## Learning Objective
After going through the chapter student shall be able to understand:

### Fundamental Analysis
- Dividend Growth Model and the PE Multiple
- Economic Analysis
  1. Factors Affecting Economic Analysis
  2. Techniques Used in Economic Analysis
- Industry Analysis
  1. Factors Affecting Industry Analysis
  2. Techniques Used in Industry Analysis
- Company Analysis

### Technical Analysis
- General Principles and Methods of Technical Analysis
  1. The Dow Theory
  2. Market Indicators
  3. Support and Resistance Levels
  4. Interpreting Price Patterns
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### Bond Valuation
  1. Some Basics of a Bond
  2. Bond Valuation Model
  3. Bond Value Theorems
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1. Introduction

Investment decision depends on securities to be bought, held or sold. Buying security is based on highest return per unit of risk or lowest risk per unit of return. Selling security does not depend on any such requirement. A security considered for buying today may not be attractive tomorrow due to management policy changes in the company or economic policy changes adopted by the government. The reverse is also true. Therefore, analysis of the security on a continuous basis is a must.

Security Analysis involves a systematic analysis of the risk return profiles of various securities which is to help a rational investor to estimate a value for a company from all the price sensitive information/data so that he can make purchases when the market under-prices some of them and thereby earn a reasonable rate of return.

Two approaches viz. fundamental analysis and technical analysis are in vogue for carrying out Security Analysis. In fundamental analysis, factors affecting risk-return characteristics of securities are looked into while in technical analysis, demand/supply position of the securities along with prevalent share price trends are examined.

2. Fundamental Analysis

Fundamental analysis is based on the assumption that the share prices depend upon the future dividends expected by the shareholders. The present value of the future dividends can be calculated by discounting the cash flows at an appropriate discount rate and is known as the ‘intrinsic value of the share’. The intrinsic value of a share, according to a fundamental analyst, depicts the true value of a share. A share that is priced below the intrinsic value must be bought, while a share quoting above the intrinsic value must be sold.

Thus, it can be said that the price the shareholders are prepared to pay for a share is nothing but the present value of the dividends they expect to receive on the share and this is the price at which they expect to sell it in the future.

As a first step, to arrive at a compact expression, let us make a simple assumption, that the company is expected to pay a uniform dividend of \( D \) per share every year, i.e.,

\[
D(1) = D(2) = D(3) = \ldots = D,
\]

The Eq., would then become:

\[
P(0) = \frac{D}{(1+k)} + \frac{D}{(1+k)^2} + \frac{D}{(1+k)^3} + \ldots + \ldots
\]
But it is unrealistic to assume that dividends remain constant over time. In case of most shares, the dividends per share (DPS) grow because of the growth in the earnings of the firm. Most companies, as they identify new investment opportunities for growth, tend to increase their DPS over a period of time.

Let us assume that on an average the DPS of the company grows at the compounded rate of \( g \) per annum, so that dividend \( D(1) \) at the end of the first period grows to \( D(1)(1+g) \), \( D(1)(1+g)^2 \), etc., at the end of second period, third period, etc. respectively. So we must have:

\[
P(0) = \frac{D(1)}{(1+k)} + \frac{D(1)(1+g)}{(1+k)^2} + \frac{D(1)(1+g)^2}{(1+k)^3} + \ldots + \ldots (3)
\]

which is a perpetual geometric series.

If growth rate in dividends, \( g \), is less than the desired rate of return on share, \( k \), we must have:

\[
P(0) = \frac{D(1)}{(k-g)} \tag{4}
\]

or

\[
P(0) = \frac{D(0)(1+g)}{(k-g)} \tag{5}
\]

Since \( D(1) \) may be approximated as \( D(0)(1+g) \), \( D(0) \) being the DPS in the current period (0).

When growth rate in dividends, \( g \), is equal to or greater than the desired rate of return on share, \( k \), the above model is not valid, since the geometric series leads to an infinite price. The condition that \( g \) be less than \( k \) is not very restrictive, since the long-term growth in dividends is unlikely to exceed the rate of return expected by the market on the share.

The above result [Eq.(4)] is also known as Gordon’s dividend growth model for stock valuation, named after the model’s originator, Myron J. Gordon. This is one of the most well known models in the genre of fundamental analysis.

In equation (5), if “\( g \)” is set at zero, we get back equation (2).

2.1 Dividend Growth Model and the P/E Multiple: Financial analysts tend to relate price to earnings via the P/E multiples (the ratio between the market price and earnings per share).

If a company is assumed to pay out a fraction \( b \) of its earnings as dividends on an average (i.e. the Dividend Payout Ratio = \( b \)), \( D(1) \) may be expressed as \( b \) \( E(1) \), where \( E(1) \) is the earning per share (EPS) of the company at the end of the first period. Equation (4) then becomes:

\[
P(0) = \frac{bE(1)}{(k-g)} \tag{6}
\]

or
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\[
P(0) = \frac{bE(0)(1+g)}{(k-g)} \tag{7}
\]

The fundamental analysts use the above models or some of their variations, for estimating the fundamental or intrinsic price or the fundamental price-earnings multiple of a security. Towards this end, they devote considerable effort in assessing the impact of various kinds of information on a company’s future profitability and the expected return of the shareholders. If the prevailing price or the P/E multiple of a security is higher than the estimated fundamental value (i.e. if the security appears to be overpriced), they recommend a selling stance with respect to that security, since once the information becomes common knowledge, the price of the security may be expected to fall. On the other hand, if the security is under-priced in the market, the prevailing price (or the P/E multiple) of the security being lower than the estimated fundamental value, they recommend buying the security, counting upon a price rise.

Because of these inherent complex interrelationships in the production processes, the fortunes of each industry are closely tied to those of other industries and to the performance of the economy as a whole. Within an industry, the prospects of a specific company depend not only on the prospects of the industry to which it belongs, but also on its operating and competitive position within that industry. The key variables that an investor must monitor in order to carry out his fundamental analysis are economy wide factors, industry wide factors and company specific factors. In other words, fundamental analysis encompasses economic, industrial and company analyses. They are depicted by three concentric circles and constitute the different stages in an investment decision making process.

2.2 Economic Analysis: Macro-economic factors e.g. historical performance of the economy in the past/present and expectations in future, growth of different sectors of the economy in future with signs of stagnation/degradation at present to be assessed while analyzing the overall economy. Trends in peoples’ income and expenditure reflect the growth of a particular industry/company in future. Consumption affects corporate profits, dividends and share prices in the market.

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2.2.1 Factors Affecting Economic Analysis: Some of the economy wide factors are discussed as under:

(a) Growth Rates of National Income and Related Measures: For most purposes, what is important is the difference between the nominal growth rate quoted by GDP and the ‘real’ growth after taking inflation into account. The estimated growth rate of the economy would be a pointer to the prospects for the industrial sector, and therefore to the returns investors can expect from investment in shares.

(b) Growth Rates of Industrial Sector: This can be further broken down into growth rates of various industries or groups of industries if required. The growth rates in various industries are estimated based on the estimated demand for its products.

(c) Inflation: Inflation is measured in terms of either wholesale prices (the Wholesale Price Index or WPI) or retail prices (Consumer Price Index or CPI). The demand in some industries, particularly the consumer products industries, is significantly influenced by the inflation rate. Therefore, firms in these industries make continuous assessment about inflation rates likely to prevail in the near future so as to fine-tune their pricing, distribution and promotion policies to the anticipated impact of inflation on demand for their products.

(d) Monsoon: Because of the strong forward and backward linkages, monsoon is of great concern to investors in the stock market too.

2.2.2 Techniques Used in Economic Analysis: Economic analysis is used to forecast national income with its various components that have a bearing on the concerned industry and the company in particular. Gross national product (GNP) is used to measure national income as it reflects the growth rate in economic activities and has been regarded as a forecasting tool for analyzing the overall economy along with its various components during a particular period.

Some of the techniques used for economic analysis are:

(a) Anticipatory Surveys: They help investors to form an opinion about the future state of the economy. It incorporates expert opinion on construction activities, expenditure on plant and machinery, levels of inventory – all having a definite bearing on economic activities. Also future spending habits of consumers are taken into account.

In spite of valuable inputs available through this method, it has certain drawbacks:

(i) Survey results do not guarantee that intentions surveyed would materialize.

(ii) They are not regarded as forecasts per se, as there can be a consensus approach by the investor for exercising his opinion.

Continuous monitoring of this practice is called for to make this technique popular.

(b) Barometer/Indicator Approach: Various indicators are used to find out how the economy shall perform in the future. The indicators have been classified as under:

(i) Leading Indicators: They lead the economic activity in terms of their outcome. They relate to the time series data of the variables that reach high/low points in advance of economic activity.
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(ii) *Roughly Coincidental Indicators:* They reach their peaks and troughs at approximately the same in the economy.

(iii) *Lagging Indicators:* They are time series data of variables that lag behind in their consequences vis-a-vis the economy. They reach their turning points after the economy has reached its own already.

All these approaches suggest direction of change in the aggregate economic activity but nothing about its magnitude. The various measures obtained from such indicators may give conflicting signals about the future direction of the economy. To avoid this limitation, use of diffusion/composite index is suggested whereby combining several indicators into one index to measure the strength/weaknesses in the movement of a particular set of indicators. Computation of diffusion indices is no doubt difficult notwithstanding the fact it does not eliminate irregular movements.

Money supply in the economy also affects investment decisions. Rate of change in money supply in the economy affects GNP, corporate profits, interest rates and stock prices. Increase in money supply fuels inflation. As investment in stocks is considered as a hedge against inflation, stock prices go up during inflationary period.

(c) **Economic Model Building Approach:** In this approach, a precise and clear relationship between dependent and independent variables is determined. GNP model building or sectoral analysis is used in practice through the use of national accounting framework. The steps used are as follows:

(i) Hypothesize total economic demand by measuring total income (GNP) based on political stability, rate of inflation, changes in economic levels.

(ii) Forecasting the GNP by estimating levels of various components viz. consumption expenditure, gross private domestic investment, government purchases of goods/services, net exports.

(iii) After forecasting individual components of GNP, add them up to obtain the forecasted GNP.

(iv) Comparison is made of total GNP thus arrived at with that from an independent agency for the forecast of GNP and then the overall forecast is tested for consistency. This is carried out for ensuring that both the total forecast and the component wise forecast fit together in a reasonable manner.

2.3 **Industry Analysis:** When an economy grows, it is very unlikely that all industries in the economy would grow at the same rate. So it is necessary to examine industry specific factors, in addition to economy-wide factors.

First of all, an assessment has to be made regarding all the conditions and factors relating to demand of the particular product, cost structure of the industry and other economic and Government constraints on the same. Since the basic profitability of any company depends upon the economic prospects of the industry to which it belongs, an appraisal of the particular industry's prospects is essential.
2.3.1 Factors Affecting Industry Analysis: The following factors may particularly be kept in mind while assessing the factors relating to an industry.

(a) **Product Life-Cycle:** An industry usually exhibits high profitability in the initial and growth stages, medium but steady profitability in the maturity stage and a sharp decline in profitability in the last stage of growth.

(b) **Demand Supply Gap:** Excess supply reduces the profitability of the industry because of the decline in the unit price realization, while insufficient supply tends to improve the profitability because of higher unit price realization.

(c) **Barriers to Entry:** Any industry with high profitability would attract fresh investments. The potential entrants to the industry, however, face different types of barriers to entry. Some of these barriers are innate to the product and the technology of production, while other barriers are created by existing firms in the industry.

(d) **Government Attitude:** The attitude of the government towards an industry is a crucial determinant of its prospects.

(e) **State of Competition in the Industry:** Factors to be noted are- firms with leadership capability and the nature of competition amongst them in foreign and domestic market, type of products manufactured viz. homogeneous or highly differentiated, demand prospects through classification viz customer-wise/area-wise, changes in demand patterns in the long/immediate/short run, type of industry the firm is placed viz. growth, cyclical, defensive or decline.

(f) **Cost Conditions and Profitability:** The price of a share depends on its return, which in turn depends on profitability of the firm. Profitability depends on the state of competition in the industry, cost control measures adopted by its units and growth in demand for its products.

Factors to be considered are:

(i) Cost allocation among various heads e.g. raw material, labors and overheads and their controllability. Overhead cost for some may be higher while for others labour may be so. Labour cost which depends on wage level and productivity needs close scrutiny.

(ii) Product price.

(iii) Production capacity in terms of installation, idle and operating.

(iv) Level of capital expenditure required for maintenance / increase in productive efficiency.

Investors are required to make a thorough analysis of profitability. This is carried out by the study of certain ratios such as G.P. Ratio, Operating Profit Margin Ratio, R.O.E., Return on Total Capital etc.

(g) **Technology and Research:** They play a vital role in the growth and survival of a particular industry. Technology is subject to change very fast leading to obsolescence. Industries which update themselves have a competitive advantage over others in terms of quality, price etc.

Things to be probed in this regard are:

(i) Nature and type of technology used.
(ii) Expected changes in technology for new products leading to increase in sales.

(iii) Relationship of capital expenditure and sales over time. More capital expenditure means increase in sales.

(iv) Money spent in research and development. Whether this amount relates to redundancy or not?

(v) Assessment of industry in terms of sales and profitability in short, immediate and long run.

2.3.2 Techniques Used in Industry Analysis: The techniques used for analyzing the industry wide factors are:

(a) Regression Analysis: Investor diagnoses the factors determining the demand for output of the industry through product demand analysis. Factors to be considered are GNP, disposable income, per capita consumption / income, price elasticity of demand. For identifying factors affecting demand, statistical techniques like regression analysis and correlation are used.

(b) Input – Output Analysis: It reflects the flow of goods and services through the economy, intermediate steps in production process as goods proceed from raw material stage through final consumption. This is carried out to detect changing patterns/trends indicating growth/decline of industries.

2.4 Company Analysis: Economic and industry framework provides the investor with proper background against which shares of a particular company are purchased. This requires careful examination of the company's quantitative and qualitative fundamentals.

(a) Net Worth and Book Value: Net Worth is sum of equity share capital and free reserves less intangible assets and any carry forward of losses. The total net worth divided by the number of shares is the much talked about book value of a share. Though the book value is often seen as an indication of the intrinsic worth of the share, this may not be so for two major reasons. First, the market price of the share reflects the future earnings potential of the firm which may have no relationship with the value of its assets. Second, the book value is based upon the historical costs of the assets of the firm and these may be gross underestimates of the cost of the replacement or resale values of these assets.

(b) Sources and Uses of Funds: The identification of sources and uses of funds is known as Funds Flow Analysis.

One of the major uses of funds flow analysis is to find out whether the firm has used short-term sources of funds to finance long-term investments. Such methods of financing increases the risk of liquidity crunch for the firm, as long-term investments, because of the gestation period involved may not generate enough surplus in time to meet the short-term liabilities incurred by the firm. Many a firm has come to grief because of this mismatch between the maturity periods of sources and uses of funds.

(c) Cross-Sectional and Time Series Analysis: One of the main purposes of examining financial statements is to compare two firms, compare a firm against some benchmark figures for its industry and to analyse the performance of a firm over time. The techniques that are
used to do such proper comparative analysis are: common-sized statement, and financial ratio analysis.

(d) Size and Ranking: A rough idea regarding the size and ranking of the company within the economy, in general, and the industry, in particular, would help the investment manager in assessing the risk associated with the company. In this regard the net capital employed, the net profits, the return on investment and the sales figures of the company under consideration may be compared with similar data of other companies in the same industry group. It may also be useful to assess the position of the company in terms of technical know-how, research and development activity and price leadership.

(e) Growth Record: The growth in sales, net income, net capital employed and earnings per share of the company in the past few years should be examined. The following three growth indicators may be particularly looked into: (a) Price earnings ratio, (b) Percentage growth rate of earnings per annum, and (c) Percentage growth rate of net block.

The price earnings ratio is an important indicator for the investment manager since it shows the number of times the earnings per share are covered by the market price of a share. Theoretically, this ratio should be the same for two companies with similar features. However, this is not so in practice due to many factors. Hence, by a comparison of this ratio pertaining to different companies the investment manager can have an idea about the image of the company and can determine whether the share is under-priced or over-priced.

Consider the following example:

<table>
<thead>
<tr>
<th></th>
<th>Company A</th>
<th>Company B</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) Market price of share of ₹</td>
<td>150</td>
<td>250</td>
</tr>
<tr>
<td>(b) Earnings per share</td>
<td>25</td>
<td>25</td>
</tr>
<tr>
<td>(c) Price earnings ratio [ (a) ÷ (b) ]</td>
<td>6</td>
<td>10</td>
</tr>
</tbody>
</table>

It is obvious that the purchaser of company A’s shares pays 6 times its annual earnings while the purchaser of company B's shares pays 10 times. If other factors (intrinsic value of share, growth potential, etc.) are quite similar, it is obvious that the shares of company A are preferable. In practice, however, the other factors are never similar in the case of two companies. The investment manager must try to ascertain why the EPS in company B is comparatively low – may be some factors are not apparent. EPS calculation cannot be the sole basis of deciding about an investment. Yet it is one of the most important factors on the basis of which the investment manager takes a decision to purchase the shares. This is because it relates the market price of the shares and the earnings per share.

The percentage growth rate of net blocks shows how the company has been developing its capacity levels. Obviously, a dynamic company will keep on expanding its capacities and diversify its business. This will enable it to enter new and profitable lines and avoid stagnation in its growth.

In this context, an evaluation of future growth prospects of the company should be carefully made. This requires an analysis of existing capacities and their utilisation, proposed expansion and diversification plans and the nature of the company's technology. The existing
capacity utilisation levels can be known from the quantitative information given in the published profit and loss accounts of the company. The plans of the company, in terms of expansion or diversification, can be known from the Directors’ Reports, the Chairman’s statements and from the future capital commitments as shown by way of notes in the balance sheets. The nature of technology of a company should be seen with reference to technological developments in the concerned fields, the possibility of its product being superseded or the possibility of emergence of a more effective method of manufacturing.

Growth is the single most important factor in company analysis for the purpose of investment management. A company may have a good record of profits and performance in the past; but if it does not have growth potential, its shares cannot be rated high from the investment point of view.

(f) Financial Analysis: An analysis of its financial statements for the past few years would help the investment manager in understanding the financial solvency and liquidity, the efficiency with which the funds are used, the profitability, the operating efficiency and the financial and operating leverages of the company. For this purpose, certain fundamental ratios have to be calculated.

From the investment point of view, the most important figures are earnings per share, price earning ratios, yield, book value and the intrinsic value of the share. These five elements may be calculated for the past 10 years or so and compared with similar ratios computed from the financial accounts of other companies in the industry and with the average ratios for the industry as a whole. The yield and the asset backing of a share are important considerations in a decision regarding whether the particular market price of the share is proper or not.

Various other ratios to measure profitability, operating efficiency and turnover efficiency of the company may also be calculated. The return on owners’ investment, capital turnover ratio and the cost structure ratios may also be worked out.

To examine the financial solvency or liquidity of the company, the investment manager may work out current ratio, liquidity ratio, debt-equity ratio, etc. These ratios will provide an overall view of the company to the investment analyst. He can analyse its strengths and weaknesses and see whether it is worth the risk or not.

(g) Quality of Management: This is an intangible factor. Yet it has a very important bearing on the value of the shares. Every investment manager knows that the shares of certain business houses command a higher premium than those of similar companies managed by other business houses. This is because of the quality of management, the confidence that investors have in a particular business house, its policy vis-a-vis its relationship with the investors, dividend and financial performance record of other companies in the same group, etc. This is perhaps the reason that an investment manager always gives a close look to the management of a company in whose shares he is to invest. Quality of management has to be seen with reference to the experience, skills and integrity of the persons at the helm of affairs of the company. The policy of the management regarding relationship with the shareholders is an important factor since certain business houses believe in very generous dividend and bonus distributions while others are rather conservative.
(h) **Location and Labour-Management Relations:** The locations of the company’s manufacturing facilities determines its economic viability which depends on the availability of crucial inputs like power, skilled labour and raw-materials, etc. Nearness to markets is also a factor to be considered.

In the past few years, the investment manager has begun looking into the state of labour-management relations in the company under consideration and the area where it is located.

(i) **Pattern of Existing Stock Holding:** An analysis of the pattern of existing stock holdings of the company would also be relevant. This would show the stake of various parties in the company. An interesting case in this regard is that of the Punjab National Bank in which the Life Insurance Corporation and other financial institutions had substantial holdings. When the bank was nationalised, the residual company proposed a scheme whereby those shareholders, who wish to opt out, could receive a certain amount as compensation in cash. It was only at the instance and the bargaining strength, of institutional investors that the compensation offered to the shareholders, who wished to opt out of the company, was raised considerably.

(j) **Marketability of the Shares:** Another important consideration for an investment manager is the marketability of the shares of the company. Mere listing of a share on the stock exchange does not automatically mean that the share can be sold or purchased at will. There are many shares which remain inactive for long periods with no transactions being effected. To purchase or sell such scrips is a difficult task. In this regard, dispersal of shareholding with special reference to the extent of public holding should be seen. The other relevant factors are the speculative interest in the particular scrip, the particular stock exchange where it is traded and the volume of trading.

2.4.1 **Techniques Used in Company Analysis:** Through the use of statistical techniques the company wide factors can be analysed. Some of the techniques are discussed as under:

(a) **Correlation & Regression Analysis:** Simple regression is used when inter relationship covers two variables. For more than two variables, multiple regression analysis is followed. Here the inter relationship between variables belonging to economy, industry and company are found out. The main advantage in such analysis is the determination of the forecasted values along with testing the reliability of the estimates.

(b) **Trend Analysis:** The relationship of one variable is tested over time using regression analysis. It gives an insight to the historical behavior of the variable.

(c) **Decision Tree Analysis:** Information relating to the probability of occurrence of the forecasted value is considered useful. A range of values of the variable with probabilities of occurrence of each value is taken up. The limitations are reduced through decision tree analysis and use of simulation techniques.
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In decision tree analysis, the decision is taken sequentially with probabilities attached to each sequence. To obtain the probability of final outcome, various sequential decisions given along with probabilities, their probabilities of each sequence is to be multiplied and them summed up.

Thus, fundamental analysis is basically an examination of the economic and financial aspects of a company with the aim of estimating future earnings and dividend prospects. It includes an analysis of the macro-economic and political factors which will have an impact on the performance of the company. After having analysed all the relevant information about the company and its relative strength vis-a-vis other companies in the industry, the investor is expected to decide whether he should buy or sell the securities.

Apart from these, the Group Analysis has also become an important factor. SEBI, in particular, emphasizes the need for disclosure, in public offer documents, of all relevant parameters—especially the financial health and promise versus performance of the group companies. RBI has also been focusing more and more on the Group Exposure Norms of commercial Banks.

3. Technical Analysis

Technical Analysis is a method of share price movements based on a study of price graphs or charts on the assumption that share price trends are repetitive, that since investor psychology follows a certain pattern, what is seen to have happened before is likely to be repeated. The technical analyst is concerned with the fundamental strength or weakness of a company or an industry; he studies investor and price behaviour.

A technical analyst attempts precisely that. The two basic questions that he seeks to answer are: (i) Is there a discernible trend in the prices? (ii) If there is, then are there indications that the trend would reverse? The methods used to answer these questions are visual and statistical. The visual methods are based on examination of a variety of charts to make out patterns, while the statistical procedures analyse price and return data to make trading decisions.

Technical analysts use three types of charts for analyzing data. They are:

(i) Bar Chart: In a bar chart, the highest price, the lowest price and the closing price of each day are shown on a daily basis. The highest and lowest price of a particular day has been shown through a vertical line on the bar chart. The highest price of the day is shown on the top of the bar chart. And, the lowest price of the day is shown on the bottom of the bar chart. Moreover, closing price of the day is visible in the form of a small horizontal hash on the right hand side of the bar. Also, opening price is shown as a hash on the left side of the bar chart. The bar chart has been explained in the following diagram as depicted below:
(ii) **Line Chart:** In a line chart, lines are used to connect successive day's prices. The closing price for each period is plotted as a point. These points are joined by a line to form the chart. The period may be a day, a week or a month.

(iii) **Point and Figure Chart:** Point and Figure charts are more complex than line or bar charts. They are used to detect reversals in a trend. For plotting a point and figure chart, we have to first decide the box size and the reversal criterion. The box size is the value of each box on the chart, for example each box could be Re.1, ₹ 2 or ₹ 0.50. The smaller the box size, the more sensitive would the chart be to price change. The reversal criterion is the number of boxes required to be retraced to record prices in the next column in the opposite direction.
### 3.1 General Principles and Methods of Technical Analysis

#### 3.1.1 The Dow Theory:
The Dow Theory is one of the oldest and most famous technical theories. It was originated by Charles Dow, the founder of Dow Jones Company in late nineteenth century. It is a helpful tool for determining the relative strength of the stock market. It can also be used as a barometer of business.

The Dow Theory is based upon the movements of two indices, constructed by Charles Dow, Dow Jones Industrial Average (DJIA) and Dow Jones Transportation Average (DJTA). These averages reflect the aggregate impact of all kinds of information on the market. The movements of the market are divided into three classifications, all going at the same time; the primary movement, the secondary movement, and the daily fluctuations. The primary movement is the main trend of the market, which lasts from one year to 36 months or longer. This trend is commonly called bear or bull market. The secondary movement of the market is shorter in duration than the primary movement and is opposite in direction. It lasts from two weeks to a month or more. The daily fluctuations are the narrow movements from day-to-day. These fluctuations are not part of the Dow Theory interpretation of the stock market. However, daily movements must be carefully studied, along with primary and secondary movements, as they go to make up the longer movement in the market.

Thus, the Dow Theory’s purpose is to determine where the market is and where is it going, although not how far or high. The theory, in practice, states that if the cyclical swings of the stock market averages are successively higher and the successive lows are higher, then the market trend is up and a bullish market exists. On the contrary, if the successive highs and successive lows are lower, then the direction of the market is down and a bearish market exists.

Charles Dow proposed that the primary uptrend would have three moves up, the first one being caused by accumulation of shares by the far-sighted, knowledgeable investors, the second move would be caused by the arrival of the first reports of good earnings by
corporations, and the last move up would be caused by widespread report of financial well-being of corporations. The third stage would also see rampant speculation in the market. Towards the end of the third stage, the far-sighted investors, realizing that the high earnings levels may not be sustained, would start selling, starting the first move down of a downtrend, and as the non-sustainability of high earnings is confirmed, the second move down would be initiated and then the third move down would result from distress selling in the market.

3.1.2 Market Indicators

(i) **Breadth Index**: It is an index that covers all securities traded. It is computed by dividing the net advances or declines in the market by the number of issues traded. The breadth index either supports or contradicts the movement of the Dow Jones Averages. If it supports the movement of the Dow Jones Averages, this is considered sign of technical strength and if it does not support the averages, it is a sign of technical weakness i.e. a sign that the market will move in a direction opposite to the Dow Jones Averages. The breadth index is an addition to the Dow Theory and the movement of the Dow Jones Averages.

(ii) **Volume of Transactions**: The volume of shares traded in the market provides useful clues on how the market would behave in the near future. A rising index/price with increasing volume would signal buy behaviour because the situation reflects an unsatisfied demand in the market. Similarly, a falling market with increasing volume signals a bear market and the prices would be expected to fall further. A rising market with decreasing volume indicates a bull market while a falling market with dwindling volume indicates a bear market. Thus, the volume concept is best used with another market indicator, such as the Dow Theory.

(iii) **Confidence Index**: It is supposed to reveal how willing the investors are to take a chance in the market. It is the ratio of high-grade bond yields to low-grade bond yields. It is used by market analysts as a method of trading or timing the purchase and sale of stock, and also, as a forecasting device to determine the turning points of the market. A rising confidence index is expected to precede a rising stock market, and a fall in the index is expected to precede a drop in stock prices. A fall in the confidence index represents the fact that low-grade bond yields are rising faster or falling more slowly than high grade yields. The confidence index is usually, but not always a leading indicator of the market. Therefore, it should be used in conjunction with other market indicators.

(iv) **Relative Strength Analysis**: The relative strength concept suggests that the prices of some securities rise relatively faster in a bull market or decline more slowly in a bear market than other securities i.e. some securities exhibit relative strength. Investors will earn higher returns by investing in securities which have demonstrated relative strength in the past because the relative strength of a security tends to remain undiminished over time.

Relative strength can be measured in several ways. Calculating rates of return and classifying those securities with historically high average returns as securities with high relative strength is one of them. Even ratios like security relative to its industry and security relative to the entire market can also be used to detect relative strength in a security or an industry.

(v) **Odd - Lot Theory**: This theory is a contrary-opinion theory. It assumes that the average person is usually wrong and that a wise course of action is to pursue strategies contrary to
Popular opinion. The odd-lot theory is used primarily to predict tops in bull markets, but also to predict reversals in individual securities.

3.1.3 Support and Resistance Levels: When the index/price goes down from a peak, the peak becomes the resistance level. When the index/price rebounds after reaching a trough subsequently, the lowest value reached becomes the support level. The price is then expected to move between these two levels. Whenever the price approaches the resistance level, there is a selling pressure because all investors who failed to sell at the high would be keen to liquidate, while whenever the price approaches the support level, there is a buying pressure as all those investors who failed to buy at the lowest price would like to purchase the share. A breach of these levels indicates a distinct departure from status quo, and an attempt to set newer levels. Let us get a better understanding about these levels by using price data for about two months for shares of companies A and B given in the following Table:

<table>
<thead>
<tr>
<th>Date</th>
<th>A</th>
<th>B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dec. 1, 2005</td>
<td>177</td>
<td>177</td>
</tr>
<tr>
<td>5</td>
<td>171</td>
<td>171.5</td>
</tr>
<tr>
<td>7</td>
<td>172</td>
<td>175.5</td>
</tr>
<tr>
<td>12</td>
<td>174</td>
<td>177</td>
</tr>
<tr>
<td>13</td>
<td>177.5</td>
<td>181</td>
</tr>
<tr>
<td>14</td>
<td>181</td>
<td>184</td>
</tr>
<tr>
<td>15</td>
<td>180</td>
<td>186.5</td>
</tr>
<tr>
<td>18</td>
<td>163</td>
<td>176</td>
</tr>
<tr>
<td>19</td>
<td>142</td>
<td>162.5</td>
</tr>
<tr>
<td>20</td>
<td>127</td>
<td>156</td>
</tr>
<tr>
<td>22</td>
<td>123</td>
<td>147</td>
</tr>
<tr>
<td>25</td>
<td>124</td>
<td>147</td>
</tr>
<tr>
<td>Jan. 3, 2006</td>
<td>107.5</td>
<td>137.5</td>
</tr>
<tr>
<td>4</td>
<td>97.5</td>
<td>140</td>
</tr>
<tr>
<td>8</td>
<td>105</td>
<td>145</td>
</tr>
<tr>
<td>10</td>
<td>102.5</td>
<td>143.75</td>
</tr>
<tr>
<td>12</td>
<td>108.75</td>
<td>150</td>
</tr>
<tr>
<td>15</td>
<td>100</td>
<td>142.5</td>
</tr>
<tr>
<td>25</td>
<td>95</td>
<td>135</td>
</tr>
<tr>
<td>26</td>
<td>91.25</td>
<td>133.75</td>
</tr>
<tr>
<td>Feb. 1</td>
<td>97.5</td>
<td>138.75</td>
</tr>
<tr>
<td>2</td>
<td>106.25</td>
<td>147.5</td>
</tr>
<tr>
<td>5</td>
<td>113.75</td>
<td>152.5</td>
</tr>
</tbody>
</table>
The line charts for Company A and Company B shares are shown in the graph below. From the charts, it appears that the support level and resistance level for Company A at that time were about ₹ 100 and ₹ 125, while these levels for Company B were ₹ 140 and ₹ 160.

<table>
<thead>
<tr>
<th></th>
<th>Company A</th>
<th>Company B</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>120</td>
<td>155</td>
</tr>
<tr>
<td>7</td>
<td>120</td>
<td>152.5</td>
</tr>
<tr>
<td>8</td>
<td>113.75</td>
<td>150</td>
</tr>
<tr>
<td>9</td>
<td>113.75</td>
<td>147.5</td>
</tr>
</tbody>
</table>

3.1.4 Interpreting Price Patterns: There are numerous price patterns documented by technical analysts but only a few and important of them have been discussed here:

(a) Channel: A series of uniformly changing tops and bottoms gives rise to a channel formation. A downward sloping channel would indicate declining prices and an upward sloping channel would imply rising prices.

(b) Wedge: A wedge is formed when the tops (resistance levels) and bottoms (support levels) change in opposite direction (that is, if the tops, are decreasing then the bottoms are increasing and vice versa), or when they are changing in the same direction at different rates over time.
(c) Head and Shoulders: It is a distorted drawing of a human form, with a large lump (for head) in the middle of two smaller humps (for shoulders). This is perhaps the single most important pattern to indicate a reversal of price trend. The neckline of the pattern is formed by joining points where the head and the shoulders meet. The price movement after the formation of the second shoulder is crucial. If the price goes below the neckline, then a drop in price is indicated, with the drop expected to be equal to the distance between the top of the head and the neckline.

(i) Head and Shoulder Top Pattern: This has a left shoulder, a head and a right shoulder. Such formation represents bearish development. If the price falls below the neck line (line drawn tangentially to the left and right shoulders) a price decline is expected. Hence it’s a signal to sell.

(ii) Inverse Head and Shoulder Pattern: As the name indicates this formation, it is an inverse of head and shoulder top formation. Hence it reflects a bullish development. The price rise to above the neck line suggests price rise is imminent and a signal to purchase.
(d) **Triangle or Coil Formation**: This formation represents a pattern of uncertainty and is difficult to predict which way the price will break out.

(e) **Flags and Pennants Form**: This form signifies a phase after which the previous price trend is likely to continue.

![Triangle or Coil](image1)

![Flag & Pennant](image2)

(f) **Double Top Form**: This form represents a bearish development, signals that price is expected to fall.

(g) **Double Bottom Form**: This form represents bullish development signaling price is expected to rise.

![Double Top](image3)

![Double Bottom](image4)

(h) **Gap**: A gap is the difference between the opening price on a trading day and the closing price of the previous trading day. The wider the gap the stronger the signal for a continuation of the observed trend. On a rising market, if the opening price is considerably higher than the
previous closing price, it indicates that investors are willing to pay a much higher price to acquire the scrip. Similarly, a gap in a falling market is an indicator of extreme selling pressure.

3.1.5 Decision Using Data Analysis: Technical analysts have developed rules based on simple statistical analysis of price data. Moving Averages is one of the more popular methods of data analysis for decision making.

(a) Moving Averages: Moving averages are frequently plotted with prices to make buy and sell decisions. The two types of moving averages used by chartists are the Arithmetic Moving Average (AMA) and the Exponential Moving Average (EMA). An $n$-period AMA, at period $t$, is nothing but the simple average of the last $n$ period prices.

$$\text{AMA}_{n,t} = \frac{1}{n}[P_t + P_{t-1} + \ldots + P_{t-(n-1)}]$$

To identify trend, technical analysts use moving average analysis:

(i) A 200 day’s moving average of daily prices or a 30 week moving of weekly price for identifying a long term trend.
(ii) A 60 day’s moving average of daily price to discern an intermediate term trend.
(iii) A 10 day’s moving average of daily price to detect a short term trend.

For example Moving Average is calculated by considering the most recent observation for which the closing price of a stock on ‘10’ successive trading days are taken into account for the calculation of a 5-day moving average of daily closing prices.

<table>
<thead>
<tr>
<th>Trading day</th>
<th>Closing prices</th>
<th>Sum of 5 most recent closing price</th>
<th>Two-item Centred Total</th>
<th>Moving Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>25.00</td>
<td>126.00</td>
<td>255.00</td>
<td>25.50</td>
</tr>
<tr>
<td>2</td>
<td>26.00</td>
<td>128.00</td>
<td>256.50</td>
<td>25.65</td>
</tr>
<tr>
<td>3</td>
<td>25.50</td>
<td>128.50</td>
<td>258.00</td>
<td>25.80</td>
</tr>
<tr>
<td>4</td>
<td>24.50</td>
<td>131.00</td>
<td>260.50</td>
<td>26.05</td>
</tr>
<tr>
<td>5</td>
<td>26.00</td>
<td>132.00</td>
<td>263.00</td>
<td>26.30</td>
</tr>
<tr>
<td>6</td>
<td>26.00</td>
<td>132.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>26.50</td>
<td>132.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>26.50</td>
<td>132.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>26.00</td>
<td>132.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>27.00</td>
<td>132.00</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Buy and Sell Signals Provided by Moving Average Analysis

<table>
<thead>
<tr>
<th>Buy Signal</th>
<th>Sell Signal</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) Stock price line rise through the moving average line when graph of the moving average line is flattering out.</td>
<td>(a) Stock price line falls through moving average line when graph of the moving average line is flattering out.</td>
</tr>
<tr>
<td>(b) Stock price line falls below moving average line which is rising.</td>
<td>(b) Stock price line rises above moving average line which is falling.</td>
</tr>
<tr>
<td>(c) Stock price line which is above moving average line falls but begins to rise again before reaching the moving average line.</td>
<td>(c) Stock price line which is slow moving average line rises but begins to fall again before reaching the moving average line.</td>
</tr>
</tbody>
</table>

(b) **Exponential Moving Average**: Unlike the AMA, which assigns equal weight of $1/n$ to each of the $n$ prices used for computing the average, the Exponential Moving Average (EMA) assigns decreasing weights, with the highest weight being assigned to the latest price. The weights decrease exponentially, according to a scheme specified by the exponential smoothing constant, also known as the exponent, $a$.

$$EMA_t = aP_t + (1-a)(EMA_{t-1})$$

Where, $a$ (exponent) = $\frac{2}{n+1}$

$P_t$ = Price of today

$EMA_{t-1}$ = Previous day’s EMA

Or

$$EMA_t = (Closing\ Price \ of \ the \ day - EMA \ of \ Previous \ Day) \times Exponent + Previous \ day \ EMA$$

**Illustration 1**

*Closing values of BSE Sensex from 6th to 17th day of the month of January of the year 200X were as follows:*

<table>
<thead>
<tr>
<th>Days</th>
<th>Date</th>
<th>Day</th>
<th>Sensex</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>6</td>
<td>THU</td>
<td>14522</td>
</tr>
<tr>
<td>2</td>
<td>7</td>
<td>FRI</td>
<td>14925</td>
</tr>
<tr>
<td>3</td>
<td>8</td>
<td>SAT</td>
<td>No Trading</td>
</tr>
<tr>
<td>4</td>
<td>9</td>
<td>SUN</td>
<td>No Trading</td>
</tr>
<tr>
<td>5</td>
<td>10</td>
<td>MON</td>
<td>15222</td>
</tr>
<tr>
<td>6</td>
<td>11</td>
<td>TUE</td>
<td>16000</td>
</tr>
<tr>
<td>7</td>
<td>12</td>
<td>WED</td>
<td>16400</td>
</tr>
</tbody>
</table>

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<table>
<thead>
<tr>
<th>Date</th>
<th>Sensex</th>
<th>EMA for Previous day</th>
<th>1-2</th>
<th>3×0.062</th>
<th>EMA</th>
<th>2 + 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>14522</td>
<td>15000</td>
<td>(478)</td>
<td>(29.636)</td>
<td>14970.364</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>14925</td>
<td>14970.364</td>
<td>(45.364)</td>
<td>(2.812)</td>
<td>14967.55</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>15222</td>
<td>14967.55</td>
<td>254.45</td>
<td>15.776</td>
<td>14983.32</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>16000</td>
<td>14983.32</td>
<td>1016.68</td>
<td>63.034</td>
<td>15046.354</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>16400</td>
<td>15046.354</td>
<td>1353.646</td>
<td>83.926</td>
<td>15130.28</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>17000</td>
<td>15130.28</td>
<td>1869.72</td>
<td>115.922</td>
<td>15246.203</td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>18000</td>
<td>15246.203</td>
<td>2753.797</td>
<td>170.735</td>
<td>15416.938</td>
<td></td>
</tr>
</tbody>
</table>

Conclusion – The market is bullish. The market is likely to remain bullish for short term to medium term if other factors remain the same. On the basis of this indicator (EMA) the investors/brokers can take long position.

3.2 Evaluation of Technical Analysis: Technical Analysis has several supporters as well several critics. The advocates of technical analysis offer the following interrelated argument in their favour:

(a) Under influence of crowd psychology trend persist for some time. Tools of technical analysis help in identifying these trends early and help in investment decision making.

(b) Shift in demand and supply are gradual rather then instantaneous. Technical analysis helps in detecting this shift rather early and hence provides clues to future price movements.

(c) Fundamental information about a company is observed and assimilated by the market over a period of time. Hence price movement tends to continue more or less in same direction till the information is fully assimilated in the stock price.

Detractors of technical analysis believe that it is an useless exercise; their arguments are as follows:

(a) Most technical analysts are not able to offer a convincing explanation for the tools employed by them.
(b) Empirical evidence in support of random walk hypothesis cast its shadow over the usefulness of technical analysis.

(c) By the time an up trend and down trend may have been signalled by technical analysis it may already have taken place.

(d) Ultimately technical analysis must be self defeating proposition. With more and more people employing it, the value of such analysis tends to decline.

In a nutshell, it may be concluded that in a rational, well ordered and efficient market, technical analysis may not work very well. However with imperfection, inefficiency and irrationalities that characterizes the real world market, technical analysis may be helpful. If technical analysis is used in conjunction with fundamental analysis, it might be useful in providing proper guidance to investment decision makers.

4. Bond Valuation

A bond or debenture is an instrument of debt issued by a business or government.

4.1 Some Basics of a Bond

(a) Par Value: Value stated on the face of the bond. It is the amount a firm borrows and promises to repay at the time of maturity.

(b) Coupon Rate and Frequency of Payment: A bond carries a specific interest rate known as the coupon rate. The interest payable to the bond holder is par value of the bond × coupon rate. If, the annual interest payable on a bond with a par value of ₹ 100 and a coupon rate of 13.5 percent is ₹ 13.50 (₹ 100 × 13.5 per cent). The frequency of payment of interest also needs to be specified (e.g. payable annually, semi annually, quarterly or monthly)

(c) Maturity Period: Corporate bonds have a maturity period of 3 to 10 years, while government bonds can have maturity periods extending up to 30 years.

(d) Redemption: Bullet i.e. one shot repayment of principal (it could be in installments as well) at par (could be at some premium also)

4.2 Bond Valuation Model: The holder of a bond receives a fixed annual interest payment for a certain number of years and a fixed principal repayment (equal to par value) at the time of maturity. So the value of a bond is:

\[
V = \sum_{t=1}^{n} \frac{I}{(1+k)^{t}} + \frac{F}{(1+k)^{n}} = I(PVIFA_{k,n}) + F(PVIF_{k,n})
\]

Where,

\[
V = \text{value of the bond}
\]

\[
I = \text{annual interest payable on the bond, assuming annual interest payments}
\]

\[
F = \text{principal amount (par value) of the bond repayable at the time of maturity,}
\]
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assuming bullet redemption at par.

\[ n = \text{maturity period of the bond.} \]

Illustration 2

A ₹ 1,000 par value bond bearing a coupon rate of 14 per cent matures after 5 years, the required rate of return on this bond is 13 per cent. Calculate the value of the bond.

Solution

The value of the bond is

\[
V = \text{₹ 140} \times (PVIFA_{13\%,\ 5\ yrs}) + \text{₹ 1,000} \times (PVIF_{13\%,\ 5\ yrs})
\]

\[
= \text{₹ 140} \times (3.517) + \text{₹ 1,000} \times (0.543)
\]

\[
= \text{₹ 1,035.4}
\]

4.3 Bond Value Theorems: Some Basic Rules which should be remembered with regard to Bonds are:

(a) When the required rate of return equals the coupon rate, the bond sells at par value.

(b) When the required rate of return exceeds the coupon rate, the bond sells at a discount. The discount declines as maturity approaches.

(c) When the required rate of return is less than the coupon rate, the bond sells at a premium. The premium declines as maturity approaches.

(d) The longer the maturity of a bond, the greater is its price change with a given change in the required rate of return.

4.4 Yield to Maturity: If the market price of a ₹ 1,000 par value bond, carrying a coupon rate of 9 per cent and maturing after 8 years with a bullet redemption at par, is ₹ 800. What would be the rate of return, if one buys the bond and holds it till its maturity? The rate of return one earns is called the Yield to Maturity (YTM). The YTM is defined as that value of the discount rate (\(k_d\)) for which the Intrinsic Value of the Bond equals its Market Price (Note the similarity between YTM of a Bond and IRR of a Project). If we ignore the issue related expenses, \(k_d\) equals the relevant cost of (debt) capital for the company.

\[
= \text{₹ 90} \times (PVIFA_{k_d,\ 8\ yrs}) + \text{₹ 1,000} \times (PVIF_{k_d,\ 8\ yrs})
\]

To find the value of \(k_d\), several values of \(k_d\) are considered till the right value is obtained. With a discount rate of 12 percent and putting a value of 12 per cent for \(k_d\) the right-hand side becomes

\[
= \text{₹ 90} \times (PVIFA_{12\%,\ 8\ yrs}) + \text{₹ 1,000} \times (PVIF_{12\%,\ 8\ yrs}) = \text{₹ 90} \times (4.968) + \text{₹ 1,000} \times (0.404) = \text{₹ 851.00}
\]

Since this value is greater than ₹ 800 a higher value for \(k_d\) is opted. Let \(k_d = 14\) per cent so that

\[
= \text{₹ 90} \times (PVIFA_{14\%,\ 8\ yrs}) + \text{₹ 1,000} \times (PVIF_{14\%,\ 8\ yrs}) = \text{₹ 90} \times (4.639) + \text{₹ 1,000} \times (0.351) = \text{₹ 768.10}
\]

Since this value is less than ₹ 800 a lower value for \(k_d\) is used. Let us try \(k_d = 13\) per cent.
\[
90(\text{PVIFA}_{13\%,8\text{yrs}}) + 1,000 (\text{PVIF}_{13\%,8\text{yrs}}) = 90 (4.800) + 1,000(0.376) = 808
\]
Thus \(k_d\) lies between 13 per cent and 14 per cent. Using linear interpolation in the range of 13 percent to 14 percent, \(k_d\) is equal to 13.2 per cent.

\[
\frac{13\% + (14\% - 13\%) \times \frac{808 - 800}{808 - 768.1}}{100.046 - 90} = 13.2\%
\]

**Illustration 3**

*If the price per bond is \(\text{Rs} 90\) and the bond has a par value of \(\text{Rs} 100\), a coupon rate of 14 per cent, and a maturity period of 6 years, calculate its yield to maturity.*

**Solution**

\[
90 = \sum_{t=1}^{6} \frac{14}{(1+k_{d})^t} + \frac{100}{(1+k_{d})^6} = 14(\text{PVIFA}_{k_d,6\text{yrs}}) + 100(\text{PVIF}_{k_d,6\text{yrs}})
\]

To find the value of \(kd\), several values of \(kd\) are considered till the right value is obtained. With a discount rate of 14 percent and putting a value of 14 per cent for \(kd\) the right-hand side becomes \(14 (\text{PVIFA}_{14\%, 6\text{yrs}}) + 100 (\text{PVIF}_{14\%, 6\text{yrs}}) = 14 (3.889) + 100(0.456) = 100.046\)

Since this value is greater than \(\text{Rs} 90\) a higher value for \(kd\) is opted. Let \(kd = 17\) per cent so that \(14(\text{PVIFA}_{17\%, 6\text{yrs}}) + 100 (\text{PVIF}_{17\%, 6\text{yrs}}) = 14(3.589) + 100(0.390) = 89.246\)

Thus \(kd\) lies between 14 per cent and 17 per cent. Using linear interpolation in the range of 14 percent to 17 percent, \(kd\) is equal to 16.79 per cent.

\[
14\% + (17\% - 14\%) \times \frac{100.046 - 90}{100.046 - 89.246} = 16.79\%
\]

### 4.5 Bond Values with Semi-Annual Interest:

Bonds pay interest semi-annually. This requires the bond valuation equation to be modified as follows:

(a) The annual interest payment, \(I\), divided by two to obtain the semi-annual interest payment.

(b) The number of years to maturity is multiplied by two to get the number of half-yearly periods.

(c) The discount rate divided by two to get the discount rate applicable to half-yearly periods.

The basic bond valuation equation thus becomes:

\[
V = \sum_{t=1}^{n} \left(\frac{I}{2}\right) \left(\frac{1}{(1+k_{d}/2)^t}\right) + \left(\frac{F}{(1+k_{d}/2)^{2n}}\right)
\]

\[
= \frac{I}{2}(\text{PVIFA}_{k_d/2,2n}) + F(\text{PVIF}_{k_d/2,2n})
\]

Where,

- \(V\) = Value of the bond
- \(I/2\) = Semi-annual interest payment
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\[ \text{Kd/2} = \text{Discount rate applicable to a half-year period} \]
\[ \text{F} = \text{Par value of the bond repayable at maturity} \]
\[ 2n = \text{Maturity period expressed in terms of half-yearly periods} \]

Illustration 4

If a `100 par value bond carries a coupon rate of 12 per cent and a maturity period of 8 years and interest payable semi-annually then the value of the bond with required rate of return of 14 per cent will be what?

Solution

\[
V = \sum_{t=1}^{16} \left\{ \frac{6}{(1.07)^t} \right\} + \left\{ \frac{100}{(1.07)^{16}} \right\}
\]

\[
= 6(\text{PVIFA7\%, 16yrs}) + 100(\text{PVIF7\%, 16yrs})
\]

\[
= ₹ 6(9.447) + ₹ 100(0.339) = ₹ 90.58
\]

4.6 Price-Yield Relationship: One of the properties of a bond is that its price (value) varies inversely with its yield because as the required yield increases, the present value of the cash flow decreases; hence the price decreases. On the other hand, when the required yield decreases, the present value of the cash flow increases; hence the price increases. The price-yield relationship for any callable bond has a convex shape as shown in the following diagram.

![Price – Yield Relationship](image)

4.7 Relationship between Bond Price and Time: Since the price of a bond must equal its par value at maturity (assuming that there is no risk of default), bond prices change with time. For example, a bond that is redeemable for ₹ 1000 (which is its par value) after five years when it matures, will have a price of ₹ 1,000 at maturity, no matter what the current price is. If its current price is ₹ 1,100, it is said to be a premium bond. If the required yield does not change between now and the maturity date, the premium will decline over time as shown by curve A in the following diagram. On the other hand, if the bond has a current price of ₹ 900, it is said to be a discount bond. The discount too will disappear over time as shown by curve B in the same diagram. Only when the current price is equal to par value – in such a
case only the bond is said to be a par bond – there is no change in price as time passes, assuming that the required yield does not change between now and the maturity date. This is reflected by the dashed line in the diagram.

Price Changes with Time

4.8 The Yield Curve: The term structure of interest rates, popularly known as Yield Curve, shows how yield to maturity is related to term to maturity for bonds that are similar in all respects, except maturity.

Consider the following data for Government securities:

<table>
<thead>
<tr>
<th>Face Value</th>
<th>Interest Rate</th>
<th>Maturity (years)</th>
<th>Current Price</th>
<th>Yield to Maturity</th>
</tr>
</thead>
<tbody>
<tr>
<td>10,000</td>
<td>0</td>
<td>1</td>
<td>8,897</td>
<td>12.40</td>
</tr>
<tr>
<td>10,000</td>
<td>12.75</td>
<td>2</td>
<td>9,937</td>
<td>13.13</td>
</tr>
<tr>
<td>10,000</td>
<td>13.50</td>
<td>3</td>
<td>10,035</td>
<td>13.35</td>
</tr>
<tr>
<td>10,000</td>
<td>13.50</td>
<td>4</td>
<td>9,971</td>
<td>13.60</td>
</tr>
<tr>
<td>10,000</td>
<td>13.75</td>
<td>5</td>
<td>9,948</td>
<td>13.90</td>
</tr>
</tbody>
</table>

The yield curve for the above bonds is shown in the diagram. It slopes upwards indicating that long-term rates are greater than short-term rates.
Yield curves, however, do not have to necessarily slope upwards. They may follow any pattern. Four patterns are depicted in the given diagram:

**Types of Yield Curve**

Another perspective on the term structure of interest rates is provided by the forward interest rates, viz., the interest rates applicable to bonds in the future.

To get forward interest rates, begin with the one-year Treasury bill:

\[ 8,897 = \frac{10,000}{(1 + r_1)} \]

Where,

- \( r_1 \) is the one-year spot rate i.e. the discount rate applicable to a risk less cash flow receivable a year hence.

Solving for \( r_1 \), we get \( r_1 = 0.124 \).

Next, consider the two-year government security and split its benefits into two parts, the interest of ₹1,275 receivable at the end of year 1 and ₹11,275 (representing the interest and principal repayment) receivable at the end of year 2. The present value of the first part is:

\[ \frac{1,275}{(1 + r_1)} = \frac{1.134}{1.124} \]

To get the present value of the second year’s cash flow of ₹11,275, discount it twice at \( r_1 \) (the discount rate for year 1) and \( r_2 \) (the discount rate for year 2)

\[ \frac{1,275}{(1 + r_1)(1 + r_2)} = \frac{1.275}{1.124(1 + r_2)} \]

\( r_2 \) is called the ‘forward rate’ for year two, i.e., the current estimate of the next year’s one-year
spot interest rate. Since \( r_1 \), the market price of the bond, and the cash flow associated with the bond are known the following equation can be set up:

\[
9,937 = \frac{1,275}{(1.124)} + \frac{11,275}{(1.124)(1 + r_2)}
\]

\[
9,937(1.124)(1 + r_2) = 1,275 (1 + r_2) + 11,275
\]

\[
11,169 + 11,169 r_2 = 1,275 + 1,275 r_2 + 11,275
\]

\[
11,169 r_2 - 1,275 r_2 = 11,275 - 11,169 + 1,275
\]

\[
9,894 r_2 = 1,381
\]

\[
\frac{1,381}{9,894} = 0.1396
\]

Thus solving this equation we get \( r_2 = 0.1396 \)

To get the forward rate for year 3\( (r_3) \), set up the equation for the value of the three year bond:

\[
10,035 = \frac{1,350}{(1 + r_1)} + \frac{1,350}{(1 + r_1)(1 + r_2)} + \frac{11,350}{(1 + r_1)(1 + r_2)(1 + r_3)}
\]

\[
10,035 = \frac{1,350}{(1.124)} + \frac{1,350}{(1.124)(1.140)} + \frac{11,350}{(1.124)(1.140)(1 + r_3)}
\]

\[
10,035 = \frac{1,350}{1.124} + \frac{1,350}{1.28136} + \frac{11,350}{1.28136(1 + r_3)}
\]

\[
10,035 = 1,201 + 1,054 + \frac{11,350}{1.28136(1 + r_3)}
\]

\[
7781 = \frac{11,350}{1.28136(1 + r_3)}
\]

\[
1 + r_3 = 1.134845
\]

\[
r_3 = 0.13845
\]

Solving this equation we get \( r_3 = 0.13845 \). This is the forward rate for year three. Continuing in a similar fashion, set up the equation for the value of the four-year bond:

\[
9,971 = \frac{1,350}{(1 + r_1)} + \frac{1,350}{(1 + r_1)(1 + r_2)} + \frac{1,350}{(1 + r_1)(1 + r_2)(1 + r_3)} + \frac{11,350}{(1 + r_1)(1 + r_2)(1 + r_3)(1 + r_4)}
\]

Solving this equation we get \( r_4 = 0.1458 \). The following diagram plots the one-year spot rate and forward rates \( r_2, r_3, r_4 \). It can be noticed that while the current spot rate and forward rates are known, the future spot rates are not known – they will be revealed as the future unfolds.
Thus, on the basis of above it can be said that though YTM and Forward Rates are two distinct measures but used equivalent way of evaluating a riskless cash flows.

Discount at the yield to maturity: \( (R_t) \ PV\ [CF(t)] = \frac{CF(t)}{(1+R_t)^t} \)

Discount by the product of a spot rate plus the forward rates

\[
PV\ [CF(t)] = \frac{CF(t)}{(1+r_1)(1+r_2)\ldots(1+r_t)}
\]

4.9 Duration of Bond: The concept of duration is straightforward. It measures how quickly a bond will repay its true cost. The longer the time it takes the greater exposure the bond has to changes in the interest rate environment. It is an important tool in structuring and managing a fixed income securities. Following are some of factors that affect bond’s duration:

1. Time to maturity: Consider two bonds that each cost ₹ 1,000 and yield 7%. A bond that matures in one year would more quickly repay its true cost than a bond that matures in 10 years. As a result, the shorter-maturity bond would have a lower duration and less price risk. The longer the maturity, the higher the duration.

2. Coupon rate: Coupon payment is a key factor in calculation of duration of bonds. If two identical bonds pay different coupons, the bond with the higher coupon will pay back its original cost quicker than the lower-yielding bond. The higher the coupon, the lower is the duration.

Duration can also be used to measure risk of investment in bonds. Although there are many formulae to calculate the duration. However, following are commonly used methods:
(a) Macaulay Duration: This method was developed by Frederic Macaulay. This formula measures the number of years required to recover the true cost of a bond, considering the present value of all coupon and principal payments received in the future. Macaulay duration is calculated by adding the results of multiplying the present value of each cash flow by the time it is received and dividing by the total price of the security. The formula for Macaulay duration is as follows:

$$\text{Macaulay Duration} = \frac{\sum_{i=1}^{n} \frac{t^i C}{(1+i)^i} + \frac{n^i M}{(1+i)^n}}{P}$$

Where

- $n$ = Number of cash flows
- $t$ = Time to maturity
- $C$ = Cash flows
- $i$ = Required yield (YTM)
- $M$ = Maturity (par) value
- $P$ = Bond price

This is only the duration which is calculated in years.

(b) Short Cut Method: The duration can also be calculated if figure of Coupon Yield ($c$), YTM ($y$) and Time to Maturity ($t$) is given the duration shall be calculated as follows:

$$\text{Duration} = \frac{1 + y}{y} \cdot \frac{t(c - y)}{c[(1+y)^t - 1] + y}$$

(c) Modified Duration: This is a modified version of Macaulay duration which takes into account the interest rate changes because the changes in interest rates affect duration as the yield gets affected each time the interest rate varies. In other words it indicates the volatility of Bond Value consequent upon the change in interest rate.

Normally in coupon bonds, the interest rates and bond price move in opposite directions. This duration is well suited to measure a particular bond’s volatility. There is an inverse relationship between modified duration and an approximate 1% (100 basis points) change in yield.

The formula for modified duration is as follows:

$$\text{Modified Duration} = \left[ \frac{\text{Macaulay Duration}}{1 + \frac{\text{YTM}}{n}} \right]$$
6.32 Strategic Financial Management

Where

\[ n = \text{Number of compounding periods per year i.e. 2 for Semi-Annual and 4 for Quarter} \]
\[ \text{YTM} = \text{Yield to Maturity} \]

Illustration 5

The following data are available for a bond

| Face value | ₹1,000 |
| Coupon Rate | 16% |
| Years to Maturity | 6 |
| Redemption value | ₹1,000 |
| Yield to maturity | 17% |

Calculate the duration and volatility of this bond?

Solution

To calculate the duration first we shall calculate Market price of bond as follows:

\[ 160 \times (PVIFA 17\%,6) + 1,000 \times (PVIF 17\%,6) \]
\[ = 160 \times (3.589) + 1,000 \times (0.390) \]
\[ = 574.24 + 390 \]
\[ = 964.24 \]

1. Duration

<table>
<thead>
<tr>
<th>Year</th>
<th>Cash flow</th>
<th>P.V. @ 17%</th>
<th>Proportion of bond value</th>
<th>Proportion of bond value x time (years)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>160</td>
<td>0.855</td>
<td>0.142</td>
<td>0.142</td>
</tr>
<tr>
<td>2</td>
<td>160</td>
<td>0.731</td>
<td>0.121</td>
<td>0.242</td>
</tr>
<tr>
<td>3</td>
<td>160</td>
<td>0.624</td>
<td>0.103</td>
<td>0.309</td>
</tr>
<tr>
<td>4</td>
<td>160</td>
<td>0.534</td>
<td>0.089</td>
<td>0.356</td>
</tr>
<tr>
<td>5</td>
<td>160</td>
<td>0.456</td>
<td>0.076</td>
<td>0.38</td>
</tr>
<tr>
<td>6</td>
<td>1160</td>
<td>0.390</td>
<td>0.469</td>
<td>2.814</td>
</tr>
<tr>
<td></td>
<td></td>
<td>964.40</td>
<td>1.000</td>
<td>4.243</td>
</tr>
</tbody>
</table>

Duration of the Bond is 4.243 years

2. Volatility

\[ \text{Volatility of the bonds} = \frac{\text{Duration}}{1 + \text{YTM}} = \frac{4.243}{1.17} = 3.63\% \]