiring the American puts would be as similar to as expiring the European puts. The value of either the American put or the European put should be the intrinsic value. The value of put at expiration,

$$\boxed{P_a\{S_{x,}0,P\} = \max\{0, P - s\}}$$

The investors may buy the put and stock and exercise the put to get quick risk-free profit. If in case the put price is less than $[P - Sx]$. When the put expires out-of-the-money i.e., $p < s_x$ then, it would become useless. The following graph represents the value of put at expiration.
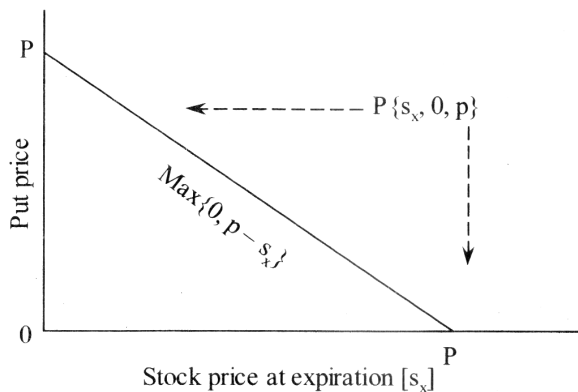
Fig.: The value of a Put at Expiration

4.7 PUT – CALL PARITY THEOREM

Q17. What is Put-Call Parity Theorem

Ans :

Put-call parity is a concept that anyone involved in options markets needs to understand. Parity is a functional equivalence. The genius of option theory and structure is that two instruments, puts and calls, are complementary with respect to both pricing and valuation.

The put-call parity holds that the relationship between a call and a put with the same underlying asset, strike price, and maturity should not yield any profit of loss. This happens because the call option expects that the price will rise further and the put option expects that the price will decline further. Because the risk and return are identical, the return is the same, yielding no profit or loss. In the case, that the call or the put option diverge from the call-put parity, then there is an arbitrage

It can highlight profitable opportunities that present themselves when option premiums are out of whack. Understanding put-call parity can also help you to gauge the relative value of an option you may be considering for your portfolio.

There are two styles of options: American and European. The exercise of American options can be at any time during their life while the exercise of European options only occurs on the options' expiration date. Generally, put-call parity only works perfectly with European style options.

Option premiums have two components: intrinsic value and time value. Intrinsic value is the in-the-money portion of the option. A $15 call option on silver with a premium of $1.50 when silver is trading at $16 has $1 of intrinsic value and 50 cents of time value. Time value represents the value of the option attributed exclusively to time. A $17 call option on silver that has a premium of 50 cents when silver is trading at $16 has no intrinsic value and 50 cents of time value. Therefore, in-the-money options have both intrinsic and time value while an out-of-the-money option has only time value.

Put-Call Parity Equation

$$C + X/(1 + r)^t = S_o + P$$

    C = Call Premium,

    r = Annual Interest Rate,

    P = Put Premium,

    t = Time in Year,

    X = Strike Price of Call and Put,

    S_o = Initial Price of Underlying.

4.8 OPTION VALUES AND CASH PAYOUTS

Q18. Explain briefly about Option Values and Cash Payouts

Ans :

If underlying asset makes cash payouts before the maturity of the option some changes takes place such as dividend is paid if underlying asset is a stock and coupon payments are made if underlying asset is a coupon bond.

If European call option is held on a stock, individual can purchase stock at maturity for the exercise price. The stock holder will receive dividends between time of purchase of call and maturity time unless some provision is mentioned in option contract stating that exercise price will decrease the exercise price at maturity by the dividend amount paid. These dividends will reduce the value of option. There should be some protection against dividend payouts otherwise European call becomes worthless if firm start paying liquidating dividend.

If firm begin to pay liquidating dividend between r and t″, the call option which matures at t′ is worthy than the option which matures at t″. In case of American call option, call option which matures at t″ will have value which is equal to option that matures at r. Therefore, American call option will provide a benefit which is not offered by European call option. As a result, American call option should be of equal value of European call option. The early exercise provision of Americans options is considered as right not an obligation.

Early exercising has both cost and benefit. The benefit is S_t is received not and cost is exercise price K should also be paid now.

If dividend is not paid on stock then there is no need to have stock before maturity of option. When stock pays dividend and exercised early, individual will receive dividend. If exercising is postponed till payment of dividend then individual can enjoy the benefit of investing the exercise price and there is no cost because of no payouts have taken place. As a result, American call options are exercised before dividend payment or not at all.

When American put option is exercised, exercise price is received which can be invested. Even limited liability feature of the option position is removed which secure investor, if stock price exceed the exercise price. The short position will incur loss till there is increase in stock price. Hence, when stock price is low, it pays to exercise as it is not worth to wait until maturity because there is nothing to ^ ain. The lost interest on investing exercise price overcome the probable gain from future declines in the stock price.

4.9 Option Pricing, Arbitrage Pricing

Q19. Write a note on Arbitrage Pricing of Option.

Ans :

Arbitrage refers to the simultaneous purchase and sale in different markets to achieve a certain profit. In market equilibrium, there must be no opportunity for profitable arbitrage. Otherwise one could make a certain profit by buying low (buying the undervalued asset) and selling high (selling the overvalued asset). There would be excess demand

for the former and excess supply for the latter. Option Pricing Based on the principle that no arbitrage opportunity can exist, one can develop an elaborate theory of option pricing.

Expiration Date

The price rises as the expiration date becomes more distant. This property conforms with the general principle that expanding one's possible choices has value. However one can say more: if the price were less for a more distant expiration date, then one could make an arbitrage profit.

Striking Price

The price rises as the striking price goes down. This property conforms with the intuitive principle that to buy for less is better than paying more. However one can say more: if the price were less for a lower striking price, then one could make an arbitrage profit.

4.10 Binomial Model

Q20. What is Binomial Option Pricing

Ans :   (Imp.)

Binomial Options Pricing Model

The binomial options pricing model is a tool for valuing stock options. Starting with certain given values, and making certain assumptions, the model uses a binomial distribution to calculate the price of an option. The binomial method is considered as accurate, if not more accurate, than the Black Scholes method of valuing options.

Calculating the value of an option using the binomial method requires certain givens and certain assumption. Start with the current price of the stock and the strike price of the option.

The necessary assumptions required for this method of options valuation include two possible stock prices for the end of the period as well as the probability for each of the two stock prices at the end of the period.

The Binomial model can be used to calculate the price for an option. The Binomial model is commonly used to valuate American options, which

can be exercised upon any moment before the maturity date, because this method can take into consideration the possibility of pre-mature execution in its calculation. It has an advantage over the Black-Scholes method because the mathematical formula is relatively easy compared to Black-Scholes. Furthermore the calculations are more accurate because market developments can be inserted in the ongoing binomial model and thus the calculation will be more in sync with the actual market developments. The higher accuracy of the Binomial model however comes at a price. This method is more time-consuming than the Black-Scholes method.

Q21. What are the assumptions in Binomial Option Pricing Model.

Ans :

The assumptions in binomial option pricing models are as follows

1. There are only two possible prices for the underlying asset on the next day. From this assumption, this model has got its name as Binomial option pricing model (Bi means two)

2. The two possible prices are the up-price and down-price

3. The underlying asset does not pay any dividends

4. The rate of interest (r) is constant throughout the life of the option

5. Markets are frictionless i.e. there are no taxes and no transaction cost

6. Investors are risk neutral i.e. investors are indifferent towards risk.

Q22. What are the approaches in Binomial Option Pricing Model.

Ans :   (May-19)

Pricing by arbitrage is a fundamental method which is used to price derivatives in general. This method operates in principle for derivative security which is purchased at present, does not have any cash flows until maturity and makes payoff at maturity.

When an option on a share is priced which has one period to maturity. If a company follows the binomial model wherein stock price may increase or decrease. Assume at date 0, stock price is $ 50, at date 1 the share price is $100 in boom period and $ 25 in recession period. The exercise price of call option is $ 50. The price of zero coupon bond that pays $ 1 at date 1 is $ 0.90 at date 0. In order to price the option by arbitrage, a portfolio is constructed at date 0 that pays the same as the option at date 1.

Replicating Portfolio Approach to Price an Option

When replicating portfolio of a share of a company, it is necessary to pay stock price minus $ 50 if option is in the money. At maturity. Payoff of the option is based on one radom variable i.e stock price. It is not appropriate for replicating portfolio to hold stock and barrow present value of $ 50 if there is any chance that option will expire out of the money. The correct replicating portfolio should pay $ 50 if stock price is $100 and $ 0 otherwise. Let us assume Z as number of shares in replicating portfolio. The present value of 5 is borrowed so B should be repaid at date 1. In this case, there is choice of Z and B:

Payoff of replicating portfolio (boom state) = Payoff of call option

$$Z \times 100 - B = 50$$

Payoff or replicating portfolio (Recession state) = Payoff of call option

$$Z \times 25 - B = 0$$

If value of Z and B are identified and above equations are satisfied, a replicating portfolio for option is created:

Pricing Options by Constructing a Hedge

There is a different approach to find the value of the option. There is long position in a call on share and investor is willing to hedge the position to bear no risk. The payoff of the option is based on one risk factor i.e stock price. The option payoff increases with stock price but a hedge need to be constructed which can make money with fall in stock price. A perfect hedge must satisfy the below equation:

Value of hedged portfolio if stock price is $ 100 = Value of hedged portfolio if stock price is $ 25.

[$ 100 – $ 50] – h × 100 = [$0] – h × 25

Stock's Expected Return Does not Affect the Option Price

Both replicating portfolio method and hedge portfolio method are used to find call price but neither method uses probability distribution of the return of the stock. Generally in replicating portfolio method, value is set for replicating portfolio same as payoff of the option for each possible outcome irrespective of its probability. By using hedging method, all risks are removed and hedged portfolio always pays the same amount. As payoff of the portfolio is independent of the stock price, probability of reaching stock price does matter.

The Binomial Model

As there are many period and in each period the stock price can move to only one of two values. Consider these values stock have one of two retuens. If returns continue to be same every period then distribution is Identically Independently ibuted (i.i.d). Here returns follow binomial distribution.

Cox, Ross and Rubinstein have proposed this model in the year 1979. BOPM provides price to a stock option by building a binomial tree. A binomial tree consists of various obtainable paths to get a stock price. BOPM is flexible in nature, it can manage the conditions depending on time. The binomial tree expends each period into two branches is called a node. The shape of tree depends on the i.i.d assumption.

Formula for call option that matures in one period

$$C(S,K,1,0) = \frac{1}{r}\left\{\left[\frac{r-d}{u-d}\right]C_u + \left[\frac{u-r}{u-d}\right]C_d\right\}$$

Q23. What are the advantages and limitations of Binomial Option Pricing Model.

Ans :

Advantages of Binomial Option Pricing Model

1. Binomial option pricing models are mathematically simple to use.

2. Binomial option pricing model is useful for valuing American options in which the option owner has the right to exercise the option any time up till expiration.

3. Binomial option model is also useful for pricing Bermudan options which can be exercised at various points during the life of the option.

4. Binomial option pricing model is very simple model that is used to price options. When to compared to Black Scholes model and other complex models.

5. This model is based on the concept of no arbitrage.

6. The model reduces possibilities of price changes and removes the possibility for arbitrage.

### Limitations of Binomial Option Pricing Model

1. One major limitation of binomial option pricing model is its slow speed.

2. Computation complexity increases in multi period binomial option pricing model.

PROBLEMS ON ONE STEP BINOMIAL MODEL

3. **A stock price is currently $ 20 and will more either upto $ 22 or down to $ 18 at the end of 3 months. This option considered is a European call option with a strike price of $ 21, and an expiration date in 3 months. The risk free interest rate is 12% per annum. Calculate the value of call option ?**

Sol :

Stock price movement

Stock price = $ 22
Option price = $ 1

Stock price = $ 20

Stock price = $ 18
Option price = $ 0
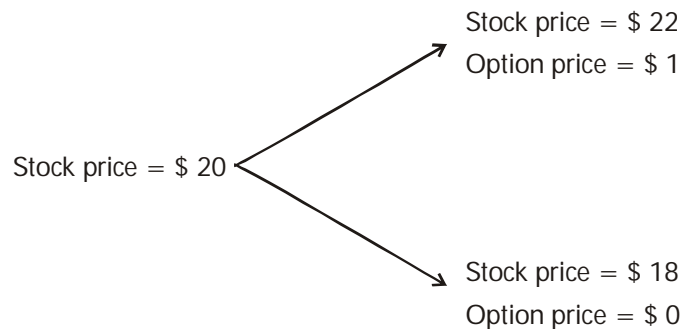
Let P as the probability of an upward movement in the stock price in a risk neutral world. The expected return on a stock in a risk-neutral world must be the risk free rate of 12%.

Then p must satisfy

$$22p + 18 (1 - p) = 20 \cdot e^{0.12 \times 3/12}$$

$$22p + 18 - 18p = 20 \cdot e^{0.12 \times 3/12}$$

$$4p + 18 = 20 \cdot e^{0.1 \times 3}$$

$$4p = 20 \cdot e^{0.3} - 18$$

$$4p = (20 \times 1.03045) - 18$$

$$4p = 20.609 - 18$$

$$4p = 2.609$$

$$p = \frac{2.609}{4} = 0.6523$$

$$p = 0.6523$$

At the end of 3 months, the call option has a 0.6523 probability of being worth 1 and a 0.3477 probability of being worth zero.

Its expected value is therefore,

$$0.6523 \times 1 + 0.3477 \times 0 = 0.6523$$

In a risk neutral world this should be discounted at the risk free rate.

The value of option today is

$$= 0.6523 \times e^{-0.12 \times 3/12}$$

$$= \$ 0.633.$$

Two-step Binomial Option Pricing Model

4.   Draw Binomial trees from the following data, show the stock prices and calculate the call option and put option value taking risk neutral probability.
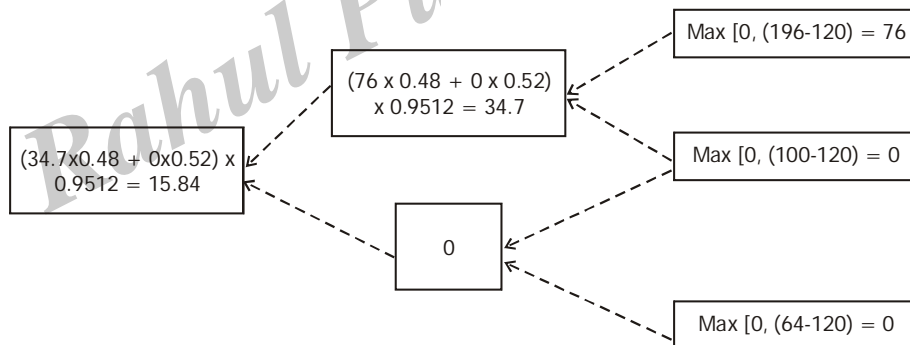
Sol :
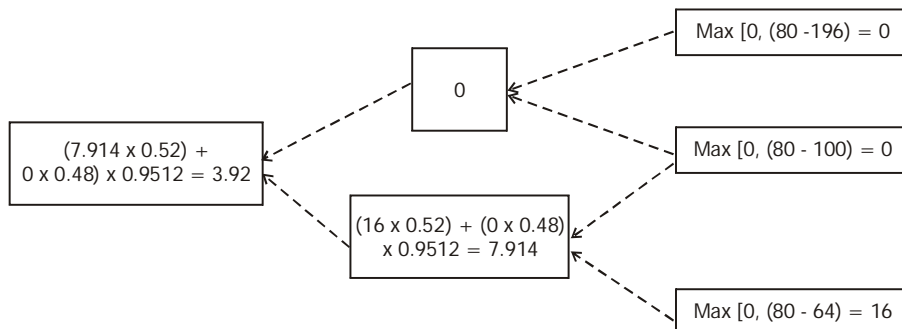
P = 0.48, Risk free interest = 10% p.a.

	Call option	**Put Option**
Stock price	– 100 Rs.	100 Rs.
Strike price	– 120 Rs.	80 Rs.
Maturity	– 1 Year	1 year
U factor	1.4	1.4
d factor	0.8	0.8
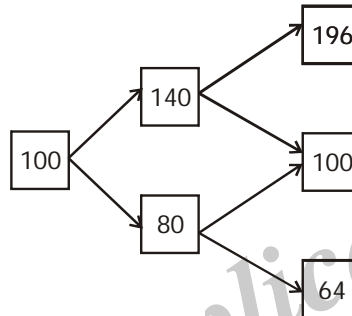
i)   **Calculation of European Call Option**

ii)   **Calculation of Put Option**

4.11 BLACK SCHOLES AND MERTON MODEL

Q24. What is Black Scholes and Merton Model.

Ans :   **(Sep.-20)**

The Black Scholes Model is one of the most important concepts in modern financial theory. The Black Scholes Model is considered the standard model for valuing options. A model of price variation over time of financial instruments such as stocks that can, among other things, be used to determine the price of a European call option. The model assumes that the price of heavily traded assets follow a geometric Brownian motion with constant drift and volatility. When applied to a stock option, the model incorporates the constant price variation of the stock, the time value of money, the option's strike price and the time to the options expiry. Fortunately one does not have to know calculus to use the Black Scholes model.

The Black-Scholes Model was first discovered in 1973 by Fischer Black and Myron Scholes, and then further developed by Robert Merton. This model is also known as the Black-Scholes-Merton Model, Black-Scholes Model, The Black and Scholes Model.

Black - Scholes is a formula designed to valuate an option, as a function of certain variables. These variables consist of the price of the underlying asset, the strike price, the volatility, and remaining time until expiration and risk-free interest rate. By using this formula it is possible to accurately calculate the value of an option, and determine whether an option is over or under valued. Due to this accurate calculation the possibility of arbitrage trading is eliminated. The Black-Scholes method is therefore crucial to the effectiveness of option trading.

The Model

$$C = SN(d_1) - Ke^{(-rt)} N(d_2)$$

C = Theoretical call premium

S = Current Stock price

t = time until option expiration

K = option striking price

r = risk – free interest rate

N = Cumulative standard normal distribution

e = exponential term (2.7183)

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

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

s = standard deviation of stock returns

In = natural logarithm.

Q25. What are the variables used in the Black – Scholes Model

Ans :   **(Sep.-20)**

The main variables used in the Black-Scholes model include :

➢ **Price of underlying asset (S)** is a current market price of the asset.

➢ **Strike price (K)** is a price at which an option can be exercised.

➢ **Volatility (σ)** is a measure of how much the security prices will move in the subsequent periods. Volatility is the trickiest input in the option pricing model as the historical volatility is not the most reliable input for this model

➢ **Time until expiration (T)** is a time between calculation and option's exercise date

➢ **Interest rate (r)** is a risk-free interest rate

➢ **Dividend yield (σ)** was not originally the main input into the model. The original Black-Scholes.

Q26. What are the limitations of Black Scholes Model.

Ans :

The Black–Scholes model disagrees with reality in a number of ways, some significant. It is widely used as a useful approximation, but proper use requires understanding its limitations – blindly following the model exposes the user to unexpected risk. Among the most significant limitations are:

1.   The Black-Scholes Model assumes that the risk-free rate and the stock's volatility are constant.

2.   The Black-Scholes Model assumes that stock prices are continuous and that large changes (such as those seen after a merger announcement) don't occur.

3.   The Black-Scholes Model assumes a stock pays no dividends until after expiration.

4.   Analysts can only estimate a stock's volatility instead of directly observing it, as they can for the other inputs.

5.   The Black-Scholes Model tends to overvalue deep out-of-the-money calls and undervalue deep in-the-money calls.

6.   The Black-Scholes Model tends to misprice options that involve high-dividend stocks.

PROBLEMS

5.   Assume that an SBI share is currently trading at INR 2,300. There is also a call option and a put option on the SBI with an exercise price of INR 2,400 and with a maturity of 90 days. The call option is priced at INR 165. The ninety-day risk-free rate is 8% per annum. Calculate the price of the put option.

Sol :

According to put-call parity,

$P = C - [S_t - (S_x \times e^{-tT})]$

$P = 165 - (2,300 - (2,400 \times e^{-[0.08 \times (90/365)]})$

$P = INR\ 165 - (INR\ 2,300 - INR\ 2,353.12)$

$\quad = INR\ 218.12$

This shows that a put option on SBI shares with an exercise price of INR 2,400 and a maturity of 90 days should sell for INR 218.12 if the price of a call option with the same exercise price and exercise date is INR 165.

6.   The S and P CNX Nifty index is at 4,623.25 on September 1. There exist call options and put options on the S and P CNX Nifty index with expiry on September 24. The exercise price of both the call and the put is INR 5.000. The call is priced at INR 32.9. According to put-call parity, what should be the put price on the basis of the assumption that the call is fairly priced? The risk-free interest rate is 8%.

Sol :

According to put-call parity,

$P = C - [S_t - (S_x \times e^{-tT})]$

$P = 32.9 - (4,623.25 - (5.000 \times e^{-[0.08 \times (24/365)]})]$

$P = INR\ 32.9 - (INR\ 4.623.5 - INR\ 4.980.31) = INR\ 389.97$

On the basis of the put-call parity, the put price should be INR 389.97.

7.   Assume that an SBI share is currently trading at INR 2,300. There is a call option and a put option on the SBI with an exercise price of INR 2,400 and with 90 days to maturity. The call option is priced at INR 165. The SBI is expected to pay a dividend of INR 100 after 30 days. If the annualized risk-free interest rate is 8% for 90 days and 5.5% for 30 days, what is the put price according to put-call parity?

Sol :

Since

$P = C - |S_t - D \times exp(rf_t) - S_x \times cxp(-rT)]$

$P = 165 - [2,300 - 100 \times e^{-0.055 \times (30/365)} - 2,400 \times e^{-0.08 \times (90/365)}]$

$P = 165 - (2,300 - 99.55 - 2,353.12) = INR\ 317.67$

8. **ITC shares arc selling at INR 230 on September 1. Call and put options arc available with expiry on October 29 with an exercise price of INR 250. The call is priced at INR 9.60. and the put is priced at INR 26.65. ITC announces a cash dividend of INR 2.50 per share on September 15, and the dividend will be paid on October 1. The risk-free rate is 9%. Calculate the put price using put-call parity. Calculate the arbitrage profit, if any. The contract size for ITC options is 1,125.**

Sol :

When a company pays dividends before the maturity of the option, the put-call parity is given by:

$$P = C - |S_f - D \times exp(rt_2) - S_x \times exp(-rT))$$

Here, C = INR 9.60. S_t = INR 230, S_x = INR 250, D = INR 2.50, r = 9%, T = number of days to the option exercise date = September 2 to October 29 = 58 days. t_1 = number of days to dividend payment = September 2 to October 1 = 30 days.

$$P = 9.60 - \left[230 - 250 \times exp\left(-0.09 \times \frac{30}{365} \right) - 250 \times exp\left(-0.09 \frac{58}{365} \right) \right] = INR\ 28.53$$

9. **ITC shares are selling at INR 230 on September 1. American call and American put options are available with expiry on October 29 with an exercise price of INR 250. The call is priced at INR 9.60, and the risk-free rate is 9%. Calculated the put price using put-call parity. The contract size for ITC options is 1,125.**

Sol :

Put-call parity for American options is given by:

$$S_T - S_x < C_A - P_A < S_t - (S_x \times e^{-tT})$$

Since S_t = INR 230, S_x = INR 2.50, r = 0.09, and T = 58/365,

$$230 - 250 < 9.60 - P_A < 230 - 250 \times e^{-0.09 \times (58/365))}$$

$$- 20 < 9.60 - P_A < (230 - 246.45)$$

$$26.05 < P_A < 29.60$$

This shows that the put price will be in the range of INR 26.05 to INR 29.60.

If the options were European, the put-call parity would have been:

$$P = C - [S_t - (S_x \times e^{-tT})]$$

$$P = 9.60 - [230 - (230 - (250 \times e^{-0.09 \times (58/365)})] = INR\ 26.05.$$

10. **ITC shares arc selling at INR 230 on September 1. American call and American put options are available with expiry on October 29 with an exercise price of INR 250. The call is priced at INR 9.60, and the risk-free rate is 9%. ITC is expected to pay a dividend of INR 10 on October 1. Calculate the put price using put-call parity. The contract size for ITC options is 1,125.**

Sol :

Put-call parity for American options on a stock that pays dividends is given by:

$$S_T - (D \times e^{-tT_1}) - S_x < C_A - P_A < S_T - (S_x \times e^{-rT})$$

Since S_t = INR 230, D = 10, t_1 = 30/365, S_x = INR 250, r = 0.09 and T = 58/365.

$$230 - 10 \times e^{-0.09 \times (30/365)} - 250 < 9.6O - P_A < 230 - 250 \times e^{-0.09 \times (58/365)}$$

$$- 29.93 < 9.60 - P_A < 16.45$$

$$26.05 < P_A < 39.53$$

This shows that the put price will be in the range of INR 26.05 to INR 39.53.

11. **Assume that a stock is currently priced at INR 1,200. There exists a put option with an exercise price of INR 1,240 and an expiry of 90 days. At the end of 90 days, the stock price can either increase by 8% or decrease by 3%. If the risk-free rate is 6%, calculate the price of the call by using the binomial options pricing model.**

Sol :

Given: $u = 1.08$; $d = 0.97$; $S_0 = $ INR 1,200; $S_x = $ INR 1,240; $r = 6\%$; $T = 90/365$

First, calculate the risk-neutral probabilities p and $(1 - p)$.

$$P = \frac{e^{rT} - d}{u - d} = \frac{e^{0.06 \times 90/36} - 0.97}{1.08 - 0.97} = 0.4082$$

$$1 - p = \frac{u - e^{rT}}{u - d} = \frac{1.08 - e^{0.06 \times 90/365}}{1.08 - 0.97} = 0.5918$$

$P_{Tu} = $ Max $[0.(S_x - S_{Tu})] = $ Max $(0, (1,240 - 1,200 \times 1.08] = $ Max $(0, (1,240 - 1,296)) = 0$

$P_{Td} = $ Max $(0. (S_x - S_{Td}) = $ Max $[0, (1,240 - 1,200 \times 0.97)) = $ Max $(0, (1,240 - 1,164))$

       $= $ INR 76

Thus,

Expected value of the put at time 1 $= 0.4082 \times 0 + 0.5918 \times 76 = $ INR 44.98

Discounting this expected terminal value at 6% over 90 days gives

$$C_{r-1} = C_T e^{-rT} = 44.98 \times e^{-0.06 \times 90/365} = \text{INR } 44.32.$$

12. **Infosys slock is selling at INR 1,130 on September I. There exists a put option on Infosys with expiry on October 29 and an exercise price of INR 1,150. It is estimated that by October 29, the Infosys price could either increase by 6% or decrease by 4%. The risk-free rate is 8%. Calculate the call price using the single-period binomial options pricing model.**

Sol :

Given: $u = 1.06$; $d = 0.96$; $S_0 = $ INR 1.130; $S_x = $ INR 1,150; $r = 8\%$; $T = 58/365$

First, calculate the risk-neutral probabilities p and $(1 - p)$.

$$P = \frac{e^{rT} - d}{u - d} = \frac{d^{0.06 \times 58/365} - 0.96}{1.06 - 0.96} = 0.528$$

$$t - p = \frac{u - e^{tT}}{u - d} = \frac{1.06 - e^{0.08 \times 58/365}}{1.06 - 0.96}$$

P_{Tu} = Max (0, (S_x – S_{ru})) = Max (0. (1,150 – 1.130 × 1.06)) = Max (0. (1,150 – 1,197.80))

     = INR 0

P_u = Max (0, (S_x – S_{TJ})] = Max (0, (1,150 – 1,130 × 0.96)) = Max (0, (1,150 – 1,084.80))

     = INR 65.20

Thus:

     Expected value of the put at time 1 = 0.528 × 0 = 0.472 × 65.20 = INR 30.77

Discounting this terminal expected value at 8% over 58 days gives

     P_{T-1} = PTe^{-rT} = 30.77 × $e{-0.08 \times 58/365}$ = INR 30.

The put price at time (T – 1) will be INR 30.38.

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13. **Assume that on June 1. Tata Steel is selling at INR 488.95 and there is a call option on this stock expiring on June 29 with an exercise price of INR 500. The risk-free rate is 12%. and the volatility of the stock is estimated as 25%. Calculate the price of the call according to the Black-Scholes formula.**

Sol :

     Given: S_0 = INR 488.95; S_x = INR 500; r = 12%; s = 25%; T = 28/365

Step 1:   Calculate the values of d_1 and d_2

$$d_1 = \frac{\ln\left(\frac{S_0}{S_X}\right) + \left(\frac{\sigma^2}{2} + r\right)T}{\sigma\sqrt{T}}$$

$$d_2 = \frac{\ln\left(\frac{488.95}{500}\right) + \left(\frac{0.25 \times 0.25}{2} + 0.12\right)}{0.25 \times \left(\frac{28}{365}\right)^{1/2}}$$

$$d_1 = -0.1552$$

$$d_2 = d_1 = \sigma\sqrt{T} = -0.1551 - \left[0.25 \times \left(\frac{28}{365}\right)^{1/2}\right] = -0.2244.$$

Step 2:   Find the values of $N(d_1)$ and $N(d_2)$. This can be done by using the Excel spreadsheet function that gives the cumulative normal distribution values.

     $N(d_1)$ = N(–0.1552) = 0.4383   and $N(d_2)$ = N(–0.2244) = 0.4112.

Step 3:   Use the value sof $N(d_1)$ and N(d2) in the Black-schols formula to calcualte the call option price.

     C_a = S_0 $N(d_1)$ – S_x $N(d_2)$ e^{-rT}

$$= (0.4383 \times 488.95) - \left[0.4112 \times \exp - \left(-0.12 \times \frac{28}{365}\right)\right] = INR\ 10.60$$

Thus, the price of the call option is INR 10.60.

14. **Assume that Tata Motors stock is currently selling for INR 750. There is a call option on Tata Motors with a maturity of 90 days and an exercise price of INR 800. The volatility in the stock price is estimated to be 22%. The risk-free rate is 8%. What will be the price of a call option that has a maturity of 90 days?**

Sol :

Given: S0 = INR 750; Sx = INR 800; r = 8% ; s = 22%; T = 90/365

Step 1: Calculate the values of d_1 and d_2.

$$d_1 = \frac{\ln\left(\frac{S_0}{S_x}\right) + \left(\frac{\sigma^2}{2} + r\right)T}{\sigma\sqrt{T}}$$

$$d_1 = \frac{\ln\left(\frac{750}{800}\right) + \left(\frac{0.22 \times 0.22}{2} + 0.08\right) \times \frac{90}{365}}{0.22 \times \left(\frac{90}{365}\right)^{1/2}}$$

$$d_1 = -0.3556$$

$$d_2 = d_1 - \sigma\sqrt{T} = -0.3556 - \left[0.22 \times \left(\frac{90}{365}\right)^{1/2}\right] = -0.4648.$$

Step 2: Find the values of $N(d_1)$ and $N(d_2)$. This can be done by using the Excel spreadsheet function that gives the cumulative normal distribution values.

$$N(d_1) = N(-0.3556) = 0.3611 \text{ and } N(d_2) = N(-0.4648) = 0.3210$$

Step 3: Use the values of $N(d_1)$ and $N(d_2)$ in the Rlack-Scholcs formula to calculate the call option price.

$$C_0 = S_0 N(d_1) - S_X N(d_2) e^{-rT}$$

$$= (0.3611 \times 750) - \left[0.3210 \times 800 \times \exp\left(-0.08 \times \frac{90}{365}\right)\right] = \text{INR } 19.00$$

Thus, the price of the call options is INR 19.00.

15. **The contract size of Bank of India options is 950. Bank of India shares are selling at INR 338 on September 1. Oil Options and put options are available with expiry on October 29 and with an exercise price of INR 350. It is estimated that the standard deviation of the stock price is 30%. Ihe risk free rate is 9%. By using the Black-Scholes options pricing model, calculate the put option price on September 1.**

Sol :

Given: S_0 = INR 338; S_X = INR 350; r = 9%; s = 30%; T= 58/365

Step 1: Calculate d_1 and d_2

This is calculated for call option pricing as:

$$d_1 = \frac{\ln\left(\frac{338}{350}\right) + \left(\frac{0.30 \times 0.30}{2} + 0.09\right) \times \frac{58}{365}}{0.09 \times \left(\frac{58}{365}\right)^{1/2}} = -0.11235$$

$$d_2 = -0.1551 - \left[0.25 \times \left(\frac{28}{365}\right)^{1/2}\right] = -0.23193.$$

Step 2:   Find the values of $N(d_1)$ and $N(d_2)$ as:

     $N(d_1) = 0.4553$ and $N(d_2) = 0.4083$

Thus:

     $N(-d_1) = 1 - 0.4533 = 0.5447$ and $N(-d_2) = 1 - 0.4083 = 0.5917$

Stpe 3:   Use the values of $N(-d_1)$ and $N(-d_2)$ in the Black-scholes formula to calculate the put option pirce.

$$P_0 = \left[\exp\left(-0.09 \times \frac{58}{365}\right) \times 350 \times 0.5917\right] - (0.5447 \times 338 = \text{INR } 25.96$$

Thus the price of the put is INR 25.96.

16.   **Consider the following data:**

     Stock price = ` 50

     Months to expiration = 3 months

     Risk-free rate of interest = 10% p.a

     Standard deviation of stock = 40%

     Exercise price= ` 55

     Option type = European call

     Calculate the value of call option as per Black - Schoies model.

Sol :

Given that,

Stock price, (5) = ` 50

Time-to-expiration (7) = 3 month = 0.25 (3/12)

Risk free rate (R) = 10%

Standard deviation (σ) = 40%

Exercise price (A) = ` 55

$$V = SN(d_1) - Ke^{-rt} N(d_2)$$

$$D = \frac{\ln\left(\dfrac{S}{K}\right) + [r + 0.5s^2]T}{\sigma\sqrt{x}}$$

$$= \frac{\ln\left(\dfrac{50}{55}\right) + [0.1 + 0.5(0.4)^2]0.25}{0.4\left(\sqrt{0.25}\right)}$$

$$= \frac{(-0.0953) + [0.045]}{0.2}$$

$$d_1 = -0.2515$$

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

$$= -0.2515 - 0.4(\sqrt{0.25}) = -0.4515$$

As per cumulative probabilities from the normal distribution table,

$$N(d_1) = jV[(-0.2515)$$

$$= N(-0.25) - 0.15 [N(-0.25) - N(-0.26)]$$

$$= 0.4013 - 0.15 (0.4013 - 0.3974)$$

$$= 0.401$$

$$N(d_2) = N(-0.4515)$$

$$= N(-0.45) - 0.15[A(-0.45) - N(-0.46)]$$

$$= 0.3264 - 0.15 (0.3264 - 0.3228)$$

$$= 0.326$$

Premium value of call option

$$V = SN(d_1) - Ke^{-rt} N(d_2)$$

$$= 50(0.401) - 55. \, e^{-0.1 \times 0.25} (0.326)$$

$$= 20.05 - 55 \times 0.975 \times 0.326$$

$$= 20.05 - 17.48$$

$$= 2.56$$

∴   The premium value of given option is ` 2.56.

17.   **Option ABS 500**

       Stock price = `120

       Call exercise price = `100

       Exercise date = 6 months

       Estimated standard deviation = 30%

Current market price = ` 28

Risk free return = 8% p.a

Calculate call option price of the stock as per Black-Scholes model.

Sol :

Given that,

     Stock price, S = `120

     Call exercise price, k = `100

     Exercise date, T = 6 months $= \dfrac{180}{365}$

     Estimated standard deviation, $\sigma = 30\%$

     Risk free return, r = 8% p.a

     Current market price = `28

$$V = SN(d_1) - ke^{-rt} N(d_2)$$

$$d_1 = \frac{\ln\left(\dfrac{S}{K}\right) + [r + 0.5\sigma^2]T}{\sigma\sqrt{T}}$$

$$= \frac{\ln\left(\dfrac{120}{100}\right) + [0.08 + 0.5(0.3)^2] \, 0.5}{0.3\sqrt{0.5}}$$

$$= \frac{0.1823 + 0.0625}{0.2121}$$

$$\therefore d_1 = 1.1542$$

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

$$= 1.1541 - 0.3\sqrt{0.5}$$

$$= 0.9420$$

The values of $N(d_1)$ and $N(d_2)$ according to cumulative probabilities for standard normal distribution,

$$N(d_1) = 0.8770$$

$$N(d_2) = 0.8289$$

Value of call option,

$$V = SN(d_1) - ke^{-rt} N(d_2)$$

$$= 120(0.870) - 100^{e-0.08 \times 0.5} (0.8289)$$

$$= 105.24 - 96.73$$

$$= `8.51$$

Short Question and Answers

1. Option contract

Ans :

Option contract is a derivative instrument under which a buyer gets the right to buy or sell and a seller undertakes an obligation to sell or buy a given quantity of the underlying asset at a given future date for a payment of Option Premium by the Buyer to the Seller.

An options contract is an agreement between two parties to facilitate a potential transaction on the underlying security at a preset price, referred to as the strike price, prior to the expiration date.

Option contracts are most commonly associated with the financial services industry, where a seller may option the opportunity to purchase stock at a certain price for a set period of time. By accepting a certain amount of money in exchange for this option, the seller has bargained away their right to revoke the offer. It's important to point out, however, that the party buying the option is under no obligation to actually exercise this option and purchase the stock, since he or she only bargained for the option to do so.

2. What are the differences between American and European Options.

Ans :

	American Option		European Option
1.	Options are exercised on or before the settlement date i.e., either today, tomorrow or at any trading day until the life of the contract. No specific expiration date.	1.	Options are exercised only on the settlement date but not on today, tomorrow or any trading day. Expiration date is specific.
2.	Majority of stock options opt for American options.	2.	European options are less frequently traded when compared to American option.
3.	The price of the option is usually high as it assumes high risk thereby charging high risk premium.	3.	The price of the option is low because it is less risky and charges less risk premium.
4.	Firm, as soon as it realises profits is liable to take delivery of the underlying asset on any day and hence can end the contract.	4.	Even though firm realises profits, is liable to take delivery of the underlying asset only on the expiration date.

3. What is Spread ?

Ans :

A spread can have several meanings in finance. Basically, however, they all refer to the difference between two prices, rates or yields.

The spread is the gap between the bid and the ask prices of a security or asset, like a stock, bond or commodity. This is known as a bid-ask spread.

A spread is defined as the sale of one or more futures contracts and the purchase of one or more offsetting futures contracts. A spread tracks the difference between the price of whatever it is you are long and whatever it is you are short. Therefore the risk changes from that of price fluctuation to that of the difference between the two sides of the spread.

Spread can also refer to the difference in a trading position – the gap between a short position (that is, selling) in one futures contract or currency and a long position (that is, buying) in another. This is officially known as a spread trade.

4. Bear Spread

Ans :

A bear spread is an option strategy that will profit when the price of the underlying security declines. The strategy involves the simultaneous purchase and sale of options, where either puts or calls can be used. A trader buying a put bear spread would purchase a put with a higher strike price while simultaneously selling a put with a lower strike price. Likewise, a trader can sell a call with a lower strike price and buy a call with a higher strike price. The options will often have the same expiration date. A bear spread is sometimes called a bear vertical spread, and is in contrast to a bull vertical spread.

Bear spreads can also involve ratios, such as buying one put to sell two or more puts at a lower strike price than the first. Because it is a spread strategy that pays off when the underlying declines, it will lose if the market rises - however, the loss will be capped at the premium paid for the spread.

5. Bull Spread

Ans :

A bull spread is a bullish, vertical spread options strategy designed to profit from a moderate rise in the price of the underlying security. It's comprised of the simultaneous purchase and sale of either call options or put options with different strike prices but with the same underlying asset and expiration date. Regardless of options type, the lower strike price is bought and the higher strike price is sold.

If the strategy uses call options, it is called a bull call spread. If it uses put options, it is called a bull put spread.

6. Exercise Price ?

Ans :

The term exercise price refers to the price at which an option contract's securities may be sold or purchased. If the call or put option is "in-the-money," the difference between the exercise price and the market price of the underlying security is the potential profit gained per share.

The exercise price is determined when the options contract is formed. The larger the difference between the current price of the underlying security and the exercise price, the greater the premium required to purchase the option (when first formed).

An **exercise price** is the price at which the holder of a call option has the right, but not the obligation, to purchase 100 shares of a particular underlying stock by the expiration date.

Individuals that invest in options pay close attention to the exercise price, since the difference between this price and the current market price of the underlying securities is what gives the option contract value. A contract that is in-the-money has real value to the investor; this can happen under two conditions:

➢ **Call Options** : if the strike price is below the current market price of the underlying security, the holder can exercise their option and purchase the security at a price that is below market.

➢ **Put Option** : if the strike price is above the current market price of the underlying security, the holder can exercise the option and sell the security at a price that is above market.

7. Kinds of Option Valuation

Ans :

In option market, the underlying assets are bought and sold at the exercise price or strike price. But it reality current market price may more or less or equal the strike price.

The following three situations may arises :

1. **In the Money :** If the current market price of the underlying asset exceeds the exercise price in case of a call option or if the current market price falls below the strike price in case of a put option, the option is said to be in the money.

2. **Out of Money :** If the current market price

of the underlying asset is less than the exercise price of a call option or if the current market price of underlying assets is more than the strike price in case of a put option, the option is said to be out of money.

3. **At the Money :** The at the money situation arises when the exercise price is equal to the current market price of the underlying asset.

8.   Binomial Options Pricing Model

Ans :

The binomial options pricing model is a tool for valuing stock options. Starting with certain given values, and making certain assumptions, the model uses a binomial distribution to calculate the price of an option. The binomial method is considered as accurate, if not more accurate, than the Black Scholes method of valuing options.

Calculating the value of an option using the binomial method requires certain givens and certain assumption. Start with the current price of the stock and the strike price of the option.

The necessary assumptions required for this method of options valuation include two possible stock prices for the end of the period as well as the probability for each of the two stock prices at the end of the period.

The Binomial model can be used to calculate the price for an option. The Binomial model is commonly used to valuate American options, which can be exercised upon any moment before the maturity date, because this method can take into consideration the possibility of pre-mature execution in its calculation. It has an advantage over the Black-Scholes method because the mathematical formula is relatively easy compared to Black-Scholes. Furthermore the calculations are more accurate because market developments can be inserted in the ongoing binomial model and thus the calculation will be more in sync with the actual market develoments. The higher accuracy of the Binomial model however comes at a price. This method is more time-consuming than the Black-Scholes method.

9.   Advantages of Binomial Option Pricing Model

Ans :

1. Binomial option pricing models are mathematically simple to use.

2. Binomial option pricing model is useful for valuing American options in which the option owner has the right to exercise the option any time up till expiration.

3. Binomial option model is also useful for pricing Bermudan options which can be exercised at various points during the life of the option.

4. Binomial option pricing model is very simple model that is used to price options. When to compared to Black Scholes model and other complex models.

5. This model is based on the concept of no arbitrage.

6. The model reduces possibilities of price changes and removes the possibility for arbitrage.

10.   Limitations of Black Scholes Model

Ans :

The Black–Scholes model disagrees with reality in a number of ways, some significant. It is widely used as a useful approximation, but proper use requires understanding its limitations – blindly following the model exposes the user to unexpected risk. Among the most significant limitations are:

1. The Black-Scholes Model assumes that the risk-free rate and the stock's volatility are constant.

2. The Black-Scholes Model assumes that stock prices are continuous and that large changes (such as those seen after a merger announcement) don't occur.

3. The Black-Scholes Model assumes a stock pays no dividends until after expiration.

4. Analysts can only estimate a stock's volatility instead of directly observing it, as they can for the other inputs.

5. The Black-Scholes Model tends to overvalue deep out-of-the-money calls and undervalue deep in-the-money calls.

6. The Black-Scholes Model tends to misprice options that involve high-dividend stocks.

Exercise Problems

1. Consider the following data:

    Stock price   =   Rs. 50
    Montsh to expiration   =   3 months
    Risk-free rate of interest   =   10% p.a.
    Standard deviation of stock   =   40%
    Exercise price   =   Rs. 55
    Option type   =   European call

    Calculate value of call option as per Black-Scholes model.

    [**Ans :** 2.56]

2. Current market price of :

		M	Y
Option	=	16.12	10.62
Stock	=	Rs. 80	Rs. 80
Exercise price	=	Rs. 70	Rs, 80
Time to expiration	=	3 months	3 months
Risk-free return	=	12% p.a.	12% p.a.
Expected dividend			
Standard deviation of			
Stock returns	=	60%	60%

    Calculate the option value for X and Y.

    [**Ans :** 10.62]

3. Option on ABC 500

    Stock price   =   Rs. 120
    Call exercise price   =   Rs. 100
    Exercise date   =   6 months
    Estimated standard deviation   =   30%
    Current market price   =   Rs. 28
    Risk-free return   =   8% p.a.,

    Calculate call option price of the stock as per black-Scholes model.

    [**Ans :** 25.56]

4. Consider a three month call option on ABC Company's stock with an exercise price of ` 45. If ABC is currently selling at `50 and the risk-free interest rate is 5%, what will be the price f the option? Apply the Black Scholes model to find call option value by assuming the standard deviation of the rate of retun of ABC stock to be 0.4.

    [**Ans :** 7.18]

5.1 SWAPS

Q1. What do you understand by swap? Explain its concept and nature in detail.

Ans : **(Imp.)**

Introduction to Swaps

The swap market today, takes place the most significant development in the global financial market. It has fundamental transformed the way in which corporate business world and the bankers look at funding choices. Swaps are frequently used by them to arrange complex and innovative financing which decrease borrowing costs and increase control over other financial variables. This market has gained popularity specifically after the demise of Bretton Woods System which caused to the instability in international funds movements.

Definition

A Swap is an a unique kind of a financial transaction which includes concurrent purchase and sale of,

(a) A underlying asset of similar kind.

(b) Obligation of equal capital amount, where the financial exchange system gives both the parties flexibility and transparency in dealing with each other.

(c) The amount is swapped for a certain number of times for a given period of time.

SWAP : Concept and Nature

The meanings of word 'Swap' or 'Swop' as per the Chamber Dictionary are to barter or to give

in exchange or to exchange one for another. So, in business world, swaps have been termed as private agreements between the two parties to exchange cash flows in the future according to a prearranged formula. In simple words, a swap is an agreement to exchange payments of two different kinds in the future. Since it involves exchange of cash flows or payments, hence, it is also called financial swap in global financial markets.

In the context of financial markets, the term 'swap' has two meanings. First, it is a purchase and simultaneous forward sale or vice versa. Second , it is defined as the agreed exchange of future cash flows, possibly, but not necessarily with a spot exchange of cash flows. The second definition of swap is most commonly used stating as an agreement to the future exchange of cash flows. These can be regard as series or portfolios of forward contracts. Such a currency swap is similar to a succession of forward foreign exchange contracts with relatively more distant maturity basis. The study of swap is, thus a natural extension of the study of forward and futures contracts.

Financial swap is a specific funding technique which permits a borrower to access one market and then exchange the liability for another type of liability. In other words, swaps can be helpful to change the nature of liability accrued on a particular instrument with the others. It means that swaps are not a funding instrument, rather just like a device to obtain the desired form of financing indirectly which otherwise might be in accessible or too expensive.

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5.2 EVOLUTION OF SWAP MARKET

Q2. Explain in detail about evolution of Swap market.

Ans :   (Imp.)

Like most other new products/instruments in the international finance, 'swaps' are not executed in a physical market. Participants and dealers in the swap markets are many and varied in their location, character, and motives in existing swaps. Most of the financial experts agree that the origin of the swap markets can be traced back to 1970s when many countries imposed foreign exchange regulations and restrictions in order to control cross-border capital flows. Some experts are of the opinion that swap markets owe their origin to the exchange rate instability that followed the demise of Bretton Wood System during the years 1971 to 1973. As a result, most of the borrowers and investors at the international level wishing to diversify their assets and liabilities compositions in varied currencies in order to control losses arising due to fluctuations in exchange rates.

In 1980s, a few countries liberalized their exchange regulatory measures; as a result, some of the MNCs' treasurers structured their portfolios and brought-out a new financial product, known as swaps. They replaced their existing contracts like parallel and back-to-back loans with the swap deals which found them more flexible and suitable due to simpler documentation and single jurisdiction. Further, swaps were found to lower financing cost and tax differences. Not only this, the disintermediation process of 1980s, most of the MNCs and other corporate borrowers were approaching to the investors directly rather than through banks, also encourage them to make financial arrangements through swaps.

The first swap contract was negotiated in 1981 between Deutsche Bank and an undisclosed counter party. Since then, the swaps market has grown very rapidly. In the early years, the bankers were only acting as brokers in the swap markets to match the complimentary requirements of the counterparties. The major dramatic change in the swap market has been the emergence of the large banks and performed as aggressive market-makers specifically in dollar interest rate swaps. As market-makers, they provide bid/offer quotes for both interest rate and currency swaps. Subsequently, the banks started to find-out a counterparty with exactly or nearly matching requirements to hedge the original swap by entering into a matching swap. Such swap warehousing or running mismatches offered two immediate benefits:

1. For the customer it was possible to cover an exposure almost as soon as the decision to do so; and

2. For the swap bank to quote the most competitive price to their clients in order to get maximum business from the clients.

The formation of the International Swap Dealers Association (ISDA) in 1984 was a significant development to speed-up the growth in the swaps market by standardizing swap documentation. In 1985, the ISDA published the first standardized swap code. This code was revised in 1986, and in 1987 published its Standard Form Agreements. These contracts are structured as master agreements. As such, all subsequent swaps entered by the same parties are treated as supplements to the original agreement.

A swap is essentially a way of changing risk in future, and the range of risks hedged through swap transactions is expanding day-by-day. For example, currency swaps were first introduced in late 1970s, and then interest rate swaps in 1981, equity and commodity swaps in mid-1980s and credit derivatives in 1990, were floated. Climatic derivatives have also been introduced recently, and further, a few new products have also being examined to include in this market.

Q3. Explain the features of swaps.

Ans :

The following are features of financial swaps:

(i) Counter parties: Financial swaps involve the agreement between two or more parties to exchange cash flows or the parties interested in exchanging the liabilities.

(ii) Facilitators: The amount of cash flow exchange between parties are huge and also the process is complex. Therefore, to facilitate

the transaction, an intermediary comes into picture which brings different parties together for big deal. These may be brokers whose objective is to initiate the counter parties to finalize the swap deal. While swap dealers are themselves counter partied who bear risk and provide portfolio management service.

(iii) Cashflows: The present values of future cash flows are estimated by the counterparties before entering into a contract. Both the parties want to get assurance of exchanging same financial liabilities before the swap deal.

(iv) Less documentation is required in case of swap deals because the deals are based on the needs of parties, therefore, less complex and less risk consuming.

(v) Transaction costs: Generating very less percentage is involved in swap agreement.

(vi) Benefit to both parties: The swap agreement will be attractive only when parties get benefits of these agreements.

(vii) Default-risk is higher in swaps than the option and futures because the parties may default the payment.

Q4. Explain the advantages of Swaps.

Ans :

The following advantages can be derived by a systematic use of swap:

1. Borrowing at Lower Cost

Swap facilitates borrowings at lower cost. It works on the principle of the theory of comparative cost as propounded by Ricardo. One borrower exchanges the comparative advantage possessed by him with the comparative advantage possessed by the other borrower. The net result is that both the parties are able to get funds at cheaper rates.

2. Access to New Financial Markets

Swap is used to have access to new financial markets for funds by exploring the comparative advantage possessed by the other party in that market. Thus, the comparative advantage possessed by parties is fully exploited through swap. Hence, funds can be obtained from the best possible source at cheaper rates.

3. Hedging of Risk

Swap cal also be used to hedge risk. For instance, a company has issued fixed rate bonds. It strongly feels that the interest rate will decline in future due to some changes in the economic scene. So, to get the benefit in future from the fall in interest rate, it has to exchange the fixed rate obligation with floating rate obligation. That is to say, the company has to enter into swap agreement with a counterparty, whereby, it has to receive fixed rate interest and pay floating rate interest. The net result is that the company will have to pay only floating rate of interest. The fixed rate it has to pay is compensated by the fixed rate it receives from the counterparty. Thus, risks due to fluctuations in interest rate can be overcome through swap agreements. Similar, agreements can be entered into for currencies also.

4. Tool to correct Asset-Liability Mismatch

Swap can be profitably used to manage asset-liability mismatch. For example, a bank has acquired a fixed rate bearing asset on the one hand and a floating rate of interest bearing liability on the other hand. In case the interest rate goes up, the bank would be much affected because with the increase in interest rate, the bank has to pay more interest.

5. Additional Income

By arranging swaps, financial intermediaries can earn additional income in the form of brokerage.

Q5. Explain briefly about the various types of swaps.

Ans :

The basic objective of a swap deal is to hedge the risk as desired by the counter parties. The major risks, which can be changed with the swap transactions, are relating to interest rate, currency,

commodity, equity, credit, climate and so on. Hence, in this section only important financial swaps, which are popular in financial markets, have been discussed.

    1.   Interest-Rate Swaps

    2.   Currency Swaps

    3.   Equity Swaps

    4.   Commodity Swaps

1.   Interest-Rate Swaps

An interest rate swap is a financial agreement between the two parties who wish to change, the interest payments or receipts in the same currency on assets or liabilities to a different basis. There is no exchange of principal amount in this swap. In other words, it is an exchange of interest payment for a specific maturity on a agreed upon notional amount. The term 'notional' refers to the theoretical principal underlying the swap. The principal amount applies only for the purpose of calculating the interest to be exchanged under an interest rate swap. Maturities range from a year to over 15 years, however, most transactions fall within two years to ten years period.

The simplest example of interest rate swap is to exchange of fixed for floating rate interest payments between two parties in the same currency. This is also known in the market as plain vanilla swap, exchange of borrowings coupon swap. It involves credit differentials between two borrowers in the fixed and floating debt markets which generate substantial cost savings for both the counter parties.

(i)   Plain vanila swap: It is also known as fixed-for-floating swap. In this swap, one party with a floating interest rate liability is exchanged with fixed rate liability. Usually swap period ranges from 2 years to over 15 years for a pre-determined notional principal amount. Most of deals occur within four years period.

(ii)   Zero coupon to floating: The holders of zero-coupon bonds get the full amount of loan and interest accrued at the maturity of the bond. Hence, in this swap, the fixed rate player makes a bullet payment at the end and floating rate player makes the periodic payment throughout the swap period.

(iii)   Alternative floating rate: In this type of swap, the floating reference can be switched to other alternatives as per the requirement of the counter party. These alternatives include three-month LIBOR, one-month commercial paper (which refers to the Federal Reserve release), T-Bill rate, etc. In other words, alternative floating interest rates are charged in order to meet the exposure of other party.

(iv)   Floating-to-floating: In this swap, one counter party pays one floating rate, say, LIBOR while the other counter party pays another, say, prime for a specified time period. These swap deals are mainly used by the non-US banks to manage their dollar exposure.

(v)   Forward swap: This swap involves an exchange of interest rate payment that does not begin until a specified future point in time. It is also kind of swap involving fixed for floating interest rate.

(vi)   Rate-capped swap: In this type of swap, there is exchange of fixed rate payments for floating rate payments, whereby the floating rate payments are capped. An upfront fee is paid by floating rate party to fixed rate party for the cap.

(vii)   Swaptions: Swaptions are combination of the features of two derivative instruments, i.e., option "and swap. Option interest rate swaps are referred as swaptions. The buyer of the swaption has the right to enter into an interest rate swap agreement by some specified date in the future. The swaption agree-ment will specify whether the buyer of the swaption will be a fixed rate receiver or a fixed rate payer. If the buyer exercises the option then the writer of the option will become the counter party.

(viii)   Swaption can be of two types: Call swaption or callable swap and put swaption or puttable swap. A callable swap provides the party making the fixed payments with the right to terminate the swap to its maturity. The writer, therefore, becomes the fixed rate receiver and floating rate payer. On the other hand, a puttable swap provides the party

making the floating rate payments with a right to terminate the swap. The writer of the put swaption, therefore, becomes the floating rate receiver and fixed rate payer.

(ix) Extendable swap: Extendable swap contains an extendable feature, which allows fixed for float-ing counter party to extend the swap period.

(x) Equity swap: The equity swap involves the exchange of interest payment linked to the change in the stock index. For example, an equity swap agreement may allow a company to swap a fixed interest rate of 6 percent in exchange for the rate of appreciation on a particular index, say, BSE or NSE Index, each year over the next four years.

2. Currency Swaps

A swap deal can also be arranged across currencies. It is an oldest technique in swap market. In this swap. The two payment streams being exchanged are denominated in two different currencies. For example, a firm which has borrowed Japanese yen at a fixed interest rate can 'swap away' the exchange rate risk by setting up a contract whereby it receives yen at a fixed rate in return for dollars at either a fixed or a floating interest rate.

The currency swap is, like interest rate swap, also two party transaction, involving two counter parties with different but complimentary needs being bought by a bank. In this swap, normally three basic steps are involved which are as under:

1. Initial exchange of principal amount

2. Ongoing exchange of interest

3. Re-exchange of principal amounts on maturity.

The first step in this swap is the initial exchange of the principal amounts at an agreed rate of exchange. This rate is usually based on the spot exchange rate. This initial exchange can be on a notional basis, i.e., no physical exchange of principal amounts. The counter parties simply convert principal amounts into the required currency-via-the spot market.

The second step is related with ongoing exchange of interest. After establishing the principal amounts, the counter parties exchange interest payment on agreed date based on the outstanding principal amounts at the fixed interest rates agreed at the outset of the transaction.

The third step is the re-exchange of principal to principal amounts. Agreement on this enables the counter parties to re-exchange the principal sums at the maturity date. These three steps have been shown through an example.

Example of currency swap: Assume that Firm A has a Swiss franc 100 million liability but interested to have a dollar loan instead. Also assume that another Firm B has a $100 million liability but prefers to have a Swiss franc liability instead. There can be a good solution through the currency swap deal and which can be arranged through a financial intermediary (an experienced bank) for a fee. A currency swap in this case can be seen from the following flowchart 11 three steps.

Step I Spot transaction: This spot transaction is carried out at the prevailing spot rate in the market.
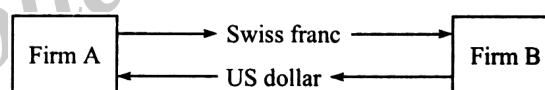

Fig.: Transaction Under Currency Swap

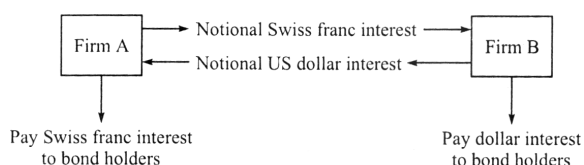**Step II** Settlement of Notional Annual Interest

Fig.: Transaction Under Currency Swap

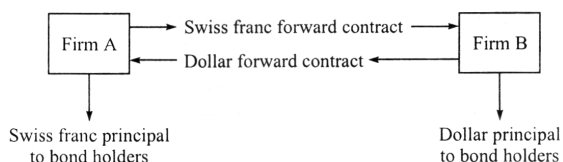## Step III Exchange of Final Contract

Fig.: Transaction Under Currency Swap

From the example, it is noted that exchange of principal amounts, both at the beginning and at the end of swap contract is notional and not real. However, then cash flows resulting from interest rates

are real. The benefits arising out of such swap to the counter parties depend upon the movements in underlying currency exchange rates and interest rates there on.

Types of Currency Swaps

The structure of currency swaps differs from interest rate swaps in a variety of ways. The major difference is that in a currency swap, there is always an exchange of principal amounts at maturity at a predetermined exchange rate. Thus, the swap contract, behaves like a long dated forward, is foreign exchange contract, where the forward is the current spot rate. The currency swaps can be of different types based on their term structure such as fixed-to-fixed currency swap, floating-to-floating currency swap, fixed-to-floating currency swap and so on. These have been discussed in brief.

i) **Fixed-to-fixed currency swap:** (In this category, the currencies are exchanged at fixed rate. This swap works like this. One firm raises a fixed rate liability in currency X, say US dollar ($) while the other firm raises fixed rate funding in currency Y, say, Pound (£). The principal amounts are equivalent at the current market rate of exchange. In swap deal, first party will get pound whereas the second party gets dollars. Subsequently, the first party will make periodic get (pound) payments to the second, in turn gets dollars computed at interest at a fixed rate on the respective principal amount of both currencies. At maturity, the dollar and pound principal are re-exchanged.

ii) **Floating-to-floating swap:** In this category, the counter parties will have payments at float-ing rate in different currencies.

iii) **Fixed-to-floating currency swap:** This swap is a combination of a fixed-to-fixed currency swap and floating swap. In this, one party makes the payment at a fixed rate in currency, say, X while the other party makes the payment at a floating rate in currency, say, Y. Contracts without the exchange and re-exchange of principals do exist. In most cases, a financial intermediary (a swap bank) structures the swaps deal and routes the payments from one party to other party.

The most important currencies in the currency swap market are the US dollar, the Swiss franc. The Deutsche mark, the ECU, the Sterling pound, the Canadian dollar and the Japanese yen. The currency swap is an important tool to manage currency exposures and cost benefits at the same time. These are often used to provide long term financing in foreign currencies. This function is important because in many foreign countries, long term capital and forward foreign exchange markets are notably absent or not well developed. However, if the international financial markets were fully developed from all the angles then the incentive to swap would be not so much due to availability of arbitrage opportunities.

3. **Equity Swaps**

These are also called as equity swaps. The parties dealing in equity swaps make payments and receive cash flows depending on the rate of return of a stock market index which is either fixed or floating. The equity swaps may be individually listed or included in a portfolio. It can happen that returns may turn to be negative, in that case the receiver has to face the loss. The equity swaps help in hedgingpttgainst the risk of change in the value of the portfolio.

4. **Commodity Swaps**

The parties in a swaps contract exchange cash flows depending on the prices or the value of commodities like crude oil and energy-related products like metals such as gold, silver and copper and agricultural products like wheat, grains and sugar.

These swaps are fixed-for-floating which depends only on one commodity. "One party pays an amount fixed rate in future and the other agrees to pay at floating rate. The principal amount is not swapped and the quality and quantity aspects should be completely standardized depending on locations.

Thus, in commodity swaps the parties at the receiving and paying end can set the prices for future dates.

5.3 INTEREST RATE SWAP

Q6.   Define interest rate swaps. Explain the features of interest rate swap.

Ans :   (May-19)

An interest rate swap is an agreement between two parties to exchange U.S dollar interest payments for a specific maturity on an agreed upon notional amount. The term 'notional' refers to the theoretical principal underlying the swap. Thus, the notional principal is simply a reference amount against which the interest is calculated. No principal ever changes hands. Maturities range from less than a year to more than 15 years, however, most transactions fall within a 2-year to 10-year period.

Interest rate swaps can be used to take on fresh interest rate risk as well as to manage existing interest rate risk.

Interest Rate swaps without offsetting underlying create interest rate risk. Each counter party in an interest rate swap is committed to pay a stream of interest payments and receive a different stream of interest payments. A payer of fixed interest rate payments is exposed to the risk of falling interest rates, while a payer of floating interest rate payments is exposed to the risk of rising interest rates. Similarly, a receiver of fixed interest rate payments is exposed to the risk of rising interest rates, while the receiver of floating interest payments is exposed to the risk of falling interest rates. In conclusion, interest rate swaps create an exposure to interest rate movements, if not offset by an underlying exposure.

Features of Interest Rate Swap

The key features of interest rate swaps are stated as follows :

1.   Notional principal

In the interest rate swap agreement, the interest amount whether fixed or floating is calculated on a specified amount borrowed or lent. It is notional because the parties do not exchange this amount at any time. Notionally, it remains constant throughout the life of the swap. It is used to compute the sequence of the payment of cash flows.

2.   Fixed Rate

This is the rate, which is used to calculate the size of the fixed payment. Banks or the other financial institutions who make market in interest rate swaps quote the fixed rate, they are willing to pay if they are fixed rate payers in a swap (bid swap rates), they are willing to receive if they are floating rate payers in a swap (ask swap rate). For example, a bank might quote a US dollar floating to fixed 5-year swap rate:

Treasuries + 20bp / Treasuries + 40bp.vs.six-month LIBOR.

This quote indicates the following:

i)   The said bank is willing to make fixed payment at a rate equal to the current yield on 5-year treasury notes plus 20 basis points (0.20 percent) in return for receiving floating payments, say at six-month LIBOR.

ii)   The bank has offered to accept at a rate equal to 5-year treasury notes plus 40 basis points in return for payment of six month LIBOR.

3.   Floating Rate

Floating rate may be defined as one of the market indexes like LIBOR, SIBOR, MIBOR. Treasury Bill rate, primary rate, etc. on which basis the floating interest rate is determined in the swap agreement. The maturity of the underlying index equals the interval between payment dates.

4.   Trade date, effective date, reset date and payment date

All the above stated dates are important terms in the swap deal. Therefore, the concept of these dates must be clear to the swap dealers. The fixed rate payments are normally paid semiannually or annually. For example, it may be March 1. September 1 etc.

The trade date may be defined as such date on which the swap deal is concluded. Effective date is that trade from which the first fixed and floating payment start to accrue.

Q7. Define the term LIBOR? Explain the Significance.

Ans :

LIBOR stands for London Inter Bank Offered Rate. LIBOR is the benchmark/reference for average interest rates – used by the A-Grade banks as "Offer" for lending their funds to the A-Grade banks as unsecured loans in marketable lot in London based interbank transactions.

➤ LIBOR rates used to be published since 1986 for the then three main currencies of the world, namely United States Dollar (USD), Great Britain Pound (GBP) and Japanese Yen (JPY) for four different maturity periods of one month, three months, six months and one year.

➤ After the merger of currencies of the European nations into Euro, on January 01, 1999, LIBOR rates started to be published for 10 major currencies of the world and for 15 different maturity periods ranging from overnight to 1 week, 2 weeks, and 12 different months. These 10 (Currencies) x 15 (Different Time Periods) = 150 rates used to be published daily at 11.30 A.M. London Time i.e. 5.00 P.M. (Indian Standard Time).

➤ The ten constituent currencies of LIBOR used to be USD, GBP, Euro, Swiss Franc, Canadian Dollar, JPY, Danish Krone, Swedish Krona, Australian Dollar and New Zealand Dollar. LIBOR used to be calculated and published by Thomas Reuters on behalf of British Bankers' Association.

Significance of LIBOR

➤ LIBOR is used by different A-Grade banks either for interbank lending of the surplus funds or for interbank borrowing for meeting their short term liquidity requirements.

➤ LIBOR has been in use as a reference/ benchmark rate by the financial institutions for deciding interest rates for the different financial instruments.

➤ The developed countries like Canada, U.K., U.S.A. and Switzerland rely on LIBOR as a reference/benchmark rate. LIBOR is also used by the well-known multinational commercial corporations.

Q8. Define the term MIBOR? Explain its Significance.

Ans :

MIBOR stands for Mumbai Interbank Offer Rate, the yardstick of the Indian call money market. It is the rate at which banks borrow unsecured funds from one another in the interbank market. At present, it is used as a reference rate for floating rate notes, corporate debentures, term deposits, interest rate swaps and forward rate agreements. The pricing of overnight indexed swaps, a type of overnight interest rate swap used for hedging interest rate risk is based on overnight MIBOR.

Based on the recommendation of the Committee for the Development of Debt Market, the National Stock Exchange (NSE) launched the Mumbai Interbank Offer Rate (MIBOR) and Mumbai Interbank Bid Rate (MIBID) in June, 1998. Subsequently, the NSE developed a benchmark rate for the term money market, like the 14-day, 1-month and 3-month MIBOR. The same was rechristened as FIMMDA-NSE MIBID/MIBOR rate in due course. The rate is computed by polling a representative panel of 30 banks and primary dealers and summarising the quotes that they provided. The next step involves identifying and isolating the noise by eliminating extreme values of the reference rates.

Significance of MIBOR

MIBOR is used by different Indian banks either for interbank lending of the surplus funds or for interbank borrowing for meeting their short term liquidity requirements.

MIBOR has been in use as a reference/ benchmark rate by the financial institutions for deciding interest rates for the different financial instruments like Interest Rate Swaps, Forward Rate Agreements, Floating Rate Debentures and Term Deposits, Loans of different maturities and mortgages, etc. MIBOR is also the benchmark for the Call Money Market Rates. But the volumes of MIBOR are quite meagre as compared with the volumes of LIBOR.

Q9. Explain the guidelines issued by RBI for Interest Rate Swaps.

Ans :

Salient Features of RBI Guidelines on IRS

1. Scheduled commercial banks (excluding Regional Rural Banks), Primary Dealers and all India Financial Institutions are free to undertake IRS as a product for their own balance sheet management for market making.

2. They may also offer these products to corporates for hedg-ing their own balance sheet exposures.

3. Participants should ensure adequate infrastructure and risk management systems before venturing into market making activities.

4. The Bench Mark rate should necessarily evolve on its own in the market and require market acceptance.

5. The parties are free to use any domestic money or debt market rate as benchmark rate provided the methodology of computing the rate is objective, transparent and mutually acceptable.

6. There is no restriction on the minimum or maximum size of notional principal amounts. Size norms are to emerge in the market with the development of the market.

7. There is no restriction on the tenor as well.

8. Banks, Financial Institutions and Primary Dealers are re-quired to maintain capital for FRAs and IRS.

9. Transactions for hedging and market making purposes should be recorded separately. Positions on account of market making activities should be marked to market at least at fortnightly intervals. Transactions entered into for hedging purposes should be accounted for on accrual basis.

10. Participants could consider using ISDA standard documen-tation with suitable modifications for transactions in FRAs and IRS.

11. Participants are required to report their operations in FRAs and IRS on a fortnightly basis to Monetary Policy Depart-ment of RBI.

12. Capital adequacy for banks and financial institutions for undertaking FRAs and IRS transactions shall be calculated.

Q10. Explain the mechanism of interest rate swaps using a diagram.

Ans :

The mechanism of interest rate swap can be understood through following example.

There are two firms X and F. Firm X is an institution which invests $ 50 million in fixed rate mortgages yielding 9.5 percent. It is assumed that firm X is not a high-rated firm and its assets can be funded by using floating rate loans for the banks i.e., charging one year LIBOR [London Inter Bank Offer Rate] plus 40 basis point [0.40 percent]]. This implies that the profitability of firm X is based on the actual level of the floating interest rate in future which is payable during long-run. Thus, when there is greater fluctuation in interest rates then, the debt service expenses of firm X will increase and accordingly, the profits also decreases. Thus, the firm may lose money if LIBOR is more than 9 percent [9.50 - 0.40] on any reset date.

Firm Y, is also another firm which also borrows $ 50 million for ten years but at a fixed rate. It is assumed that firm Y is high graded firm and is funding its loan portfolio at 7.50 percent coupon. The portfolio of firm Y is generating LIBOR plus 50 basis points. This implies that the profitability of firm ' T is based on the actual floating interest rate which is received on its portfolio. Firm F may lose money if LIBOR is less than 7 percent [7.50 - 0.50] on any reset date. This situation of firm X and F is illustrated below:
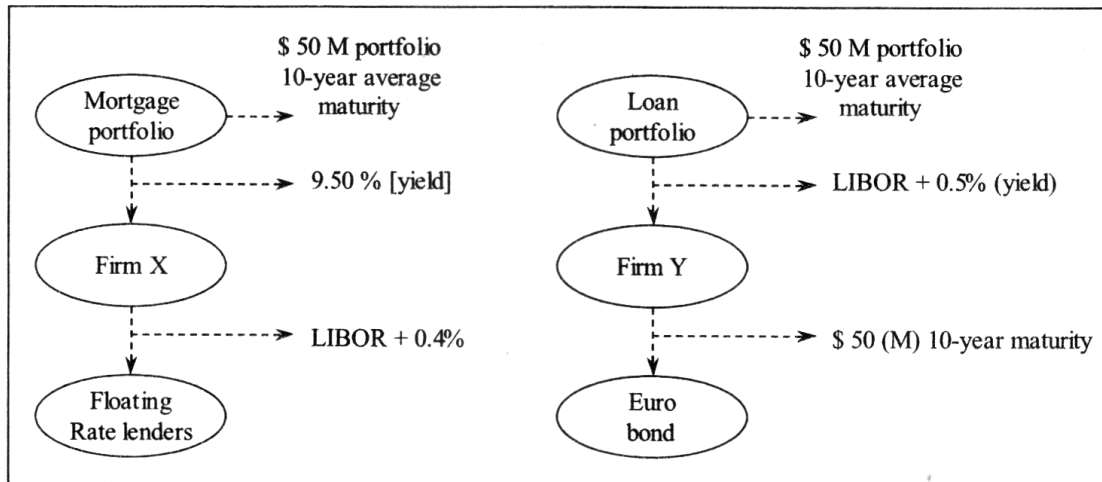

Fig.: Situation of Firm X and Y Before SWAPS

Firm X enter into interest rate swap deal with XYZ bank for removing the interest rate risk. It is assumed that firm X will pay 7.50 percent to XYZ bank for ten years with payments computed by multiplying that rate by $ 50 million notional principal amount. XYZ bank in return for this payment may agree to pay the firm X one-year LIBOR for ten years with reset dates tallying with the resets on its floating rate loan. This is represented in the figure given below.
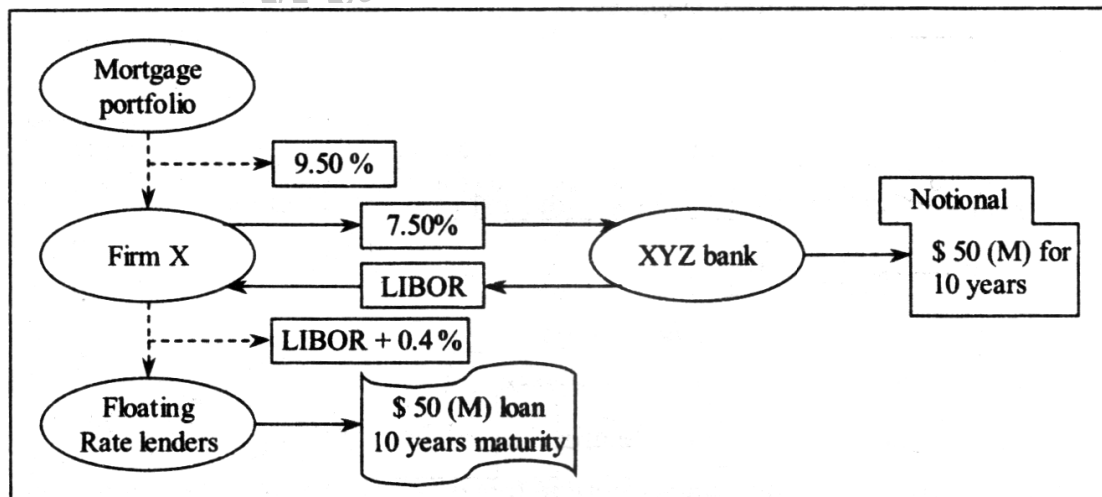

Fig.: FIRM: X Interest Rate Swap Agreement with XYZ Bank

Receipt on portfolio	→ 9.50%
Pay XYZ bank	→ 7.50%
Receiving from XYZ bank	→ LIBOR

Pay on loan	→ [LIBOR + 40 bp]
Cost of fund	→ [7.50 + 50] → 8.00 %
Locked in spread	→ 1.50 %

In the same manner, firm Y also enters into portfolio with XYZ bank and agrees to pay one year LIBOR to XYZ bank on a notional principal amount of $ 50 (M) for ten years in exchange to receive the payments of 7.40 percent. The net outcome to firm Y and swap deal is illustrated below,
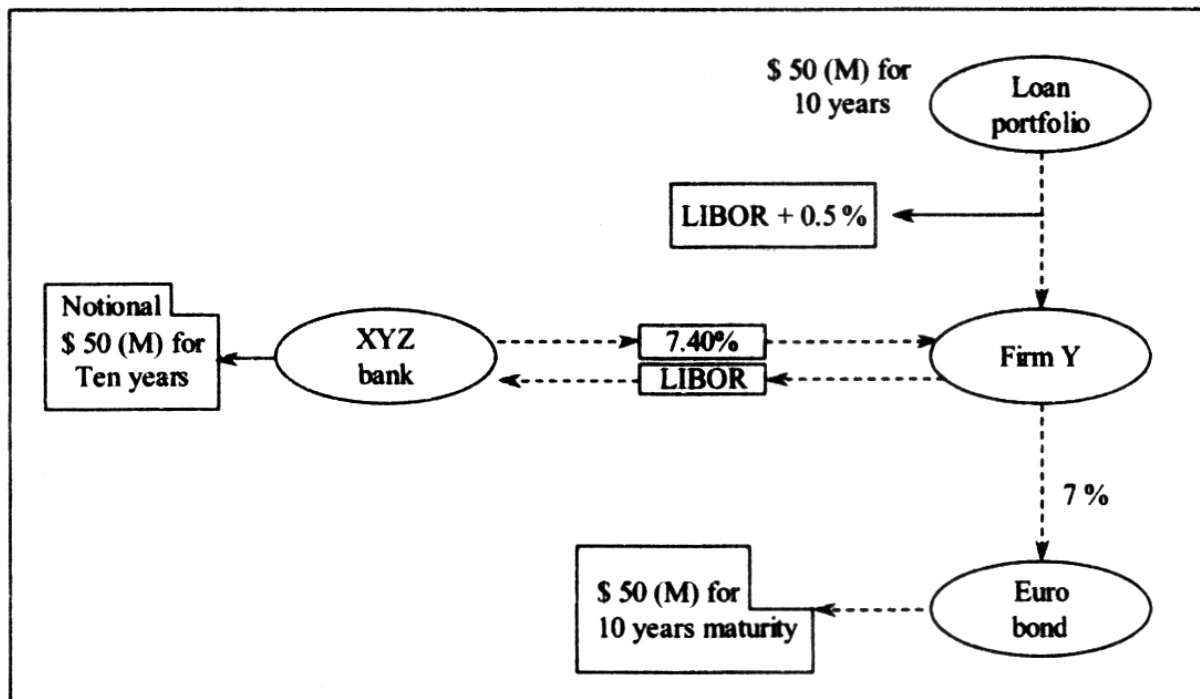

Fig.: Firm T Interest Rate Swap with XYZ Bank

The net result to firm 'F is as follows,

Receipt on portfolio	→	LIBOR + 0.5%
Pay XYZ bank	→	LIBOR
Received from XYZ bank	→	7.40 %
Pay on Euro bond	→	7.00%
Cost of funds	→	{LIBOR - 0.30 %}
Locked in spread	→	0.50 + 0.30 → 0.80 %

Firm Y's cost of funds has been minimized to LIBOR less 30 basis points and as a result, firm T has been locked in spread on its portfolio of 80 basis points.

It is necessary to evaluate the total interest of XYZ bank, who is a financial intermediary in the swap deal where the risk of loss due to interest rate fluctuations has been shifted from the counter party to XYZ bank. As a result, XYZ bank is now interested to enter into the deals with firm X and Y if it is beneficial for the bank. XYZ bank being an intermediary places together both the transactions and ultimate risk net out is left with a speed of 10 basis points. This is represented in the diagram given below.
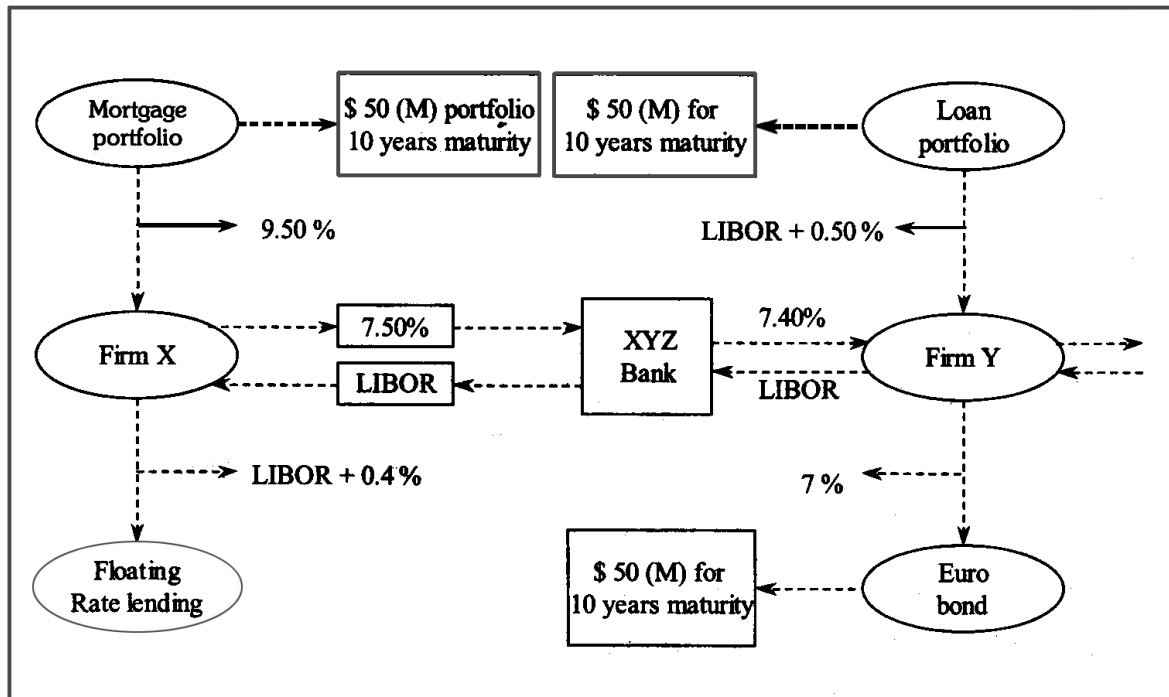
Fig.: Swap Structure

Receive	$\rightarrow$ 7.50 %
Pay	$\rightarrow$ 7.40 %
Receive	$\rightarrow$ LIBOR
Pay	$\rightarrow$ LIBOR
Net	$\rightarrow$ [7.50 – 7.40] $\rightarrow$ 10 basis points

Hence, XYZ bank will receive compensation equal to $ 1 lac annually for the next ten years on $ 50 million swap deal.

Q11. How interest rates swaps can be done through LIBOR.

Ans :

The "plain vanilla" interest rate swap is one of the most commonly existing swap. A company agrees to pay interest at a fixed rate and receives interest at a floating rate on the notional principal for a specified number of years.

LIBOR

The London Inter Back Offered Rate (LIBOR) is the rate of interest at which banks are prepared to deposit money in the Euro currency market. LIBOR is considered as a floating rate in most of the interest rate swap agreements. All major currencies quote either 1-month, 3-month, 6-month and 12-month LIBOR.

Prime serves as the reference interest rate for floating-rate loans in the domestic financial market, similarly LIBOR serves as the reference interest rate for floating-rate loans in the international market. The following example helps in understanding how the LIBOR is used.

Suppose a 2-year swap agreement has been signed between Toshiba and Sony, on January 2011. As per the agreement Toshiba agrees to pay Sony at a fixed interest rate of 10% per annum on a sum of money ` 10 lakhs and Sony agrees to pay Toshiba at 6-month LIBOR rate on ` 10 lakh, in return. The exchange is to take place every half-yearly. Therefore, the first exchange takes place in the month of June. Toshiba would pay Sony sum of ` 1 lakh at the rate of 10% on 10 lakh and Sony pays at the 6-month LIBOR rate on 10 lakh. Suppose the LIBOR rate is 9.5%, than Sony pays only ` 95,000 to Toshiba. Therefore, Toshiba only pays Sony the sum of ` 5,000 (1,00,000 - 95,000) as per the swap agreement. The next three payments also take place in the similar manner.

Using the Swap to Transform a Liability

The swap can be used by Toshiba for transforming the floating-rate loan into a fixed-rate loan. Suppose, Toshiba has arranged to borrow ? 10 lakh at LIBOR plus 0.1% from outsiders. Once the swap contract has been entered into, Toshiba has the following sets of cash flows,

(a)   Pays LIBOR plus 0.1 % to outsiders.

(b)   Receives LIBOR as per the terms of swap.

(c)   Pays at 10% as per the swap terms.

These sets result in fixed outflow of cash at 10.1%. This transforms Toshiba's borrowings from floating rate of LIBOR + 0.1% into fixed rate of 10.1%.

Similarly, for Sony the fixed-rate load is transformed into floating rate loan. Suppose Sony has a loan of ` 10 lakh outstanding and payable within 2-years @ of 10.2%. After the swap contract has been entered into the following sets of cash flows are available for Sony,

(a)   Pays 10.2% to the outsiders.

(b)   Pays LIBOR as per the swap terms.

(c)   Receives 5% under the swap.

These sets ensure the outflow of cash at LIBOR plus 0.2%. Therefore, Sony transformed its borrowing from fixed 10.2% into floating rate of LIBOR plus 0.2%.

Using the Swap to Transform an Asset

Swaps are also used for transforming the nature of assets. According to our example, Toshiba can use the swap to convert an asset earning fixed rate of interest into an asset earning floating rate of interest. Suppose, Toshiba holds bonds of ` 10 lakh that provide a return of 9.7% per annum for next 2-years. After entering into a swap contract. The following sets of cash flows are available,

(a)   Receives interest at 9.7% on the bonds.

(b)   Receives LIBOR as per the swap terms.

(c)   Pay at 10% as per the swap terms.

Therefore, the swap transforms an asset earning 9.7% into an asset earning LIBOR-0.3%.

Similarly for Sony, an asset earning fixed rate of interest is transformed into an asset earning floating rate of return. Suppose, Sony holds an investment of ` 10 lakh which gives to return of LIBOR-0.2%. Once it has entered into swap contract the following sets of cash flows take place,

(a)   Receives return on investment at LIBOR-0.2%.

(b)   Pays LIBOR as per the swap terms.

(c)   Receives 5% return as per the swap terms.

Therefore, the swap transforms an asset earning LIBOR-0.2% into an asset earning 9.8% return.

Market Makers

Since many companies like to take on opposite positions in the same swap, large financial institutions therefore act as market makers for swaps. These market makers calculate and hedge the risks that is involved and being taken. The swap market makers use instruments such as bonds, forward rate agreements and interest rate futures for hedging.

Day Count Issues

The payment of swaps is also affected by the day count issues. The following example helps in understanding the affect of day count issues on swap payments.

Suppose a six months LIBOR is quoted on the basis of 360 days in a year. The payment on ` 10 lakh when the LIBOR is 9.7% and payment is semiannually will be,

$$10,00,000 \times 0.097 \times \frac{182}{360} = \text{`} 49,038.8$$

$$\cong 49,039$$

Generally, floating rate cash flow on a LIBOR is calculated by PRn/360.

Where

P = Principal

R = Relevant LIBOR rate

n = No. of days since last payment.

The fixed rate specified on the swap transaction is based on number of days and will not be equal for each payment date. The fixed rate is quoted on actual/365 or 30/360 basis. The fixed rate is applied for the complete year and is not comparable with the LIBOR. To compare the two rates either LIBOR rate is multiplied by 365/360 or the fixed rate is multiplied by 360/365.

PROBLEM

Fixed-Floating Interest Rate SWAP

1. **A ` 10 lakhs interest rate swap has a remaining life of 10 months. Under the swap terms, six-months LIBOR is exchanged for 5% per annum (compounded annually). The average of the bid-offer rate being exchanged for six-month LIBOR in swaps of all maturities is 3% per annum. With continuous compounding. The six month LIBOR rate was 2.6% per annum two months ago. What is the current value of the swap to the party paying floating? What is the value to the party paying fixed ?**

Sol :

Amount to be received in four months = $(0.5 \times 0.05 \times 10,00,000) = \text{`} 25,000$

Amount to be paid in four months = $(0.5 \times 0.026 \times 10,00,000) = \text{`} 13,000$

∴   The value of he fixed-rate bond is :

$$25,000 \, e^{-0.03 \times 4/12} + 10,25,000 \, e^{-0.03 \times 10/12} = \text{`} 10,24,444$$

The value of floating-rate bond is

$$(10,00,000 + 13,000) \, e^{-0.03 \times 4/12} = \text{`} 10,02,920.48$$

Value of swap for party paying floating rate = ` 10,24,444 – ` 10,02,920.50

$$= \text{`} 21,523.5$$

Value of swap for party paying fixed rate = ` (–) 21,523.5

The results can also be derived by breaking down the swap into forward contracts. The first contract involves paying ` 13,000 and receiving ` 25,000 in four months.

∴   The value = $(25,000 - 13,000) \, e^{-0.03 \times 4/12}$

$$= \text{`} 11,880.59$$

$$= \text{`} 11,881$$

To value the second forward contract the forward contract the forward rate is 5%.

$\therefore$ The value of the forward contract is

$$10,00,000 \times (0.05 \times 0.5 - 0.03 \times 0.5) \, e^{-0.03 \times 10/12}$$

$$= ` \, 9,753.1$$

$\therefore$ Total value of the forward contract   = ` 11881 + ` 9753.1

$$= ` \, 21,634.1$$

5.3.1 Pricing and Valuing of Interest Rate Swaps

Q12. Discuss how interest rate swaps are priced at the time of origination.

Ans :

In a plain vanilla swap, which is a fixed-for-floating interest rate swap, one of the party in the swaps contract promises to make fixed payments to the other party and the other party pays a floating rate payment to that party. The objective of swap pricing is to identify the fixed interest rate that is equal to present value of fixed payments to the present value (P.V) of variable income. If a swap is correctly priced then it carries 'zero value'.

Determining the present value of the fixed payment requires the present annuity value for a year, this is not as difficult as the fixed payments which are known immediately the swap price is agreed. But only one cash flow is known in case of floating cash inflows, with this the succeeding cash flows have to be found. These cash flows have to be either estimated, either accurately or set out nearly equal to that agreed by the swap dealer in case if the swap is hedged.

An Example of Fixed-floating Interest Rate Swap Pricing at Market

Many swap dealers make use of forward rate agreement prices, future prices and spot zero coupon interest rates to set swap prices. The steps taken to decide the swap prices are

1.   Determine the present value (%) of the floating-rate cash flows for, say three years, that can be 3%, 5% and 7% respectively.

(0, 1) = 3%

(0, 2) = 5%

(0, 3) = 7%

Forward rates for three years can be calculated as,

r(0, 1) = 3%, r(0, 2) = 5%, r(0, 3) = 7%.

i)   One year forward rate, one year hence, can be calculated to be,

$$[1 + r(0, 2)]^2 = [1 + r(0, l)^1] \; [1 + fr(1, 2)]$$

$\Rightarrow$ $$(1 + 0.05)^2 = [1 + (0.03)^1] \; [1 + fr(1, 2)]$$

$\Rightarrow$ $$(1.05)^2 = [1.03] \; [1 + fr(1, 2)]$$

$$\frac{(1.05)^2}{1.03} = 1 + fr \, (1, 2)$$

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$$\Rightarrow \qquad \frac{1.1025}{1.03} = 1 + fr\,(1,\,2)$$

$$\Rightarrow \qquad 1.070 - 1 = fr\,(1,\,2)$$

$$0.07038 = fr\,(1,\,2)$$

ii)   One year forward rate, two years hence,

$$fr(2,\,3) = (1 + 0.07)^3$$

$$= [1 + 0.05]^2 \; [1 + fr(2,\,3)]$$

$$\Rightarrow \quad (1.07)^3 = (1.05)^2 \; [1 + fr(2,\,3)]$$

$$\frac{(1.07)^3}{(1.05)^2} = 1 + fr\,(2,\,3)$$

$$\Rightarrow \frac{1.225043}{1.1025} = 1 + fr\,(2,\,3)$$

$$\Rightarrow \qquad 1.111 = 1 + fr\,(2,\,3)$$

$$\Rightarrow 1.111 - 1 = fr\,(2,\,3)$$

$$fr\,(2,\,3) = 0.111$$

Use forward rates to find the floating amounts to be swapped,

$$C_{F_1} = 0.03 \times 100 \;\text{(Notinal price)}$$

$$= 3$$

$$C_{F_2} = 0.07038 \times 100 \Rightarrow 7.038$$

$$C_{F_3} = 0.111 \times 100 = 11.1$$

Calculate the amount of floating cash flows at a certain discount rates or the spot zero coupon interest rates can be determined as

$$= \frac{3}{(1.03)^1} + \frac{7.038}{(1.05)^2} + \frac{11.1}{(1.07)^3}$$

$$= 2.913 + 6.384 + 9.061$$

$$= 18.358$$

Identify a fixed rate that equals the present value of the fixed payments to the fixed receivables i.e.,

$$18.358 = \frac{A}{(1.03)^1} + \frac{A}{(1.05)^2} + \frac{A}{(1.07)^3}$$

$$18.358 = A \left[\frac{1}{(1.03)^1} + \frac{1}{(1.05)^2} + \frac{1}{(1.07)^3} \right]$$

$$18.358 = A\,[0.971 + 0.907 + 0.816]$$

$$18.358 = A[2.694]$$

$$\frac{18.358}{2.694} = A$$

$$A = 6.814$$

Thus, to make profit from a swaps contract, the swap dealer must quote a price below 6.814 to the fixed party receiver and above 6.814 to the fixed pay party.

Pricing Interest Rate Swaps at Origination of Contract

The pricing of market fixed for floating interest rate swaps states that the value of a floating rate debenture is closely equal to its original value, as the further cash flows are priced at a current market interest rates to reflect the changes in the interest rates. This can be better explained using an easy example.

Suppose, a two year floating rate debenture pays an annual interest. The dollar floating rate is paid for one year. So, the price is set on today's one year rate. In the same way the money is paid two year. The value is calculated as one year rate which is not yet known. Suppose a bond with face value $ 100 with rates $r(0,\,1)$ = 3% and for $(1,\,2)$ = 8% then the value of the bond is calculated as,

$$\frac{3}{1.03} + \frac{108}{(1.03)\,(1.08)} = 100$$

$$2.913 + 97.087 = 100$$

Suppose, the interest rates change say $r(0,\,1)$ = 5% and $fr(1,\,2)$ = 6.5% then, the value of the bond is the same.

$$\Rightarrow \quad \frac{5}{1.05} + \frac{106.5}{(1.05)\,(1.065)}$$

$$= 4.762 + 95.24 \cong 100$$

Thus, it can be known that the value of a floating rate bond will be exactly equal to its original par value. Due to this, the difficulty faced in pricing of swap is limited to finding the fixed payment. That equals the value of a fixed- coupon bond to its par value. The discount rates are the spot rates based on the zero-coupon bonds.

Coming back to the first example. The problem is to calculate the value of A which makes the value of the fixed cash flows based on coupon bond equal to 100.

$$100 = \frac{A}{(1.03)^1} + \frac{A}{(1.05)^2} + \frac{A}{(1.065)^3} + \frac{100}{(1.065)^3}$$

$$100 = A\left[\frac{1}{(1.03)^1} + \frac{1}{(1.05)^2} + \frac{1}{(1.065)^3}\right] + \frac{100}{1.208}$$

$$100 = A[0.971 + 0.907 + 0.828] + 82.78$$

$$100 = A[2.706] + 82.78$$

$$100 - 82.78 = A[2.706]$$

$$17.22 = A[2.706]$$

$$A = 6.36\%$$

Conclusion

Thus, the fixed rate of interest that should be set for the swap is 7% which is found to be almost same both in the beginning and at the end of the contract.

$$[r(0, l)]^2 = r(0, 2) [1 + f(1, 2)]$$

$$\Rightarrow (1 + 0.03)^2 = 0.04 [1 + f(1, 2)]$$

$$\Rightarrow (1.03)^2.$$

Q13. Explain how an interest rate swap is valued after origination.

Ans :

The interest rates will actually change after the swap contract has been originated; this will also change the value of the swaps.

Importance of Valuing Swaps after Origination

1.   To understand the current financial position of the firms.

2.   To find the default risk that can arise in future and if the firm employs swap as its asset, then they will become more worried about the risk associated with the counter parties.

3.   As most of the swaps are priced at market rates, it becomes necessary to value swaps after origination. There are two methods for valuing an interest rate swap after origination.

Method 1

(a) Identify the present value of the left over fixed cash payments and the present value of the left over expected floating receipts.

Where,

$$r(0, 1) = 3\%$$

$$(0, 2) = 5\%$$

$$r(0, 3) = 7\%$$

$$r(0, 4) = 8\%$$

$$1.08^4 = 1.07^3 \, [1 + fr(3, 4)]$$

$$\Rightarrow \quad 1.360 = 1.225 \, [1 + fr(3, 4)]$$

$$1.110 = 1 + fr \, (3, 4)$$

$$1.110 - I = fr \, (3, 4)$$

$$0.11 = fr \, (3, 4)$$

$$\Rightarrow \quad 100 = \frac{A}{1.03} + \frac{A}{1.05^2} + \frac{A}{1.07^3} + \frac{A}{1.08^4} = \frac{100}{1.08^4}$$

$$100 = A \left[\frac{1}{0.03} + \frac{1}{(1.05)^2} + \frac{1}{(1.07)^3} + \frac{1}{(1.08)^4} \right] + 73.503$$

$$26.497 = A[0.791 + 0.907 + 0.816 + 0.735]$$

$$26.497 = A \, [3.4282]$$

$$A = 7.72\% \text{ or } 0.0772$$

The annual fixed payments are

Coupon interest rate $= (0.0772 \times \$ \, 20,000,000)$

$$= \$ \, 15,44,000$$

The present value is calculated as

$$\Rightarrow \quad \frac{15,44,000}{1.035} + \frac{15,44,000}{1.04^2} + \frac{15,44,000}{1.05^3}$$

$$= 14,91,787.44 + 14,27,514.793 + 13,33,765.252$$

$$= \$ \, 42,53,067.485$$

The present value of expected leftover floating payment is determined by using forward rates.

$$\Rightarrow \quad 1.04^2 = 1.035 \, [1 + r(1, 2)]$$

$$\frac{1.04 \times 1.04}{1.035} = 1 + r(1, 2)$$

$\Rightarrow$ $1.045 - 1 = r(I, 2)$

       $fr(1, 2) = 0.045024$

       $1.05^3 = 1.04^2 [1 + r(2, 3)]$

$$\frac{1.05^3}{1.04^2} - 1 = r(2, 3)$$

$$\frac{1.157625}{1.0816} - 1 = r(2, 3)$$

       $1.07028 - 1 = r(2, 3)$

       $fr(2, 3) = 0.07028$

$\therefore$ The P.V. of the expected floating receipts is

$\Rightarrow$ $\dfrac{(0.035)\ (\$\ 20,000,000)}{1.035} + \dfrac{(0.045024)\ (\$20,000,000)}{1.04^2} + \dfrac{(0.07028)\ (\$\ 20,000,000)}{1.05^3}$

$\Rightarrow$ $6,76,328.504 + 8,32,544.3787 + 12,14,210.129$

$\Rightarrow$ $27,23,083.01$

(b)   The difference between both i.e., P.V of payments and P.V of receipts is the value of the swap.

     $\Rightarrow$ P.V of receipts – P.V of payments

     $\Rightarrow$ $2723083.01 - 4253067.485$

     $\Rightarrow$ (1529984.475)

The negative figure' means there is a liability for the paying party and it is a profit for the receiving party.

Method 2

In the second method, the swap market-maker quotes a price at a fixed rate for a maturity period of three years, this price is set after a year of origination of swaps contract. This price is then exchanged for one year LIBOR. The amount of difference between face value of swaps fixed payments and the current fixed payments is equal to the original value of the swap.

The new price is calculated as,

$$100 = \frac{A}{1.035} + \frac{A}{1.04^2} + \frac{A}{1.05^3} + \frac{100}{1.05^3}$$

$$100 = A\left[\frac{1}{1.035} + \frac{1}{1.04^2} + \frac{1}{1.05^3}\right] + \frac{100}{1.157625}$$

$$100 = A\ [0.966 + 0.924 + 0.863] + 86.38$$

$$100 = A[2.753] + 86.38$$

$$100 - 86.38 = A(2.753)$$

$$13.62 = A(2.753)$$

$$\Rightarrow \quad A = \frac{13.62}{2.753} = 4.947$$

The new swap then would be = P.V × New swap price

$\Rightarrow$ $0.04947 \times \$ 20,000,000 = 9,89,400$

Thus, the difference between the old swaps value of fixed payment and the new value os,

$\Rightarrow$ $13,08,000 - 9,89,400$

$\Rightarrow$ \$ 3,18,600 per year

$$= \frac{\$ 3,18,600}{(1.035)} + \frac{\$ 3,18,600}{(1.04)^2} + \frac{\$ 3,18,600}{(1.05)^2}$$

$$= 3,07,826.087 + 2,94,563.6095 + 2,75,218.6589$$

$$= \$ 8,77,608.354$$

Pricing of fixed to fixed currency swap.

Maturity	Three Years
Principal	$10 million
Currency	Pounds
Fixed dollar rate	8%
Fixed pound rate	To be determined
Day count method	30/360
Exchange rate	$0.50/£

Year to Maturity	U.S $	Great Britain
0.5	0.045	0.060
1.0	0.055	0.062
1.5	0.062	0.060
2.0	0.065	0.058
2.5	0.067	0.058
3.0	0.068	0.058

<u>P</u><u>ROBLEM</u>

2. **The spot term structure on August 3,2000 is,**

    One-year rate = 9.5%

    Two-year rate = 9.0%

    Three-year rate = 8.75%

    Four-year rate = 8.60%

    (a) Find the price of a four-year swap with a national principal of $25 Million. The floating rate is one-year LIBOR. Payments are annual.

(b) Suppose that one year after the swap in part (a) was originated, the spot term structure has changed to,

One-year rate = 6%

Two-year rate = 7.3%

Three-year rate = 7.8%

Four-year rate = 8.1%

What is the value of the swap for the receive fixed counterparty?

Sol :

(a) Given

$(0.1) = 9.5\%$ $r(0, 2) = 9.0\%$ $r(0, 3) = 8.75\%$ $r(0, 4) = 8.60\%$

1st Step

Calculation of forward rates,

$$(r_2)^2 = r_1[1 + r(1, 2)]$$

$$r(1, 2): (1.09)^2 = (1.095)[1 + r(1, 2)]$$

$$1.188 = (1.095)[1 + r(1, 2)]$$

$$\frac{1.188}{1.095} - 1 = r(1, 2)$$

$$r(1, 2) = 0.085$$

r(2, 3)

$$(r_3)^3 = (r_2)^2 [1 + r(2, 3)]$$

$$(1.0875)^3 = (1.09)^2 [1 + r(2, 3)]$$

$$\frac{1.286}{1.188} - 1 = r(2, 3)$$

$$r(2, 3) = 0.082$$

r(3, 4)

$$(r_4)^4 = (r_3)^3 [1 + r(3, 4)]$$

$$(1.086)^4 = (1.0875)^3 [1 + r(3, 4)]$$

2nd Step

Calculation of cash flows:

∴ Cash flows are as follows,

$$CF_1 = 0.095 \times 25 = 2.375$$

$$CF_2 = 0.085 \times 25 = 2.125$$

$$CF_3 = 0.082 \times 25 = 2.05$$

$$CF_4 = 0.082 \times 25 = 2.05$$

3rd Step

Valuation of cash flows at appropriate discount rates,

$$\frac{2.375}{1.095} + \frac{2.125}{1.09^2} + \frac{2.05}{1.0875^3} + \frac{2.05}{1.086^4}$$

$$= 2.169 + 1.789 + 1.594 + 1.474$$

$$= 7.026$$

4th Step

Calculating the fixed rate payments,

$$7.026 = \frac{A}{1.095} + \frac{A}{1.09^2} + \frac{A}{1.0875^3} + \frac{A}{1.086^4}$$

$$7.026 = A\left[\frac{1}{1.095} + \frac{1}{1.09^2} + \frac{1}{1.0875^3} + \frac{1}{1.086^4}\right]$$

$$7.026 = A\,(0.913 + 0.842 + 0.778 + 0.719)$$

$$A = \frac{7.026}{3.252}$$

$$= 2.161 \text{ or } 0.02161$$

∴   The swap market maker may quote price of 2.00% to fixed-rate receiver and 2.36% to a fixed rate-payer, so : as to make profit. Therefore, the swap spreads are 16/20 respectively.

(b)   The Structure Changed

The annual fixed payments are,

$$(0.02161) \times (2,50,00,000) = \$ 5,40,250$$

Calculation of fixed values:

$$\frac{540250}{1.06} + \frac{540250}{1.073^2} + \frac{540250}{1.078^3} + \frac{540250}{1.081^4}$$

$$= 5,09,670 + 4,69,374 + 4,31,165 + 3,95,498$$

$$= \$ 18,05,707$$

Calculation of floating values:

Given rate

$$r(0, 1) = 6\%$$

$$r(0, 2) = 7.3\%$$

$$r(0, 3) = 7.8\%$$

$$r(0, 4) = 8.1\%$$

r(1, 2)

$(1.073)^2 = 1.06 [1 + r(l, 2)]$

$\dfrac{1.151}{1.06} - 1 = r(1, 2)$

$r(1, 2) = 0.0858$

r(2, 3)

$(1.078)^3 = (1.073)^2 [1 + r(2, 3)]$

$\dfrac{1.253}{1.151} - 1 = r(2, 3)$

$r(2, 3) = 0.0886$

r(3, 4)

$(1.081)^4 = (1.078)^3 [1 + r(3, 4)]$

$\dfrac{1.366}{1.253} - 1 = r(3, 4)$

$r(3, 4) = 0.0902$

∴   Present value of expected floating receipts

$$\dfrac{(0.06)\,(\$25000000)}{1.06} + \dfrac{(0.0858)\,(\$25000000)}{1.073^2}$$

$$+ \dfrac{(0.0886)\,(\$25000000)}{1.078^2} + \dfrac{(0.0902)\,(\$25000000)}{1.0814}$$

$= 1415094.33 + 1863596.87 + 17,67, 757.38$

$= 66,97,253.85 \simeq 66,97,554$

Since the present value of the fixed payments is \$18,05,707 and present value of floating receipts is \$66,97,254, the swap has a positive value of \$48,91,547 and is an asset for the pay fixed party. Therefore, the swap is a negative value liability for the received - fixed counter party.

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5.4 CURRENCY SWAP

Q14. What is currency swap discuss the three steps of currency swap?

Ans :   **(Sep.-20, Dec.-19)**

Currency Swap

A currency swap is an exchange transaction that involves two different types of currencies. In currency swaps one party'agrges to make series of payments to the other party at a specific date in exchange for an amount of payment from the other party in different denominated currencies.

Steps

Currency swap involves three fundamental steps which are as follows,

Step I: Initial exchange of principal amount

Step II: Ongoing exchange of interest

Step III: Re-exchange of principal amounts on maturity.

Step I: Initial Exchange of Principal Amount

The first step deals with the initial exchange of principal amounts at an agreed rate of exchange (i.e., spot exchange rate). This initial exchange is done normally on a notional basis where the counter parties changes the principal amounts into the desired currency with the help of spot market.

Step II: Ongoing Exchange of Interest

After the principal amounts have been introduced the next step deals with the exchange of interest payment between the counter parties on the date specified, on basis of the outstanding principal amounts at fixed interest rates, which was agreed at the beginning of the transaction.

Step III: Re-exchange of Principal Amounts on Maturity

Finally, counter-parties will re-exchange the principal amounts at the maturity date. The above mentioned three steps can be clearly understood with the help of the following examples.

Q15. Explain the Benefits of Currency Swaps.

Ans :

1. Currently swaps enable corporate to exploit their comparative advantage in raising funds in one currency to obtain savings in other currencies.

2. Currency swaps permit corporate to switch their loans from a particular currency to another depending on their expectations of the future movement of the currency and interest rates.

3. It offers flexibility to corporate seeking to hedge the risk associated with a particular currency.

4. A company no longer has to live with a bad decision, if it has selected a wrong currency for its overseas funding operations, a currency swap can undo the damage.

5. Currency swap can be used to lock into exchange rates for a longer period and it do not require monitoring and reviewing.

6. The currency swap mode can be chosen to restructure the currency base of companies liabilities.

7. Currency swaps are used to hedge exposure to currency risk on future receipts (asset swaps) and payments (liability swaps), and to raise funds at a lower cost.

8. A high degree of liquidity in currency swap market ensures a steady supply of principals ready to assume the opposite side of a transaction.

9. In a currency swap, the exchange rates at maturity is known at the outset.

10. Early termination of swap contracts may be possible by agreement of the counter parties.

11. Currency swaps can be entered into at any time during the life of the transaction, they are being used to hedge.

5.4.1 Pricing and Valuing of Currency Swap

Q16. Explain with an example how a currency swap is priced at origination.

Ans :

In a fixed-for-floating currency swap, the notional amounts that are denominated in two different currencies are swapped at the beginning of the contract, but this involves only a normal exchange with some profit or gain. There are no pricing or valuing difficulties at the time of initial exchange for both the parties.

Example

If the prevailing exchange rate is ¥ 1,45/£, then exchanging ¥ 15,000,000 for £ will be,

$$1£ = ¥ 1.45$$

$$? = ¥ 15,000,000$$

$$\Rightarrow \frac{15,0000000}{17} = £ \ 10,344,827.59$$

Therefore, such a transaction is of no value from the perspective of the counter parties.

In a currency swap the payments are either fixed or floating. It is the same with a company issuing bond, expressed in one currency and purchasing it in a different currency. When these two amounts are transformed at the current spot exchange rate, the assets and liabilities of both the firms will be the same.

The pricing of a currency swap is similar to the pricing of an interest rate swap, that is, the present value of receipt and payments have been ought to be zero at the time of origination of the contract. In a currency swap, the notional amounts are also exchanged at the time of maturity of the contract; this amount is included in the valuation of currency swaps. The present values are computed in any one currency and the relationship between two present values is the spot rate at origination.

The present value of the fixed dollar payment is determined by discounting the six semi annual, payments of $ 40 thousands each at the spot U.S interest rates including the discounted cash flows of the principal value of $10 million that has to be exchanged after three years at the time of maturity of swaps contract. The semi annual payment is $ 40,000 and the fixed U.S dollar swap rate is 8%. Payments are made semi annually and the day count method is 30/360. Therefore, the semiannual interest is 4% and 4% of $ 10,00,000 is $ 40,000.

$$\Rightarrow \quad \frac{\$\,40,000}{1.045^{0.5}} + \frac{\$\,40,000}{1.055} + \frac{\$\,40,000}{1.062^{1.5}} + \frac{\$\,40,000}{1.065^2} + \frac{\$\,40,000}{1.067^{2.5}} + \frac{10,40,000}{1.068^3}$$

$$= \frac{\$\,40,000}{1.0222} + \frac{\$\,40,000}{1.055} + \frac{\$\,40,000}{1.0944} + \frac{\$\,40,000}{1.134} + \frac{\$\,40,000}{1.176} + \frac{10,40,000}{1.218}$$

$$= 39131.28 + 37914.69 + 36549.7 + 35273.36 + 34013.6 + 853858.7849$$

$$= \$\,1036741.415$$

After this, we need to know the fixed interest that effects the fixed periodic pound cash flows that will be exchanged. The notional amount denominated in pounds is based on the origination date of exchange rate of $ 0.5/£.

$$= \$\,10,00,000 \ (£/\$ \ 0.5) = £ \ 2,000,000$$

The £ 20,00,000 are exchanged for $1 million, this is included at the time of origination of swaps contract and at maturity. There is no influence of exchange rate at origination but at the time of pricing the swaps the exchange date is taken into consideration. The present value of the fixed £ cash flow is transformed to US $ as,

$$\left[\begin{array}{c} \dfrac{x\,(£\,2,000,000)}{1.06^{0.5}} + \dfrac{x(£\,2,000,000)}{1.062} + \dfrac{x(£\,2,000,000)}{1.06^{1.5}} \\[3mm] + \dfrac{x\,(£\,2,000,000)}{1.58^2} + \dfrac{x\,(£\,2,000,000)}{1.058^{2.5}} + \dfrac{x\,(£\,2,000,000)}{1.058^3} + \dfrac{x\,(£\,2,000,000)}{1.58^3} \end{array} \right] \times \dfrac{\$\,0.5}{£}$$

By keeping in view that, at time 3 both a payment of x (£ 2,000,000) and the principal amount £ 2,000,000 have been swapped and discounted back to three periods at a rate of 5.8%. The figures in the above given square brackets are the P. Vs of the pound cash flows expressed in pounds. The last item, $ 0.5/£ converts the £ value to dollar at the origination date spot exchange rate. The P.V cash flows must be equal to the foregone cash flow. The interest rates that affect the fixed periodic payments of pound cash flows needs to be exchanged.

$\Rightarrow$ [£ 1942571.725x + £ 1883239.171x + £ 1832614.835x

+ £ 1786728.892x + £ 1737064.027x + £ 1688779.672x + £ 1688779.672] $\times \dfrac{\$\, 0.5}{£}$

= [£ 10870998.32x + £ 1688779.672] $\times \dfrac{\$\, 0.5}{£}$

= \$ 6279888.995

Pricing a Fixed-floating Currency Swap

To value a fixed-to-floating currency swap, we must determine a fixed rate that makes the present value of floating cash flows, equal to that of P. Vs of fixed cash flows. The forward floating cash flows are predicted as future prices that the swap market maker will be paying or receiving at the time of managing and protecting the risk, by entering in a foreign exchange contract or a futures contract.

Example

Assume a fixed-floating currency swap with the following features,

Maturity	Three Years
Principal	$ 1 million
Floating currency	Japan ¥
Fixed dollar rate	Yet to be found
Payment dates	Every six months
Day count method	30/360

The spot exchange rate is $ 0.50/¥ and spot interest rates on zero coupon bond in each nation are as follows,

Spot Interest Rates

Years to Maturity	U.S, r_{us}	Japan, ¥
0.5	0.045	0.06
1.0	0.055	0.062
1.5	0.062	0.06
2.0	0.065	0.058
2.5	0.067	0.058
3.0	0.068	0.058

The objective is to correct the fixed rate of U.S interest rate that makes the market swap of no value for the counter parties. The theoretical forward prices are calculated by using the equation,

$$F = S \left[\dfrac{1 + r_{US}}{1 + r_{¥}} \right]^{T}$$

Where, F and S are denominated as $/¥ and S = 0.50.

Years to Maturity	Forward rate, $F = S\left[\dfrac{1+r_{US}}{1+r_{\yen}}\right]^T$
0.5	$F = 0.50\left[\dfrac{1.045}{1.06}\right]^{0.5} = 0.4790$
1.0	$F = 0.50\left[\dfrac{1.055}{1.062}\right]^{1} = 0.496704$
1.5	$F = 0.50\left[\dfrac{1.062}{1.06}\right]^{1.5} = 0.50141$
2.0	$F = 0.50\left[\dfrac{1.065}{1.058}\right]^{2} = 0.50663$
2.5	$F = 0.50\left[\dfrac{1.067}{1.058}\right]^{2.5} = 0.51070$
3.0	$F = 0.50\left[\dfrac{1.068}{1.058}\right]^{3} = 0.5143$

Q17. Discuss briefly about valuing of currency swap after origination.

Ans :

Consider that at origination a plain vanilla currency swap, in which fixed U.S dollars are exchanged for fluctuating ¥, is currently priced at 6.54%. The maturity period is 3 years, the principal amount is SI million, payments are made semiannually and the spot exchange rate is $0.50/¥.

After an year of swap's contract origination, the 2 year fixed U.S $ for variable ¥ swaps are priced at 7.74%, i.e., (the fixed U.S interest rate). The swaps U.S interest rates after origination of swap contract are,

Maturity Period	Interest Rate (%)
0.50	8.25
1.00	8.20
1.50	8.00
2.00	7.90

As interest rates are available only for the U.S $ and no interest rates are provided for ¥ (Japan), we can determine the present value of the left out fixed U.S dollar payments of the existing swap and then relate it with the present value of fixed U.S dollar payments on a freshly originated swap. Thus, the difference between these two present values gives the value of the swap.

1.   P.V cash flows of remaining payments on the previous swap ($'s).

$$\Rightarrow \frac{(0.0654 / 2)\,(\$10,00,000)}{1.0825^{0.5}} + \frac{(0.0654 / 2)\,(\$10,00,000)}{1.082} + \frac{(0.0654 / 2)\,(\$10,00,000)}{1.08^{1.5}}$$

$$+ \frac{(0.0654 / 2)\,(\$10,00,000)}{1.079^{2}} + \frac{\$10,00,000}{1.079^{2}}$$

= 31429.23 + 30221.81 + 29134.8 + 28086.96 + 858928.6926

= 977801.4926

2.   The second set of cash flows is the P.V's of the fixed U.S dollar payments for a new swap.

$$\Rightarrow \frac{(0.0774 / 2)\,(\$10,00,000)}{1.0825^{0.5}} + \frac{(0.0774 / 2)\,(\$10,00,000)}{1.082} + \frac{(0.0774 / 2)\,(\$10,00,000)}{1.08^{1.5}}$$

$$+ \frac{(0.0774 / 2)\,(\$10,00,000)}{1.079^{2}} + \frac{\$10,00,000}{1.079^{2}}$$

= 37196.06 + 35767.09 + 34480.64 + 33240.54 + 858928.69

= $999613.02

Thus, the value of the swap

= 999613.02 – 977801.4926

= $21811.53

The pay-fixed party will be paying interest with P. Vs of 977801.4926 *i.e.,* it will be paying less as compared to newly priced swaps of value $ 999613.02.

SOLVED PROBLEMS

Fixed-Fixed Currency Swap (At Origination)

3.   **A firm wishes to enter into a fixed-fixed currency swap. The principal amount is $60 million and the firm wishes to receive a fixed rate of 7.5% in U.S. dollars. The firm will pay Japanese yen. Suppose the spot exchange rate is ¥98/$. The swap tenor is two years, and payments will be quarterly. Principal amounts will be swapped at origination and at termination. Spot interest rates on zero coupon debt instruments in the U.S. are as follows,**

Years to Maturity	Interest Rate
0.25	5.25%
0.50	6.00%
0.75	6.60%
1.00	7.00%
1.25	72.5%
1.50	7.40%
1.75	7.50%
2.00	7.55%

Forward rates in Japan, defined as fr(t1, t2), where the forward period begins at time t1 and ends at time t2 are as follows,

fr(0,025) = 0.80%

fr(0.25,0.50) = 0.898%

fr(0.50,0.75) = 1.0%

fr(0.75,1.00) = 1.2%

fr(1.00,1.25) = 1.29%

fr(1.25,1.50) = 1.35%

fr(1.50,1.75) = 1.42%

fr(1.75,200) = 1.45%

Compute the fixed Japanese interest rate for the swap.

Sol :

Step 1

Calculation of present value of fixed dollar payments,

Given that,

     Fixed rate = 7.5%

     Payments = Quarterly

∴   Fixed value of dollar payments

$$= \$ 60 \text{ million} \times \frac{7.5\%}{4}$$

$$= \$ 6,00,00,000 \times 1.8$$

$$= \$ 11,25,000$$

∴   Present value of fixed dollar payments

$$= \frac{FV}{r_1^{t_1}} + \frac{FV}{r_2^{t_2}} ..... \frac{FV}{r_n^{t_n}}$$

Where,

     FV = Fixed value

     r = Interest rate

     t = Maturing time.

$$= \frac{1125000}{(1.0525)^{0.25}} + \frac{1125000}{(1.06)^{0.5}} + \frac{1125000}{(1.066)^{0.75}} + \frac{1125000}{1.07} + \frac{1125000}{(1.0725)^{1.25}} + \frac{1125000}{(1.075)^{1.5}}$$

$$+ \frac{1125000}{(1.074)^{1.5}} + \frac{1125000}{(1.0755)^2}$$

$$= 11,10,701 + 10,92,697 + 10,72,345 + 10,51,402 + 10,30,756 + 10,10,755$$
$$+ 9,91,260 + 9,72,590$$

$$= \$ 83,32,510$$

Step 2

Calculation of principal amount in terms of Japanese Yen.

∴ $60,000,000 (¥98/$) = ¥5,880,000,000

∴   ¥5,880,000,000 are exchange for $60 million at origination and termination. However the termination amount is likely to include a pricing problem. Therefore the present value of fixed cash flows in term of Yen is,

$$
\left[
\begin{array}{l}
\dfrac{x(¥\,5880\ million)}{1.008^{0.25}} + \dfrac{x(¥\,5880\ million)}{1.008^{0.5}} + \dfrac{x(¥\,5880\ million)}{1.01^{0.75}} \\[2mm]
+ \dfrac{x(¥\,5880\ million)}{1.012} + \dfrac{x(¥\,5880\ million)}{10129^{1.25}} + \dfrac{x(¥\,5880\ million}{1.0135^{1.5}} \\[2mm]
+ \dfrac{x(¥5880\ million)}{1.0142^{1.75}} + \dfrac{x(¥5880\ million)}{1.0145^{2}} + \dfrac{(¥5880\ million)}{1.0145^{2}}
\end{array}
\right] \times ¥\,\dfrac{1\$}{98}
$$

⇒ [x(¥ 5,868,298,449 + ¥ 5,854,297,512 + ¥ 5,836,282,370 + ¥ 5,810,276,679 + ¥ 5,786,542,033 + ¥5,762,908,133 + ¥5,736,685,154 + ¥5,713,118,383) + ¥5,713,118,383] $\times \dfrac{1\$}{98¥}$ = $8,332,510.

⇒ (¥ 46,368,408,713 x + ¥ 5,713,118,383) $\dfrac{1\$}{¥98}$ = $8,332,510.

473147028x + 58297126 = $83325 / D

⇒ $ 473,147,028 x = 49,964,616

⇒ x = $\dfrac{49,964,616}{473,147,028}$

∴   x = 0.10560

∴   The fixed Japanese interest rate for the swap is 10.56%.

(2)   Fixed - Floating Currency Swap

4.   Maturity Two years

Principal $10 million

Floating currency Euro (•)

Fixed dollar rate —

Payment date Semiannually

Day count 30/360

The spot exchange rate is $0.8/• and the spot interest rates on zero coupon bond in each nation are as follows,

Spot Interest Rates

Years to Maturity	U.S, $r_{U.S}$	Euro, $r•$
0.5	0.049	0.07
1.0	0.056	0.072
1.5	0.060	0.07
2.0	0.068	0.062

Sol.

Method 1

To calculate the fixed U.S interest rate, the theoretical forward prices should be calculated.

∴   The forward price is,

$$F = S\left[\frac{1+r_{US}}{1+r_{\in}}\right]^T$$

Where F and S are denominated as $/• and S = 0.8.

Years to Maturity	Forward rate $F = S\left[\dfrac{1+r_{US}}{1+r_{\in}}\right]^t$
0.5	$F = 0.8\left[\dfrac{1.049}{1.07}\right]^{0.5} = 0.7921$
1.0	$F = 0.8\left[\dfrac{1.056}{1.072}\right]^{1} = 0.7881$
1.5	$F = 0.8\left[\dfrac{1.06}{1.07}\right]^{1.5} = 0.7888$
2.0	$F = 0.8\left[\dfrac{1.068}{1.062}\right]^{2} = 0.8091$

Method 2

Calculation of annualized and semi annualized for ward rates.

Annual	Semi Annual
r(0.0, 0.5) = 0.070.	03441
r(0.5, 1.0) = 0.07400	0.03634
r(1.0, 1.5) = 0.06601	0.03248
r(1.5, 2.0) = 0.03836	0.01900

Annual

r(0.5, 1.0): 1.072 = 1.07$^{0.5}$ [1 + r(0.5, 1.0)]$^{0.5}$

$$1.072 = 1.07^{0.5} \ [I + r(0.5, 1.0)]^{0.5}$$

$$1.03634 = [1 + r(0.5, 1.0)]^{0.5}$$

$$1.07400 - 1 = r(0.5, 1.0)$$

$$r(0.5, 1.0) = 0.07400$$

r(1.0, 1.5)

$$1.07^{1.5} = 1.072^{1} \ [1 + r(1.0, 1.5)]^{0.5}$$

$$1.03248 = [1 + r(1.0, 1.5)]^{0.5}$$

$$1.06601 = 1 + r(1.0, 1.5)$$

$$r(1.0, 1.5) = 0.06601$$

r(1.5, 2.0)

$$0.062^{2} = 1.07^{1.5} \ [1 + r(2.0, 1.5)]^{0.5}$$

$$1.01900 = [1 + r(2.0, 1.5)]^{0.5}$$

$$1.03836 = 1 + r(2.0, 1.5)$$

$$r(2.0, 1.5) = 0.03836$$

Semi annually,

$$r_{semi} \ (0.0, 0.5) = \{[1 + r(0.0, 0.5)]^{1/2} - 1\}$$

$$= [(1.07)^{0.5} - 1] = 0.03441$$

$$r_{semi} \ (0.5, 1.0) = (1.07400)^{1/2} - 1$$

$$= 0.03634$$

$$r_{semi} \ (1.0, 1.5) = (1.06601)^{1/2} - 1$$

$$= 0.03248$$

$$r_{semi} \ (1.5, 2.0) = (1.03836)^{1/2} - 1$$

$$= 0.019$$

Shortcut Method

$$\frac{x(\$10,000,000)}{1.049^{0.5}} + \frac{x(\$10,000,000)}{1.056^{1}} + \frac{x(\$10,000,000)}{1.06^{1.5}} + \frac{x(\$10,000,000)}{1.068^{2}} + \frac{x(\$10,000,000)}{1.068^{2}}$$

$$= \$10,000,000$$

$$x(49,763,651 + 9,469,697 + 9,163,074 + 8,767,131) + 8,767,131 = \$10,000,000$$

$$37,163,553 \ x = 1,232,869$$

$$x = \frac{1232869}{37,163,553}$$

$$x = 0.0332$$

∴   Semi annual rate = 3.32%

∴   The fixed U.S rate = 6.64%.

5. **On Oct 1, 2012, the spot term structure is as follows,**

12 months	24 months	36 months	48 months
2.52	5.08	7.73	10.4

Determine the fixed rate on a 4-year swap for the pay fixed part.

Sol.

Given that,

$$r(0, 1) = 2.52\%$$
$$= 0.0252$$
$$r(0, 2) = 5.08\%$$
$$= 0.0508$$
$$r(0, 3) = 7.73\%$$
$$= 0.0773$$
$$r(0, 4) = 10.4\%$$
$$= 0.104$$

Step-1

Calculation of forward rates,

(a) **r(1, 2)**

$$(r_2)^2 = r_1[1 + r(1, 2)]$$
$$(1 + 0.0508)^2 = r_1[1 + r(1, 2)]$$
$$(1.0508)^2 = 1.0252[1 + r(1, 2)]$$
$$1.1042 = 1.0252[1 + r(1, 2)]$$
$$\frac{1.1042}{1.0252} - 1 = r(1, 2)$$
$$\Rightarrow \quad 1.077 - 1 = r(1, 2)$$
$$r(1, 2) = 0.077$$

(b) **r(2, 3)**

$$(r_3)^3 = (r_2)^2 [1 + r(2, 3)]$$
$$(1.0773)^3 = (1.0508)^2 [1 + 4(2, 3)]$$
$$1.2503 = 1.1042 [1 + r(2, 3)]$$
$$\frac{1.2503}{1.1042} - 1 = r(2, 3)$$
$$\Rightarrow \quad 1.132 - 1 = r(2, 3)$$
$$r(2, 3) = 0.132$$

(b)   **r(3, 4)**

$$(r_4)^4 = (r_3)^3 [1 + r(3, 4)]$$

$$(1.104)^4 = (1.0773)^3 [1 + r(3, 4)]$$

$$1.4855 = 1.2503 [1 + r(3, 4)]$$

$$\frac{1.4855}{1.2503} - 1 = r(3, 4)$$

$$1.188 - 1 = r(3, 4)$$

$$r(3, 4) = 0.188$$

Step - 2

Calculation of cash flows,

[Assuming national price = `100]

$$CF_1 = 0.0252 \times 100$$

$$= 2.52$$

$$CF_2 = 0.077 \times 100$$

$$= 7.7$$

$$CF_3 = 0.132 \times 100$$

$$= 13.2$$

$$CF_4 = 0.188 \times 100$$

$$= 18.8$$

Step - 3

Valuation of cash flows at appropriate discount rates,

$$= \frac{2.52}{(1.0252)^1} + \frac{7.7}{(1.0508)^2} + \frac{13.2}{(1.0773)^3} + \frac{18.8}{(1.104)^4}$$

$$= \frac{2.52}{1.0252} + \frac{7.7}{1.1042} + \frac{13.2}{1.2503} + \frac{18.8}{1.4855}$$

$$= 2.458 + 6.973 + 10.557 + 12.656$$

$$= 32.644$$

Step - 4

Calculating the fixed rate payments,

$$32.644 = \frac{A}{1.0252} + \frac{A}{(1.0508)^2} + \frac{A}{(1.0773)^3} + \frac{A}{(1.104)^4}$$

$$32.644 = A \left[\frac{1}{(1.0252)^1} + \frac{1}{(1.0508)^2} + \frac{1}{(1.0773)^3} + \frac{1}{(1.104)^4} \right]$$

$$32.644 = A\left[\frac{1}{1.0252} + \frac{1}{1.1042} + \frac{1}{1.2503} + \frac{1}{1.4855}\right]$$

$$32.644 = A(0.975 + 0.906 + 0.800 + 0.673)$$

$$32.644 = A(3.354)$$

$$A = \frac{32.644}{3.354}$$

$$= 9.73\%$$

Therefore, in order to make profit out of the swaps contract, the swap dealer needs to quote a price below 9.73 to the fixed party receiver and above 9.73 to the fixed pay party.

5.5 EQUITY SWAP

Q18. What is Equity Swap

Ans :

An equity swap is a type of Delta One product. This is really great for meeting an investor's diversification goals because it combines several underlying securities and therefore the owner has a simple approach to use a single product to get the exposure of a basket of securities. Equity swaps are great investment tools to offer investor leverage like derivative products.

An equity swap is a special type of total return swap, where the underlying asset is a stock, a basket of stocks, or a stock index. An exchange of the potential appreciation of equity's value and dividends for a guaranteed return plus any decrease in the value of the equity. An equity swap permits an equity holder a guaranteed return but demands the holder give up all rights to appreciation and dividend income. Compared to actually owning the stock, in this case you do not have to pay anything up front, but you do not have any voting or other rights that stock holders do have.

Equity swaps make the index trading strategy even easier. Besides diversification and tax benefits, equity swaps also allow large institutions to hedge specific assets or positions in their portfolios

The equity swap is the best swap amongst all the other swaps as it being an over-the-counter derivatives transaction; they have the attractive feature of being customizable for a particular user's situation. Investors may have specific time horizons, portfolio compositions, or other terms and conditions that are not matched by exchange-listed derivatives. They are private transactions that are not directly reportable to any regulatory authority.

A derivatives dealer can, through a foreign subsidiary in the particular country, invest in the foreign securities without the withholding tax and enter into a swap with the parent dealer company, which can then enter a swap with the American investor, effectively passing on the dividends without the withholding tax.

Q19. Explain the steps involve in Equity Swap Valuation.

Ans :   **(Imp.)**

There are two legs in an equity swap: an equity leg and a floating interest leg. The payoff for both legs could be set at every reset date or at maturity; or could be one side at maturity and the other at every reset date. The price of the swap is the difference between the present values of both legs' cash flows. In other words, the present value of swap is net of present value of "equity leg" and "money market leg".

The present value of an euity leg is given by,

$$PV_{equity}(t) = N\sum_{i=1}^{n}\left[\frac{s_i - s_{i-1}}{s_{i-1}}\right]D_i$$

where

t = Valuation date

N = Notational principal amount

t = i^{th} cash flow from I to n

$D_i = D(t, T_i)$ – discount factor

$S_i = [S - PV_i(D)]\,e^{r_i(\tau_i - t)}$ - equity forward price

S = equity spot price at valuation date

$PV_i(D) = \Sigma_{t<\tau<T_i}d_\tau e^{-r_r(\tau-t)}$ - present value of all dividends between t and T_i

d_τ = Discrete dividend paid at τ where $t \le \tau \le T$

r_i = continuously compounde interest rate from t to T_i

The present value of a floating interest rate leg can expressed as

$$PV_{floating}(t) = N\sum_{i=1}^{m}(F_i + s)\tau_i D_i \qquad\qquad ... (2)$$

where

t – Valuation date

N – notational principal amount

i – i^{th} cash flow (swaplet) from I to n

$\tau_i = t(T_{i-1}, T_i)$ – discount factor

$$F_i = F(t; T_{i-1}, T_i) = \frac{1}{\tau_i}\left(\frac{D_{i-1}}{D_i} - 1\right)$$ - simply compounded forward rate

S – floating spread.

The present value of the equity swap from the equity receiver perspective is given by

$$PV(t) = PV_{equity}(t) - PV_{floating}$$

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5.6 COMMODITY SWAP

</div>

Q20. What are commodity swap? Explain the types of commodity swaps.

Ans :   (Dec.-19)

The parties in a swaps contract exchange cash flows depending on the prices or the value of commodities like crude oil and energy-related products like metals such as gold, silver and copper and agricultural products like wheat, grains and sugar.

These swaps are fixed-for-floating which depends only on one commodity, "One party pays an amount at a fixed rate in future and the other agrees to pay at floating rate. The principal amount is not swapped and the quality and quantity aspects should be completely standardized depending on locations.

Thus, in commodity swaps the parties at the receiving and paying end can set the prices for future dates.

Types of Commodity Swaps

Commodity swaps are of two types. They are as follows,

1.   Fixed Floating Commodity Swaps

Fixed-floating commodity swaps are swaps based on the commodity index. Goldman Sachs Commodities Index (GSCI) and the Commodities Research Board Index (CRB) are general market indices in the commodities market which helps in developing commodity swap. These two indices sets varied weights on different commodities and are applied as per the requirements of swap agents. The figure given below depicts the working of fixed-floating swap.
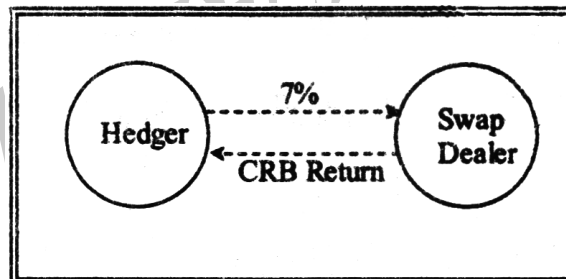

Fig.: Fixed for Floating Swap

2.   Commodity - for - Interest Swaps

In this type of swap, the total return on the commodity is swapped for some money market rate plus (or) minus a spread. This is illustrated in the figure given below.
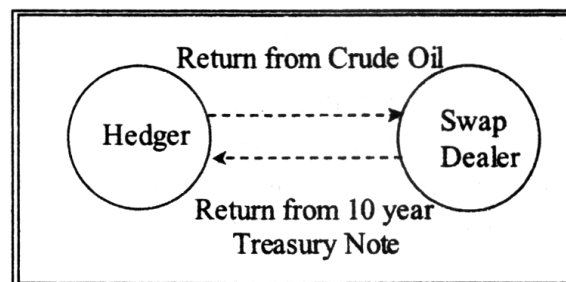

Fig.: Commodity for Interest Swap

Commodity swaps possess few additional factors like, the cost of hedging, the institutional structure of the specific commodity, the liquidity of the underlying commodity market; seasonality and its impact on the underlying commodity market; the variability of the futures bid/offer spread, brokerage fees, capital costs and other administrative costs.

Thus, commodity swaps are mostly used by the firms which are associated with the energy chemical and agricultural field/streams.

5.6.1 Pricing and Valuing - Commodity Swap

Q21. Explain briefly about pricing and valuing of commodity swap.

Ans :   **(Imp.)**

In pricing commodity swaps, one can think of the swap as a scrip of forwards each priced at inception with zero market value (in a present value sense). Thinking of a swap as a scrip of at-the-money forwards is also a useful intuitive way of interpreting interest rate swaps or equity swaps.

Commodity swaps are characterized by some distinctive peculiarities, though, these include the following factors which should be given due consideration:

1. The cost of hedging,

2. The institutional structure of the particular commodity market in question,

3. The liquidity of the underlying commodity market,

4. Seasonality and its effects on the underlying commodity market,

5. The variability of the futures bid/offer spread,

6. Brokerage fees,

7. Credit risk, capital costs and administrative costs.

Some of above factors must be extended to the pricing and hedging of interest rate swaps, currency swaps and equity swaps as well. The idiosyncratic nature of the commodity markets refers more to the often limited number of participants in these markets (naturally begging questions of liquidity and market information), the unique factors driving these markets, the inter-relations with related markets and the individual participants in these markets.

<div style="border:1px solid black; text-align:center;">

5.7 SWAPATIONS

</div>

Q22. What is Swaptions.

Ans :

Options on interest rate swaps are termed swaptions. The buyer of the option holds the right to exercise an interest fate swap contract at a prespecified time. Firms would want to enter into a borrowing when a contract is finalized. However, at the time for bidding for the contract, the firm could hedge its exposure at the pre-specified time when the bidding process is to be finalized. If the contract is awarded to the firm, the firm would enter into a swap contract to protect its interest rate risk exposure through the leverage incurred because of the award of the contract. If on the other hand the contract is not awarded to the firm, it may not exercise its right to enter into the swap contract to protect its debt since the debt would never be entered into by the firm. Swaptions are also entered into by financial institutions to protect their interest rate exposures due to upcoming economic changes in banking habits. The holder of the option pays an upfront premium to the option seller. Financial institutions assume the role of both the buyer and the seller of an option contract on interest rate swaps with firms or other financial institutions.

Q23. Explain different types of Swaption

Ans :

Swaptions are combination of the features of two derivatives instruments, i.e., option and swap. Options interest rate swaps are refereed as Swaptions. The buyer of the swaption has the right to enter into an interest rate swap agreement by some specified data in the future. The swaption agreement will specify whether the buyer of the swaption will be a fixed rate receiver or a fixed rate payer. If the buyer exercises the option then the writer of the option will become the counter party.

Types of Swaptions

Swaption are classified into two types namely;

1. Call Swaption

A Callable swap provides the party making the fixed payments with the right to terminate the swap to its maturity. The writer, therefore, becomes the fixed rate receiver and floating rate payer.

2. Put Swaption

A puttable swaption provides the party making the floating rate payments with a right to terminate the swap. The writer of the put swaption, therefore, becomes the floating rate receiver and fixed rate payer.

Short Question and Answers

1.   **Swap**

Ans :

The swap market today, takes place the most significant development in the global financial market. It has fundamental transformed the way in which corporate business world and the bankers look at funding choices. Swaps are frequently used by them to arrange complex and innovative financing which decrease borrowing costs and increase control over other financial variables. This market has gained popularity specifically after the demise of Bretton Woods System which caused to the instability in international funds movements.

Definition

A Swap is an a unique kind of a financial transaction which includes concurrent purchase and sale of,

(a)   A underlying asset of similar kind.

(b)   Obligation of equal capital amount, where the financial exchange system gives both the parties flexibility and transparency in dealing with each other.

(c)   The amount is swapped for a certain number of times for a given period of time.

Q3.   **Explain the features of swaps.**

Ans :

The following are features of financial swaps:

(i)   **Counter parties**

Financial swaps involve the agreement between two or more parties to exchange cash flows or the parties interested in exchanging the liabilities.

(ii)   **Facilitators**

The amount of cash flow exchange between parties are huge and also the process is complex. Therefore, to facilitate the transaction, an intermediary comes into picture which brings different parties together for big deal. These may be brokers whose objective is to initiate the counter parties to finalize the swap deal. While swap dealers are themselves counter partied who bear risk and provide portfolio management service.

(iii)   **Cashflows**

The present values of future cash flows are estimated by the counterparties before entering into a contract. Both the parties want to get assurance of exchanging same financial liabilities before the swap deal.

(iv)   **Less documentation**

Less documentation is required in case of swap deals because the deals are based on the needs of parties, therefore, less complex and less risk consuming.

(v)   **Transaction costs**

Generating very less percentage is involved in swap agreement.

3.   **Currency Swaps**

Ans :

A swap deal can also be arranged across currencies. It is an oldest technique in swap market. In this swap. The two payment streams being exchanged are denominated in two different currencies. For example, a firm which has borrowed Japanese yen at a fixed interest rate can 'swap away' the exchange rate risk by setting up a contract whereby it receives yen at a fixed rate in return for dollars at either a fixed or a floating interest rate.

The currency swap is, like interest rate swap, also two party transaction, involving two counter parties with different but complimentary needs being bought by a bank. In this swap, normally three basic steps are involved which are as under:

1.   Initial exchange of principal amount

2.   Ongoing exchange of interest

3.   Re-exchange of principal amounts on maturity.

4.   Define interest rate swaps

Ans :

An interest rate swap is an agreement between two parties to exchange U.S dollar interest payments for a specific maturity on an agreed upon notional amount. The term 'notional' refers to the theoretical principal underlying the swap. Thus, the notional principal is simply a reference amount against which the interest is calculated. No principal ever changes hands. Maturities range from less than a year to more than 15 years, however, most transactions fall within a 2-year to 10-year period.

Interest rate swaps can be used to take on fresh interest rate risk as well as to manage existing interest rate risk.

Interest Rate swaps without offsetting underlying create interest rate risk. Each counter party in an interest rate swap is committed to pay a stream of interest payments and receive a different stream of interest payments. A payer of fixed interest rate payments is exposed to the risk of falling interest rates, while a payer of floating interest rate payments is exposed to the risk of rising interest rates. Similarly, a receiver of fixed interest rate payments is exposed to the risk of rising interest rates, while the receiver of floating interest payments is exposed to the risk of falling interest rates. In conclusion, interest rate swaps create an exposure to interest rate movements, if not offset by an underlying exposure.

5.   What is currency swap discuss the three steps of currency swap?

Ans :

Currency Swap

A currency swap is an exchange transaction that involves two different types of currencies. In currency swaps one party'agrges to make series of payments to the other party at a specific date in exchange for an amount of payment from the other party in different denominated currencies.

Steps

Currency swap involves three fundamental steps which are as follows,

Step I: Initial exchange of principal amount

Step II: Ongoing exchange of interest

Step III: Re-exchange of principal amounts on maturity.

Step I: Initial Exchange of Principal Amount

The first step deals with the initial exchange of principal amounts at an agreed rate of exchange (i.e., spot exchange rate). This initial exchange is done normally on a notional basis where the counter parties changes the principal amounts into the desired currency with the help of spot market.

Step II: Ongoing Exchange of Interest

After the principal amounts have been introduced the next step deals with the exchange of interest payment between the counter parties on the date specified, on basis of the outstanding principal amounts at fixed interest rates, which was agreed at the beginning of the transaction.

Step III: Re-exchange of Principal Amounts on Maturity

Finally, counter-parties will re-exchange the principal amounts at the maturity date. The above mentioned three steps can be clearly understood with the help of the following examples.

6.   Benefits of Currency Swaps.

Ans :

1.   Currently swaps enable corporate to exploit their comparative advantage in raising funds in one currency to obtain savings in other currencies.

2.   Currency swaps permit corporate to switch their loans from a particular currency to another depending on their expectations of the future movement of the currency and interest rates.

3. It offers flexibility to corporate seeking to hedge the risk associated with a particular currency.

4. A company no longer has to live with a bad decision, if it has selected a wrong currency for its overseas funding operations, a currency swap can undo the damage.

5. Currency swap can be used to lock into exchange rates for a longer period and it do not require monitoring and reviewing.

6. The currency swap mode can be chosen to restructure the currency base of companies liabilities.

7. Currency swaps are used to hedge exposure to currency risk on future receipts (asset swaps) and payments (liability swaps), and to raise funds at a lower cost.

8. A high degree of liquidity in currency swap market ensures a steady supply of principals ready to assume the opposite side of a transaction.

9. In a currency swap, the exchange rates at maturity is known at the outset.

10. Early termination of swap contracts may be possible by agreement of the counter parties.

11. Currency swaps can be entered into at any time during the life of the transaction, they are being used to hedge.

7.   What is Equity Swap

Ans :

An equity swap is a type of Delta One product. This is really great for meeting an investor's diversification goals because it combines several underlying securities and therefore the owner has a simple approach to use a single product to get the exposure of a basket of securities. Equity swaps are great investment tools to offer investor leverage like derivative products.

An equity swap is a special type of total return swap, where the underlying asset is a stock, a basket of stocks, or a stock index. An exchange of the potential appreciation of equity's value and dividends for a guaranteed return plus any decrease in the value of the equity. An equity swap permits an equity holder a guaranteed return but demands the holder give up all rights to appreciation and dividend income. Compared to actually owning the stock, in this case you do not have to pay anything up front, but you do not have any voting or other rights that stock holders do have.

Equity swaps make the index trading strategy even easier. Besides diversification and tax benefits, equity swaps also allow large institutions to hedge specific assets or positions in their portfolios

The equity swap is the best swap amongst all the other swaps as it being an over-the-counter derivatives transaction; they have the attractive feature of being customizable for a particular user's situation. Investors may have specific time horizons, portfolio compositions, or other terms and conditions that are not matched by exchange-listed derivatives. They are private transactions that are not directly reportable to any regulatory authority.

8.   What are commodity swap.

Ans :

The parties in a swaps contract exchange cash flows depending on the prices or the value of commodities like crude oil and energy-related products like metals such as gold, silver and copper and agricultural products like wheat, grains and sugar.

These swaps are fixed-for-floating which depends only on one commodity, "One party pays an amount at a fixed rate in future and the other agrees to pay at floating rate. The principal amount is not swapped and the quality and quantity aspects should be completely standardized depending on locations.

Thus, in commodity swaps the parties at the receiving and paying end can set the prices for future dates.

9. Types of Commodity Swaps

Ans :

1. Fixed Floating Commodity Swaps

Fixed-floating commodity swaps are swaps based on the commodity index. Goldman Sachs Commodities Index (GSCI) and the Commodities Research Board Index (CRB) are general market indices in the commodities market which helps in developing commodity swap. These two indices sets varied weights on different commodities and are applied as per the requirements of swap agents. The figure given below depicts the working of fixed-floating swap.

2. Commodity - for - Interest Swaps

In this type of swap, the total return on the commodity is swapped for some money market rate plus (or) minus a spread. This is illustrated in the figure given below.

10. Explain different types of Swaption

Ans :

Swaptions are combination of the features of two derivatives instruments, i.e., option and swap. Options interest rate swaps are refereed as Swaptions. The buyer of the swaption has the right to enter into an interest rate swap agreement by some specified data in the future. The swaption agreement will specify whether the buyer of the swaption will be a fixed rate receiver or a fixed rate payer. If the buyer exercises the option then the writer of the option will become the counter party.

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Exercise Problems

1. Suppose that the spot (zero) interest rates with continuous compounding are as follows:

Maturity (Years)	Rate (96 per annum)
1	12.00
2	13.00
3	13.70
4	14.20
5	14.50

Calculate forward interest rates for the second, third, fourth and fifth year.

[**Ans :** 2nd year- 14%, 3rd year-14.9%, 4th year-15.7%, 5th year-17.7%.]

2. PK Bank has funded a one year US$ 10 million floating rate loan on 6-month 'LIBOR +' basis. Expecting a decline in LIBOR, the PK Bank is planning to sell 6-12 FRA which is being quoted at 2.60 - 2.70 percent. If the actual LIBOR settles at 2.45 pc on the settlement date, find the present value of compensation to be received by PK Bank.

[**Ans :** $7059.]

3. CAN Bank has funded a one year ? 50 crores floating rate loan on 6-month 'MIBOR+' basis. Expecting a decline in MIBOR, the CAN Bank is seeking protection by selling 6-12 FRA which is being quoted at 5.40-5.50 percent. If actual MIBOR settles at 5.28 percent on the settlement date, find the present value of compensation to be received by CAN Bank.

[**Ans :** ` 2,99,050.]

4. Suppose that, under the terms of a swap, a company has agreed to receive six-month MIBOR and pay 8.4 percent per annum (with semi-annual compounding) on a notional principal of *X* 100 million. The swap has remaining life of 1.25 years. Zero rates for 3-month, 9-month and 1.25 year maturities are 8.0%, 8.5% and 9.0% respectively. The 6-month MIBOR rate at the last payment was 6.5%(with semi-annual compounding). Determine the value of interest-rate swap.

[**Ans :** ` 35,300 or 0.0353.]

5. A$100 million interest rate swap has a remaining life of 10 months. Under the terms of the swap, 6-month LIBOR is exchanged for 7% per annum (compounded semiannually). The average of the bid-offer rate being exchanged for 6-month LIBOR in swaps of all maturities is currently 5% per annum with continuous compounding. The 6-month LIBOR rate was 4.6% per annum 2 months ago. What is the current value of the swap to the party paying floating? What is its value to the party paying fixed?

[**Ans :** Value of swap to party paying floating = $ 2.109 million Value of swap to party paying fixed = - $ 2.109 million.]

Internal Assessment (Mid Examinations)

The pattern of Mid Exams or Continuous Internal Evaluation (CIE) prescribed by the JNTU-H as per the Regulations 2019 (R19) for all the semesters is as follows,

➢ There would be two Mid Exams or Continuous Internal Evaluation (CIE) for each semester,

  ● The Ist **Mid Term Examinations** would be conducted during the Middle of the Semester.

  ● The IInd **Mid Term Examinations** during the last week of instructions.

➢ The Mid Exam I and II would have the same pattern of question paper which would carry **25 Marks** each and the time duration for conducting each Mid exam would be 120 min.

➢ The pattern of Mid Exam Question Paper would consist of two parts i.e., **Part-A** and **Part-B.**

  ● **Part-A** consist of 5 compulsory questions each carries 2 marks (i.e 5 × 2 = 10 marks).

  ● **Part-B** consist of 5 questions out of which 3 questions should be answered, each question carries 5 marks (i.e 5 × 3 = 15 marks).

➢ The average of the two Mid exams will be added with the 75 marks of External end examination which equals to 100 marks (i.e 25 + 75 = 100).

UNIT - I

Part - A

1.	What is Risk Modeling ?	(Refer Unit-I, SQA-2)
2.	What is Multi-Factor Model ?	(Refer Unit-I, SQA-3)
3.	Define Risk Financing	(Refer Unit-I, SQA-5)
4.	Define Risk Management	(Refer Unit-I, SQA-6)
5.	What is Covariance Matrix Model ?	(Refer Unit-I, SQA-7)

Part - B

1.	What are the causes of Risk ?	(Refer Unit-I, Q.No. 2)
2.	Explain the various types of Unsystematic Risk.	(Refer Unit-I, Q.No. 6)
3.	What are the differences between Systematic Risk and Unsystematic Risk ?	(Refer Unit-I, Q.No. 7)
4.	Explain the Impact of Risk in an on organisation.	(Refer Unit-I, Q.No. 9)
5.	Define risk management explain the activities of risk management.	(Refer Unit-I, Q.No. 11)
6.	Explain the levels of risk management.	(Refer Unit-I, Q.No. 19)
7.	Outline the Process of Risk Management.	(Refer Unit-I, Q.No. 20)

UNIT - II

Part - A

Part - B

UNIT - III

Part - A

Part - B

UNIT - IV

Part - A

Part - B

UNIT - V

Part - A

Part - B

1. What do you understand by swap? Explain its concept and nature in detail. (Refer Unit-V, Q.No. 1)

2. Explain briefly about the various types of swaps. (Refer Unit-V, Q.No. 5)

3. Define interest rate swaps. Explain the features of interest rate swap. (Refer Unit-V, Q.No. 6)

4. Discuss how interest rate swaps are priced at the time of origination. (Refer Unit-V, Q.No. 12)

5. What is currency swap discuss the three steps of currency swap? (Refer Unit-V, Q.No. 14)

6. Explain with an example how a currency swap is priced at origination. (Refer Unit-V, Q.No. 16)

7. Explain the steps involve in Equity Swap Valuation. (Refer Unit-V, Q.No. 19)

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M.B.A II - Year IV - Semester Examination

R17

September - 2020

RISK MANAGEMENT

Time : 2 Hours]   [Max. Marks : 75

Answer any five questions

All questions carry equal marks

ANSWERS

1. (a) Explain Risk Management Process.   **(Unit-I, Q.No. 20)**

    (b) Explain Risk Management Methods.   **(Unit-I, Q.No. 22)**

2. (a) Briefly explain the concept of Cash Flow at Risk (CaR).   **(Unit-II, Q.No. 31)**

    (b) How do you manage risk when measured by CaR ?   **(Unit-II, Q.No. 32)**

3. (a) What is a Futures Contract?   **(Unit-III, Q.No. 9)**

    (b) What are the nature & salient features of Futures Contract ?   **(Unit-III, Q.No. 10)**

4. Suppose that the price of RIL's share at BSE is Rs. 300 and Futures price for delivery in the next 6-Months is Rs. 350 per share. An arbitrageur can borrow at 10% per annum. Should the arbitrageur buy RIL's shares?

Sol :

Given that

Spot price (S_0) R: 300

Risk free Rate of Int(r) = 10% or 0.10 P.A

Delivery Price K : 350

$$t = \frac{6}{12} = \frac{1}{2} = 0.5 \text{ P.A}$$

As it No Income Problem

Forward Price $(F_0) = S_0 e^{rt} = 300\, e^{0.10 \times 0.50}$

$\qquad\qquad\qquad 300\, e^{+0.05} = 300(1.05127)$

$\qquad\qquad\qquad F_0 = 315.3813$

Value of contract $(F) = (F_0 - K)e^{-rt}$

$\qquad\qquad\qquad (315.3813 - 350)$

$\qquad\qquad\qquad (-34.6187)\, e^{-0.10 \times 0.5}$

$\qquad\qquad (-34.6187)(0.951229)$

| Value of contract F = -32.93031 |

5.   What is Black-Scholes Model? Give Black-Scholes Model for valuing a   **(Unit-IV, Q.No. 24,25)**

      European Call. What are its advantages ?

6.   Mr. Kalyan is bearish on the stock of Vijay Corporation. He purchases

      5 put options (100 shares per Option) on Vijay shares for a premium of

      Rs. 4. The exercise price is Rs. 40 and had a maturity period of 3 months.

      The current market price of the stock is Rs. 40. If Mr. Kalyan is correct, and

      Vijay's price falls to Rs. 30. How much profit will he earn over 3-months period ?

Sol :

Exercise price of put option = ` 40

Maturity period of put option = 3 months.

Share Premium = ` 30

If the Vijay corporation's share's price falls to ` 30/- by the Expiry date, then the profit of Mr. Kalyan can be calculated as follows,

Intrinsic value of put option

= Exercise price – stock price

= 40 – 30

= ` 11 /-

When a premium of ` 3/- has to be paid his net profit is.

` 10 – 3 = ` 7/-

In this situation, the option writes has to pay ` 40 for share worth ` 30. This loss ` 10 is  partially offset by the premium receipt of ` 3. Hence, the net profit for Mr. Kalyan is 40 – 30 – 3 = ` 7 /- per share of Vijay's corporation.
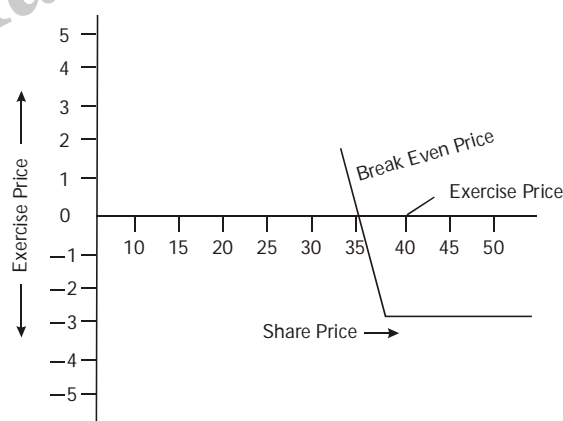
Fig.: Profit Diagram of Put option

7   (a)   What is a Financial Swap ?   **(Unit-V, Q.No. 1)**

     (b)   What are major types of Financial Swaps ?   **(Unit-V, Q.No. 5)**

8.   What is a Currency Swap ? What are the 3 basic steps involved in it ?   **(Unit-V, Q.No. 14)**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M.B.A II - Year IV - Semester Examination

R17

December - 2019

RISK MANAGEMENT

Time : 3 Hours]   [Max. Marks : 75

Note :   This question paper contains two Parts A and B.

         Part A is compulsory which carries 25 marks. Answer all questions in Part A.

         Part B consists of 5 Units. Answer any one full question from each unit.

         Each question carries 10 marks and may have a, b, c as sub questions.

PART - A (5 × 5 = 25 Marks)
(Short Answer Questions)

ANSWERS

1.	(a)	Risk Measurement.	(Unit - I, Q.No. 23)
	(b)	Credit risk.	(Unit - II, Q.No. 15)
	(c)	Future Contracts.	(Unit - III, SQA. 4)
	(d)	Put Options.	(Unit - IV, Q.No. 5)
	(e)	Swaptions.	(Unit - V, SQA. 11)

PART - B (5 × 10 = 50 Marks)
(Essay Type Questions)

2.	Define the term Risk and explain different types of risk.	(Unit - I, Q.No. 1,4,5,6)

(OR)

3.	Explain the risk management process.		(Unit - I, Q.No. 20)
4.	Explain the following.		
	(a)	Value at rist	(Unit - II, Q.No. 20)
	(b)	Liquidity risk.	(Unit - II, Q.No. 9)

(OR)

5.	(a)	Write a note on regulatory framework related to risk management in India.	(Unit - II, Q.No. 2)
	(b)	Write a note on Capital Adequacy Norms.	(Unit - II, Q.No. 3)

6. Calculate the price of a forward contract from the information given below,

Price of the share	:	` 80
Time of expire	:	10 months
Dividend expected	:	` 2.50 per share
Time of Dividend	:	4 months
Continuously compounded Risk free rate of interest	:	10 percent per annum

Sol :

Given

Forward expiry date = 10 months

Price of share = ` 80

Expected dividend = ` 2.50 per share

Time of dividend = 4 months

Continuously compounded risk free rate of return = 10% (or) 0.10

Calculating present value of the dividends

$$I = 2.50 \times e^{-0.10 \times \frac{4}{12}}$$

$$= 2.50 \times e^{-0.033}$$

$$= 2.50 \times 0.9675$$

$$= 2.42$$

∴   Value of the forwards contract (F_0)

$$= (P - I)\, e^{rf \times \frac{10}{12}}$$

$$= (80 - 2.42)\, e^{-0.10 \times \frac{10}{12}}$$

$$= 77.58 \times e^{0.0833}$$

$$= 77.58 \times 1.08687$$

$$= ` 84.32.$$

(OR)

7.   (a)   Explain the impact of Financial market imperfections.   **(Unit - III, Q.No.31)**

     (b)   Write a note on counterparty risk in the forward contract.   **(Unit - III, Q.No.19)**

8.   (a)   Explain why margin accounts are required when clients write

           options but not when they buy options.

Ans :

Margin account is prepared when there is risk in purchasing of securities with borrowed amount. The reasons for maintaining margin accounts, when clients write options are,

1.   The writer of option or trader maintain funds in margin account to satisfy the broker of trader.

2.   Margin accounts are needed to protect broker from default risk.

3.   There is unlimited loss when investor sells or write options, so it is required to maintain margin accounts.

4.   To protect against consequences of future liabilities, margin accounts are maintained when client writes an option.

5.   There is no premium when client writes an option, so there are chances of liability with the client. There fore, margin accounts are required to maintain.

(b)   Write a note on Option strategies.   (Unit - IV, Q.No.7)

(OR)

9.   (a)   List out the principles of put option pricing.   (Unit - IV, Q.No.14)

(b)   From the following information calculate the value of a European call option
        on a non-dividend paying share using Black-Scholes model,

Current price of the share	: ` 30
Exercise Price .	: ` 42
Expire Date	: Six months
Instantaneous standard deviation of return	: 0.5
Continuously compounded risk free rate of interest	: 10 Percent

Sol :

Given

Share price (S) = ` 30

exercise price (K) = ` 42

Risk free rate of interest (r) = 10 percent (or) 0.10

Expire date (T) = 6 months or 0.5 (6/12)

STandard deviation (σ) = 0.5

Determining options value using Black-scholes model.

$$V = SN(d_1) - Ke^{-rt} N(d_2)$$

$$d_1 = \frac{\ln\left(\dfrac{S}{K}\right) + \left(r + 0.5\sigma^2\right)T}{\sigma\sqrt{T}}$$

$$= \frac{\ln\left(\dfrac{30}{42}\right) + \left(0.10 + \left(0.5\right)^2\right)0.5}{0.5\sqrt{0.5}}$$

$$= \frac{\ln(0.714) + (0.10 + 0.125)0.5}{0.5\sqrt{0.5}}$$

$$= \frac{\ln(0.714) + (0.1125)}{0.5(0.7071)}$$

$$= \frac{-0.3369 + 0.1125}{0.3535}$$

$$= \frac{-0.2244}{0.3535}$$

$$\therefore \quad d_1 = -0.6348$$

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

$$= -0.6348 - 0.5\sqrt{0.5}$$

$$= -0.6348 - 0.3535$$

$$= -0.9883$$

As per cumulative probabilities from the normal distribution table,

$$N(d_1) = N(-0.6348)$$

$$= 0.26435$$

$$N(d_2) = N(-0.9883)$$

$$= 0.16354$$

Premium value of European call option

$$V = SN(d_1) - Ke^{-rt}N(d_2)$$

$$= 30(0.26435) - 42 \times e^{-0.10 \times 0.5}(0.16354)$$

$$= 7.9305 - 42 \times e^{-0.05}(0.16354)$$

$$= 7.9305 - 42 \times 0.95123(0.16354)$$

$$= 7.9305 - 39.95166(0.16354)$$

$$= 7.9305 - 6.5337$$

$$= 1.3968$$

10. Explain the following,

   (a) Commodity Swap   **(Unit - V, Q.No.20)**

   (b) Currency Swap.   **(Unit - V, Q.No.14)**

(OR)

11. X can borrow floating rate funds from dollar market at 1 -year LIBOR or he can borrow at fixed rate Euro at 7 percent, Y can borrow floating rate funds from US Dollar market at 9 percent, Y need fixed rate Euro and X need floating rate dollar. Can the currency swap be gainful to both of them?

Ans :

Let us assume that Y can borrow floating rate funds from US Dollar market at LIBOR or can borrow fixed rate funds from Euro market at 9 percent.

1. X borrows Euro and Y borrows US Dollar.

2. X will pass on Euro to Y in return for US Dollar. It implies that there is exchange of currency.

3. X will pay LIBOR to Y. Y will pay, say 8 percent fixed rate to X.

4. At the time of maturity, currencies are re-exchange.

Cost of Swap

   X : 7 percent + LIBOR - 8 percent = LIBOR - 1 percent

   Y : LIBOR + 8 percent - LIBOR = 8 percent

If X directly deals with floating rate market, he would have to pay LIBOR. But if he goes through swap, he must pay less by 1 percent. If Y directly deals with fixed rate market, he would have to pay 9 percent. But if he goes through swap, he must pay 8 percent. Hence, currency swap is gainful to both X and Y as it reduces cost of borrowings.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M.B.A II - Year IV - Semester Examination

April / May - 2019

RISK MANAGEMENT

Time : 3 Hours]　　　　　　　　　　　　　　　　　　　　　　　　　　　[Max. Marks : 75

Note : This question paper contains two Parts A and B.

Part A is compulsory which carries 25 marks. Answer all questions in **Part A.**

Part B consists of 5 Units. Answer any **one** full question from each unit.

Each question carries 10 marks and may have a, b, c as sub questions.

PART - A (5 × 5 = 25 Marks)

(Short Answer Questions)

ANSWERS

1. (a) Explain types of risk. **(Unit-I, Q.No. 4)**

   (b) Compare and contrast interest rate and exchange rate risk.

Ans :

Similarities Between Interest Rate Risk and Exchange Rate Risk

The similarities between interest rate risk and exchange rate risk are,

(i) Interest rate risk and exchange rate risk (currency risk) are related closely as they are combinely used to determine the gains on the domestic and foreign currency denominations.

(ii) Both interest rate risk and currency risk are equal when the interest rate parties hold.

Differences Between Interest Rate Risk and Exchange Rate Risk

The differences between interest rate risk and exchange rate risk (currency risk) are,

	Interest Rate Risk		Exchange Rate Risk (Currency Risk)
1.	Interest rate risk arises due to the changes in the interest rates of market.	1.	Exchange rate risk arises from the adverse changes in the exchanges rates.
2.	The various types of interest rate risk are volatility risk, put/ call risk, basis risk etc.,	2.	The various types of exchange rate risk are transaction risk, translation risk and operating risk.

(c) What are the disadvantages of physical delivery of shares in a futures contract?

Ans :

The following are the disadvantages of physical delivery/settlement of shares in a futures contract,

1. In future markets, physical delivery of shares is not a cost effective method as it involves more costs to manage the shares till delivery.

2. The physical delivery of shares fails to consider the future changes in the markets.

3. The physical delivery of shares face a problem of liquidity on the last day of trading the shares.

4. The physical delivery of shares has to face more risk when compared to the cash settlement of shares.

5. The physical delivery of shares are exposed to high risk of price manipulations.

6. The physical delivery of shares have an adverse effect on the volatility of trade and price changes

(d) Build a case for an investor choosing call option.

Sol :

In general, an investor who is optimistic for future price increase wili choose call option. A general example for this case is the exchange rate of US $ to Australian $ is $ 0.65290/A$. An investor who is willing to buy an Australian Dollar in December need to select an option either a put or call option. The strike level of US $ / Australian $ is US $ 0.65290 $ / Aus $. At the end of the February the exchange rate will be US $ 0.6843 / Aus $. As the exercise price at maturity is more than the strike price at origination, the option is said to be in the money in call option and out-of-the-money in put option.

(e) Outline the mechanism involved in the interest rate swaps with a suitable diagram.

(Unit-V, Q.No. 6)

PART - B (5 × 10 = 50 Marks)

(Essay Type Questions)

2. Examine the characteristics of different categories of risks.   **(Unit-I, Q.No. 4, 5, 6)**

(OR)

3. Evaluate the steps in the risk management process.   **(Unit-I, Q.No. 20)**

4. Discuss on the regulatory framewok with regard to financial risk management.   **(Unit-II, Q.No. 2)**

(OR)

5. Distinguish between the Features of Value at Risk (VaR) and Cash Flow at Risk (CaR) methods.

(Unit-II, Q.No. 33)

6. (a) The spot and 60 day forward rate for the Yen are $ 1.1250 and $ 1.1276, respectively. What is the forward premium or discount on the Yen ?

Sol :

Given that,

Spot rate = $ 1.1250

60-days forward rate = $ 1.1276

Forward premium/discount = $\dfrac{\text{Forward rate -Spot rate}}{\text{Spot rate}} \times \dfrac{360}{\text{Number of days of forward contract}} \times 100$

$$= \frac{1.1276 - 1.1250}{1.1250} \times \frac{360}{60} \times 100$$

$$= \frac{0.0026}{1.1250} \times 6 \times 100$$

$$= 0.0023 \times 6 \times 100$$

$$= 0.014 \times 100$$

$$= 1.4\%$$

∴ The annual forward premium is 1.4%

(b) Suppose the Pound Sterling is quoted at 0.2074-80 in Frankfurt and the Euro is quoted at 4.7010-32 in London. Is there a profitable arbitrage situation ? Explain it.

Sol :

Yes, there exists a profitable arbitrage situation.

In the given problem, the dealer has to,

(i) Convert 1 Euro into pound sterling in frank-furt ie., 1 Euro for 0.2080 pound sterling

$= \dfrac{1}{0.2080}$ € 4.8077.

(ii) Convert pound sterling into Euros in London market using the Euro which are quoted at € 4.7032 ie., 1 pound sterling for 4.7032 Euros $= \dfrac{4.8077}{4.7032} = €\,1.0222$

(iii) It means the dealer used 1 Euro to buy € 4.8077 and sold the pound in London at € 1.0222. Hence the profit is (1.0222 – 1.0000) 0.222 Euros.

The profit gained by the dealer can also be determined using Bid -ask spread on in frank furt is

given as $\left[\dfrac{\text{Ask price - Bid price}}{\text{Ask Price}} \times 100 \right]$

$$= \frac{4.7032 - 4.7010}{4.7032} \times 100$$

$$= 0.00047 \times 100$$

$$= 0.047 \cong 0.05\%$$

Bid ask spread on pound in London is given as $\left[\dfrac{\text{Ask price -bid price}}{\text{Ask price}} \times 100 \right]$

$$= \frac{0.2080 - 0.2074}{0.2080} \times 100$$

$$= 0.0029 \times 100$$

$$= 0.29\%$$

<div align="center">OR</div>

7. Estimate the impact of financial market imperfections on various stakeholders of the economy.

(Unit-III, Q.No. 31)

8. Predict suitable option strategies for a continous bull market scenario and continuous bear market scenario.

Ans :

The option strategies used in a. continuous bull market scenario are,

1. **Long Call**

   In a long call option strategy, the investor has a right to buy an option at a fixed price. This is best suitable strategy for beginners.

2. **Short Put**

   In a short put option strategy, the investor has a right to sell the option at a fixed price and the vendor exercises a contract to buy option at an agreed price. .

3. **Bull Call Spread**

   This is said to be a simple strategy and suits best for beginners. This strategy involves buying a call and write it or selling the call. It involves 2 transactions to yield a debit spread.

4. **Bull Put Spread**

   This strategy yield a credit spread and is not suitable for beginners. This strategy involves buying the option with premium and sell the option with high premium.

5. **Bull Ratio Spread**

   This strategy involves buying the two. call options and one put option. This strategy yield benefits from the call transactions. It leads to either debit or credit spread.

Option Strategies for a Continuous Bear Market

The option strategies used, for a continuous bear market scenario are,

1. **Long Put**

   In this option strategy, the investor has a right to sell the option at a fixed price. This is best suitable strategy for beginners.

2. **Short Call**

   In a short call option, strategy investor has a right to buy the options at a fixed price and the vendor exercises a contract to buy the options at agreed price.

3. **Bear Call Spread**

   In this strategy, investor has to buy the option with less premium and sell the option with higher premium. This is said to be a straight forward strategy and is not suitable for beginners. It involves two transactions and yield a credit spread.

4. **Bear Ratio Spread**

Unlike bull ratio spread, in this strategy, investor has to buy two put options and one call option. This is a complicated strategy and is not suitable for beginners. It involves two transactions and may yield either debit or credit spread.

5. **Short Bear Ratio Spread**

This strategy is said to be the toughest strategy and is not suitable for beginners. It involves two transactions and creates a credit spread.

OR

9. Demonstrate the superiorityof binomial option pricing model in a certain financial situation.

(Unit-IV, Q.No. 22)

10. (a) An investor wishes to buy Euro spot (at $ 0.1080) and Sell Euro forward for 180 days (at $ 0.1086). What is the swap rate on Euro ? Also, what is the premium on 180 day Euro ?

Sol :

Given that,

Euro spot rate = $ 0.1080

180 – days Euro forward rate = $ 0.1086

(i) Swap rate = Forward rate – spot rate

= 0.1086 – 0.1080

= 0.0006

(ii) 180 – day forward premium

$$= \frac{\text{Forward rate} - \text{Spot rate}}{\text{Spot rate}} \times \frac{360}{\text{Number of days of forward contract}} \times 100$$

$$= \frac{0.1086 - 0.1080}{0.1080} \times \frac{360}{180} \times 100$$

$$= \frac{0.0006}{0.1080} \times 2 \times 100$$

$$= 0.0055 \times 2 \times 100$$

$$= 0.011 \times 100$$

$$= 0.011 \times 100$$

$$= 1.1\%$$

(b) Mr. ABC buys a Rupee put option (contract size is 2,50,000) at a premium of $ 0.01 per Rupee. If the exercise prce is $ 0.21 and spot price of the france at the date of expiration is $ 0.2016, what is Mr. ABC's profit (loss) on the put option?

Sol :

A put option can be exercised when the spot rate at expiration is less than the exercise price.

Given that,

Size of contract (N) = 2,50,000

Exercise price (S_t) = 0.21

Premium paid (P) = $ 0.01 per share

Spot price at the time of expiration (S_o) = $ 0.2016

$$\text{Profit/loss of Mr. ABC} = S_t - S_o - P$$
$$= 0.21 - 0.2016 - 0.01$$
$$= \$ - 0.0016$$

∴ Mr. ABC incurred a loss of $ 0.0016 per share

Total loss = Loss/share × Size of contract
$$= -0.0016 \times 2,50,000$$
$$= -400.$$

OR

11. Appraise of the features, advantages and limitations of swaptions over swaps.

Ans :

S.No	Basis	Swaptions	Swaps
1.	Meaning	Swaptions refers to an option to exercise an interest rate swap contract.	Swap is a contract or agreement between two parties to exchange future cash flows.
2.	Features	(i) Swaptions allow the floating-for-fixed rates payments in a currency. (ii) Swaptions maturity ranges from 1 month - 2 years on options and upto 10 years on swap. (iii) The two basic types of swaptions are payer swaption and receiver swaption. (iv) Swaption is one of the important and new risk management tool with a combination of swap and option.	(i) Swap deal are carried out by the swap facilitators. (ii) Swaps are the important OCT interest rate derivatives. (iii) The two major types of swaps are interest rate swaps and currency swaps. (iv) Swap market is a big and continuously growing market among the derivatives.
3.	Advantages	(i) Unlike swaps, by using swaptions a company can buy the currency directly if the price is less than the agreement price and uses option when currency is more than the agreement price.	(i) Swap deals involves less transaction costs.
4.	Limitations	(ii) Borrower may get disappointed regarding the value gained due to swaptions when	(ii) Swap deals lack liquidity.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M.B.A II - Year IV - Semester Examination   **R19**

MODEL PAPER - I

RISK MANAGEMENT AND FINANCIAL DERIVATIVES

Time : 3 Hours]   [Max. Marks : 75

PART - A (5 × 5 = 25 Marks)

ANSWERS

1.	(a)	What is Risk ?	**(Unit-I, S.Q.A 1)**
	(b)	Types of Credit Risk	**(Unit-II, S.Q.A 7)**
	(c)	Forward Contract	**(Unit-III, S.Q.A 1)**
	(d)	Exercise Price	**(Unit-IV, S.Q.A 6)**
	(e)	Explain different types of Swaption	**(Unit-V, S.Q.A 10)**

PART - B (5 × 10 = 50 Marks)

2. Explain the various types of Unsystematic Risk.   **(Unit-I, Q.No.6)**

(OR)

3. Explain the various risk models.   **(Unit-I, Q.No.22)**

4. Explain the Management Of Interest Rate Risk.   **(Unit-II, Q.No.8)**

(OR)

5. Consider a position consisting of a Rs. 3 lac investment in gold and
    Rs. 5 lac investment in silver suppose that the daily volatilities of these
    two assets are 1.8% and 1.2% rep., and that the coefficients of co-relation
    b/w there returns is 0.6 what is the 10 day 97.5% value at risk for the
    portfolio by how which does diversification reduce the VaR [Two Assets].

(Unit-II, Problem - 4)

6. Explain the different types of future Prices and Expectations.   **(Unit-III, Q.No.30)**

(OR)

7. Suppose an asset is currently worth $20 and the 6-month futures
    price of this asset is $22.50. By assuming the stock docs not pay any
    dividends and the risk-free interest rate is the same for all maturities,
    calculate the I-year futures price of this asset.

(Unit-III, Problem-5)

8.   What is option Contract ? Explain the features of option contract ?   **(Unit-IV, Q.No.1)**

<div align="center">(OR)</div>

9.   Assume that Tata Motors stock is currently selling for INR 750. There is a call option on Tata Motors with a maturity of 90 days and an exercise price of INR 800. The volatility in the stock price is estimated to be 22%. The risk-free rate is 8%. What will be the price of a call option that has a maturity of 90 days ?

<div align="right">**(Unit-IV, Problem-14)**</div>

10.   A ` 10 lakhs interest rate swap has a remaining life of 10 months. Under the

swap terms, six-months LIBOR is exchanged for 5% per annum (compounded annually). The average of the bid-offer rate being exchanged for six-month LIBOR in swaps of all maturities is 3% per annum. With continuous compounding. The six month LIBOR rate was 2.6% per annum two months ago. What is the current value of the swap to the party paying floating? What is the value to the party paying fixed ?

<div align="right">**(Unit-V, Problem - 1)**</div>

<div align="center">(OR)</div>

11.   Explain the mechanism of interest rate swaps using a diagram.   **(Unit-V, Q.No.10)**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M.B.A II - Year IV - Semester Examination

MODEL PAPER - II

R19

RISK MANAGEMENT AND FINANCIAL DERIVATIVES

Time : 3 Hours]   [Max. Marks : 75

PART - A (5 × 5 = 25 Marks)

ANSWERS

1. (a) What is Multi-Factor Model ?   **(Unit-I, S.Q.A 3)**

    (b) Differentiate between Value at Risk and Cash Flow at Risk.   **(Unit-II, S.Q.A 12)**

    (c) Types of Financial Futures   **(Unit-III, S.Q.A 5)**

    (d) What are the differences between American and European Options ?   **(Unit-IV, S.Q.A 2)**

    (e) Define interest rate swaps   **(Unit-V, S.Q.A 4)**

PART - B (5 × 10 = 50 Marks)

2. Explain the Impact of Risk in an on organisation.   **(Unit-I, Q.No. 9)**

(OR)

3. Outline the Process of Risk Management.   **(Unit-I, Q.No.20)**

4. Explain the various risk management tools.   **(Unit-II, Q.No.1)**

(OR)

5. ABC limited has invested 1,000 million portfolio over 2 years period at
    95% confidential level. The standard deviation of the rate of return is
    20% per annum. You are required to measure VaR (Reporting worst loss).

                                                                        (Unit-II, Problem - 1)

6. Explain the various types of Forward Contracts.   **(Unit-III, Q.No.3)**

(OR)

7. An investor wishes to enter into 10 stock index futures contracts where the
    value of a contract is $250 times the level of the index at the start of the
    contract and each index point movement represents a gain or a loss of $250
    per contract. The stock index at the start of the contract is 1,000 points and
    the initial margin deposite is 10% of the total futures contract value.

                                                                        (Unit-III, Problem-4)

8.   What is Put-Call Parity Theorem ?   **(Unit-IV, Q.No. 17)**

                                              (OR)

9.   ITC shares are selling at INR 230 on September 1. American call and
      American put options are available with expiry on October 29 with an
      exercise price of INR 250. The call is priced at INR 9.60, and the risk-free
      rate is 9%. Calculated the put price using put-call parity. The contract
      size for ITC options is 1,125.

                                                                             (Unit-IV, Problem-9)

10.   Define interest rate swaps. Explain the features of interest rate swap.   **(Unit-V, Q.No.6)**

                                              (OR)

11.   What are commodity swap? Explain the types of commodity swaps.   **(Unit-V, Q.No.20)**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M.B.A II - Year IV - Semester Examination

R19

MODEL PAPER - III

RISK MANAGEMENT AND FINANCIAL DERIVATIVES

Time : 3 Hours]   [Max. Marks : 75

PART - A (5 × 5 = 25 Marks)

ANSWERS

1.	(a) Define Risk Management	**(Unit-I, S.Q.A 6)**
	(b) Interest Rate Risk	**(Unit-II, S.Q.A 2)**
	(c) Forward exchange contract.	**(Unit-III, S.Q.A 6)**
	(d) Option contract	**(Unit-IV, S.Q.A 1)**
	(e) Swap	**(Unit-V, S.Q.A 1)**

PART - B (5 × 10 = 50 Marks)

2. Explain the rationale for risk management.   **(Unit-I, Q.No.18)**

(OR)

3. Explain the methods of handling risks.   **(Unit-I, Q.No.16)**

4. Explain the various methods used for calculating VAR.   **(Unit-II, Q.No.24)**

(OR)

5. Explain the how the firms risk is managed by measuring with the
techniques of VaR or CaR.   **(Unit-II, Q.No.32)**

6. Explain the differences between Cash and Physical Deliver?   **(Unit-III, Q.No.24)**

(OR)

7. Explain the differences between Forward Contract and Future Contract. **(Unit-III, Q.No.15)**

8. "A call option need not be exercised, its minimum value is zero".
Explain.   **(Unit-IV, Q.No.14)**

(OR)

9. Infosys slock is selling at INR 1,130 on September I. There exists a put
option on Infosys with expiry on October 29 and an exercise price of INR
1,150. It is estimated that by October 29, the Infosys price could either
increase by 6% or decrease by 4%. The risk-free rate is 8%. Calculate the
call price using the single-period binomial options pricing model.

(Unit-IV, Problem-12)

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10. What do you understand by swap? Explain its concept and nature
    in detail.   **(Unit-V, Q.No.1)**

(OR)

11. A firm wishes to enter into a fixed-fixed currency swap. The principal amount is $60 million and the firm wishes to receive a fixed rate of 7.5% in U.S. dollars. The firm will pay Japanese yen. Suppose the spot exchange rate is ¥98/$. The swap tenor is two years, and payments will be quarterly. Principal amounts will be swapped at origination and at termination. Spot interest rates on zero coupon debt instruments in the U.S. are as follows,

Years to Maturity	Interest Rate
0.25	5.25%
0.50	6.00%
0.75	6.60%
1.00	7.00%
1.25	72.5%
1.50	7.40%
1.75	7.50%
2.00	7.55%

Forward rates in Japan, defined as fr(t1, t2), where the forward period begins at time t1 and ends at time t2 are as follows,

fr(0,025) = 0.80%

fr(0.25,0.50) = 0.898%

fr(0.50,0.75) = 1.0%

fr(0.75,1.00) = 1.2%

fr(1.00,1.25) = 1.29%

fr(1.25,1.50) = 1.35%

fr(1.50,1.75) = 1.42%

fr(1.75,200) = 1.45%

Compute the fixed Japanese interest rate for the swap.   **(Unit-V, Problem-3)**