Department of Commerce

University of Calcutta

Study Material

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Lecture Notes

Only for the Students of M.Com. (Semester IV)-2020

University of Calcutta

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Dear Students,

Hope you, your parents and other family members are safe and secured. We are going through a world-wide crisis that seriously affects not only the normal life and economy but also the teaching-learning process of our University and our department is not an exception.

As the lock-down is continuing and it is not possible to reach you face to face class room teaching. Keeping in mind the present situation, our esteemed teachers are trying their level best to reach you through providing study material cum lecture notes of different subjects. This material is not an exhaustive one though it is an indicative so that you can understand different topics of different subjects. We believe that it is not the alternative of direct teaching learning.

It is a gentle request you to circulate this material only to your friends those who are studying in Semester IV (2020).

Stay safe and stay home.

Best wishes.

DSE 405A:

Financial Analysis (FA)

M.COM. [SEMESTER IV]
UNIVERSITY OF CALCUTTA

Paper DSE 405A: FINANCIAL ANALYSIS

MODULE I

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Unit 1 of Module I of the syllabus has already been covered in class lectures. So this reading material covers Units 2, 3 and 4 of Module I of the syllabus.

Unit 2: Tools and Techniques of Financial Statement Analysis

2 sets of tools & techniques –
(i) *Horizontal or Time series analysis* - a firm's own performance is compared over a period of time in the past thereby facilitating intra-firm comparisons; also known as horizontal analysis because of right to left or left to right analysis of account balances in financial statements. It can be done using the technique of *comparative financial statement analysis.*
(ii) Vertical or Cross-sectional analysis - a firm's performance is compared with that of other firms usually in the same industry or in a related industry at the same point in time thereby facilitating inter-firm comparisons primarily; also known as vertical analysis due to its up-down or down-up evaluation of account balances in financial statements. It can be done using the techniques of *common-size analysis* and *financial ratio analysis.*

Comparative financial statement analysis
Comparative financial statement analysis sets_side by side and reviews changes in individual account balances in consecutive balance sheets, income statements or statements of cash flows from period to period either on a year-to-year basis commonly known as year-on-year (Y-o-Y) change analysis or on a multi-year basis commonly known as index number trend analysis. The most important revelation by comparative financial statement analysis is *trend*. A comparison of financial statements over several years reveals direction, speed and extent of trends.
Comparative financial statement analysis over relatively short time periods (i.e., 2 to 3 years) can be done using *year-to-year change analysis* whereas long-term comparisons (i.e., over periods covering more than 2 to 3 years) is done with the help of *index-number trend series analysis*. Year-to-year change analysis reveals the changes in absolute rupee value [current year's value - previous year's value] as well as the percentage changes [absolute change as % of previous year's value] in between two successive years over a 2-3 year period. But when analysis runs into more than 3 years, using year-to-year change analysis may often be cumbersome. An alternative in such a situation could be to choose a normal year with regard to business conditions as the 'base year' and assign the value 100 for all the items in the financial statement of that year. Then, recast the financial statement values of other years in terms of the base year i.e., all index numbers for all the years of analysis are computed as a percentage of the base year. Thus, such index numbers indicate the percentage change in individual item with reference to base year. However, the percentage change in between any two successive years can be computed by expressing the difference in the index number of the latter and the former years as a percentage of the former. It must be noted that in case of both year-to-year change and index number trend series analysis, a meaningful percentage change in between two successive years cannot be computed when a negative amount appears in

the previous/base year and a positive amount in the next year and vice-versa or when an item has no value in the base/previous year. But when an item has value in the base/previous year and none in the next year, percentage change can be computed and the decrease shall be taken as 100% in relation to base year.

Ref. Illustrations 1 and 2 and solve Problem 1 [Financial Analysis – illustrations.pdf]

Common size financial statement analysis

This is a technique to standardize financial statement components by expressing them as a percentage of a relevant base. That is, in common size balance sheet, each item of asset is expressed as a percentage of total assets and each item of liability and capital is expressed as a percentage of total of liabilities and capital (which is the same as total assets). In common size income statement, each item of income and expense from ordinary activities is expressed as a percentage of net sales. Common-size statements standardize the scaling differences (i.e., size differences) between two or more firms for a particular period and hence make comparison of their financial statements easier. Common-size statements help to interpret the relation of the components to the whole – as for example, the liabilities side of a common size balance sheet indicates the distribution of financing among current liabilities, non-current liabilities and equity, its assets side shows the proportionate application of funds in fixed assets, current and non-current assets while the common-size income statement reveals the proportion of net sales composed by operating and non-operating expenses and profit margin.

Solve Problem 2 [Ref. Financial Analysis – illustrations.pdf]

Financial ratio analysis

A ratio expresses a mathematical relation between two quantities. To be meaningful, a ratio must refer to an economically important relation i.e., ratios should relate two matching components. As for example, there is a direct and crucial relation between an item's sale price and its cost. Accordingly, the ratio of cost of goods sold to sales is a significant one. But, there is no obvious relation between wages and salaries paid to employees and investments made in securities of other companies. So computation of a ratio between the two is meaningless.

While computation of a ratio is a simple arithmetic operation, its interpretation is far more complex. Ratios are not significant in themselves and are interpretable only in comparison with – (1) *prior ratios* i.e., performance of a ratio relative to the same ratio over a past period; or (2) *predetermined standards* which are usually the *industry average* or

some alternative measure of industry central tendency such as the median of a particular ratio; or (3) *ratios of competitors* i.e., performance of a firm vis-a-vis the most successful firms in the same industry with respect to a particular ratio. However, the most frequently used ratio criteria is the *industry average* and inferences are drawn based on the extent and direction of deviation of observed ratios from the industry averages.
Several financial ratios can be computed using a company's financial statements which capture different economic aspects of the firm's operations. As for example, ratios may be computed for *activity analysis* (i.e., analysis of the relationship between the firm's level of operations and the assets needed to sustain that level), *liquidity analysis*, *solvency analysis*, *profitability analysis* and in assessing *cash movement* of the firm. Depending on the kind of analysis for which a ratio may be useful, financial ratios are categorized into above-mentioned analytical groups. A discussion of the various categories of ratios is done in subsequent units of the Module.

Statistical analysis of financial ratios

The advancement of the subject 'Financial Analysis' lies in the application of statistical tools and techniques on financial ratios for conducting the analysis and facilitating better decision making. One such common statistical technique is to test for the degree or strength of relationship or association between financial variables/ratios using correlation measures as follows.

- *Karl Pearson's Simple Correlation* which tests for the degree of association between two financial ratios ignoring the existence of other financial variables / ratios on their relationship. It is calculated by the formula –

$$r_{xy} = Cov_{xy} / \sigma_x \sigma_y$$

To test for statistical significance of calculated value of simple correlation coefficient t-test can be performed with (n-2) degrees of freedom (dof) where t is calculated as –

$$t = r_{xy} \sqrt{(n-2)/\{1-(r_{xy})^2\}}$$

If the calculated value of MOD t test statistic is ≥ table value with (n-2) dof, then null hypothesis (H_o) of correlation coefficient being statistically insignificant is rejected, otherwise not.

Illustration

The following Karl Pearson's correlation coefficients are determined based on data extracted from annual reports of B Ltd. for the period 1998-1999 to 2018-2019.

i. Pearson's correlation coefficient between inventory turnover ratio and return on assets is 0.6.
ii. Pearson's correlation coefficient between debtors turnover ratio and return on assets is (-)0.7.
iii. Pearson's correlation coefficient between cash turnover ratio and return on assets is 0.4.

Test for statistical significance of above correlation coefficients and comment on the results obtained.
]Given table value of t at 5% significance level as 2.093 and at 1% as 2.861 with 19 dof in 2-tailed test]

Solution: Karl Pearson's correlation coefficient between two financial variables can be tested using t test statistic with (n-2) dof based on following null hypothesis (H_o) –
Null Hypothesis (H_o) : The calculated value of Karl Pearson's correlation coefficient between two financial variables is statistically insignificant.

Vs.

Alternative Hypothesis (H_a) : The calculated value of Karl Pearson's correlation coefficient between two financial variables is statistically significant.

where $t = r_{xy} \sqrt{(n-2)/\{1-(r_{xy})^2\}}$

r_{xy} = Karl Pearson's correlation coefficient two financial variables x and y
n= no. of pairs of observations of two variables x and y = 21 [from 1998-99 to 2018-19]
dof = n-2 = 21-2 = 19

i. Calculated $t = 0.6 \sqrt{(21-2)/\{1-(0.6)^2\}} = 3.269$
The calculated value of correlation coefficient suggests that there is a moderate influence of inventory management as indicated by inventory turnover ratio on profitability of the firm as indicated by return on assets ignoring the effects of debtors and cash management on such relationship. Moreover, as calculated t (3.269) > table value of t (2.861) at 1% level of significance with 19 dof, H_o of statistical insignificance of correlation coefficient can be rejected with 99% CI. This implies that better inventory management has a moderate, but significant impact on profitability of the firm.

ii. Calculated $|t| = -0.7 \sqrt{(21-2)/\{1-(-0.7)^2\}} = |4.272|$
The calculated value of correlation coefficient suggests that there is an inverse relationship between debtors management as indicated by debtors turnover ratio and profitability of the firm as indicated by return on assets ignoring the effects of inventory and cash management on such relationship. Moreover, as calculated t ($|4.272|$) > table value of t (2.861) at 1% level of significance with 19 dof, H_o of statistical insignificance of correlation coefficient can be rejected with 99% CI. This implies that better debtors management has a significant, but negative impact on profitability of the firm, quite contrary to theory.

iii. Calculated t = $0.4 \sqrt{(21-2)/\{1-(0.4)^2\}} = 1.902$
The calculated value of correlation coefficient suggests that there is a low association between cash management as indicated by cash turnover ratio and profitability of the firm as indicated by return on assets ignoring the effects of debtors and inventory management on such relationship. Moreover, as calculated t (1.902) < table value of t (2.093) at 5% level of significance with 19 dof, H_o of statistical insignificance of correlation coefficient cannot be rejected even with 95% CI. This implies that better cash management does not quite influence profitability of the firm, contrary to theory.

- *Partial Correlation* which examines the strength of relationship between two financial variables after eliminating the effects of other financial variables on such relationship. Its statistical significance can be tested using t-test.

- *Multiple Correlation* which examines the joint effect of different influencing financial variables on a particular financial variable. Its statistical significance can be tested using F-test.

- *Spearman's Rank Correlation* examines the degree of similarity / dissimilarity in 2 sets of rankings of two financial variables. Its statistical significance can be tested using Spearman's rank correlation table values or z-test.

- *Kendall's Coefficient of Concordance* is a non-parametric test that examines the degree of similarity / dissimilarity in more than 2 (i.e. k) sets of rankings of k no. of financial variables over N no. of years or observations. Kendall's W is to be calculated whose statistical significance can be tested using Chi square test.

Solve Problem 7 [Ref. Financial Analysis – illustrations.pdf]

Unit 3: Profitability and Cash Flow Analysis

Profitability Analysis

Profitability analysis helps in judging the firm's ability to generate, sustain and increase profits over time and the most important financial statement to aid such analysis is the income statement of a firm. Profitability ratios can be computed on following bases –

- ❖ profitability in relation to sales i.e., expressing the various dimensions of profit per rupee of sales
- ❖ profitability in relation to a firm's investment that is required to generate them i.e., expressing the different profit measures in proportion to investment value
- ❖ profitability in relation to valuation of the firm

Profitability in relation to sales

- Gross Profit Margin = Gross Profit (i.e. Net Sales – Manufacturing or Merchandising COGS) ÷ Net Sales
  where Net Sales = Gross Sales less return inward.
- Net Profit Margin = Net Income or Profit After Tax (PAT) ÷ Net Sales
- Operating margin = Operating Profit [i.e. Operating Income – Operating Expenses] ÷ Net Sales
  where Operating Expenses exclude non-operating expenses, finance expenses and tax expenses
- Operating Ratio = Operating Expenses ÷ Net Sales
  = Cost of goods sold ratio + Administrative expense ratio + Selling & Distribution expenses ratio
- Margin Before Interest & Tax = EBIT ÷ Net Sales
- Pretax Margin = Profit Before Tax (PBT) ÷ Net Sales

A comparison of the above profitability ratios with industry averages reveals the relative efficiency level of the business. A low gross margin reflects higher percentage of cost of goods sold which may be attributed to the firm's inability to purchase raw-materials or tradable commodities at favourable terms, inefficient utilization of plant and machinery or over-investment in plant and machinery in case of manufacturing business. So, in the first place companies must take steps to improve its gross margin by curtailing costs etc. A wider difference between gross margin and net margin ratios could be due to heavier operating expense burden of the firm, which can be

understood by comparing gross and operating margin, or due to higher finance expense burden arising because of increased debt-financing by the firm, which can be understood by looking at pre-tax margin. If the gap between gross and net margin is due to higher operating expenses, an analysis of operating ratio and its components shall help to identify the specific operating costs where cost control measures need to be directed.

Profitability in relation to investment

The popular ratio under this category is *return on investment (ROI),* which is a mixed ratio as it relates items in income statement to balance sheet. The variations of ROI are as follows.

- Return on Assets (ROA) = EBIT (1-t) ÷ Average Total Assets
  where t = tax rate
  Average Total Assets = [Opening + Closing balance of assets] ÷ 2
  Since total assets represent the total pool of funds circulating in the business in the form of equity, debt capital and current obligations, it will be unsound to use net income or PAT, which denotes return to stockholders alone, in the numerator for calculating ROA. Thus, to make a proper match of the numerator with the denominator in calculating ROA, EBIT adjusted for taxes is used in the numerator. Moreover, as such numerator is a flow variable, while assets is a stock concept, average of assets is taken in the denominator for better matching.
  ROA acts as an indicator of the management's ability and efficiency in using the firm's assets to generate profits vis-à-vis the industry.
  The Du Pont company, USA has pioneered a system of financial analysis which decomposes ROA into the following component ratios with a view to understanding the overall earning power of the firm.

$$ROA = \frac{\text{Return}}{\text{Total Assets}}$$

$$= \frac{\text{Return}}{\text{Sales}} \times \frac{\text{Sales}}{\text{Total Assets}}$$

$$= (\text{Margin on Sales}) \times (\text{Total Asset Turnover})$$

  ROA measure is a combination of two kinds of ratios – a *profitability* ratio (i.e., margin on sales) and an *activity* ratio (i.e, total asset turnover) – and hence can be improved by enhancing either of the two ratios. Thus, a low ROA can result from low turnover indicating poor asset management or low profit margins or a combination of both the factors or when lower turnover more than offsets the increase in profitability or vice-versa. Also, we can we can explain why a grocery store having a low margin on sales but a high asset turnover can have the same ROA as that of a jewellery shop having a high margin but a low turnover based on Du Pont analysis.

- Return on Equity (ROE) or Return on Net Worth (RONW)

  = Net Income or Profit After Tax (PAT) ÷ Average Stockholders' Equity

  If the firm has preferred stock, ROE may also be so calculated as to focus on the return accruing to the owners of the firm i.e., common or ordinary shareholders and hence will be known as Return on Common Equity (ROCE) and computed as follows –

  ROCE = (Net Income – Preferred Dividend) ÷ Average Common Stockholders' Equity

  ROA, as discussed earlier, gives a measure of returns to the firm's lenders as well as stockholders who provide the much needed capital by the firm to acquire assets of the business. ROE measures profitability of the capital supplied by the firm's stockholders alone. Since the stockholders are entitled to residual profit, a part of which is distributed as dividend while the remaining part is retained in the business, the ratio uses net income (after interest and taxes) in the numerator. ROE thus indicates how well the firm has used the resources of its owners by earning a satisfactory return on their investment.

  The basic premise of Du Pont analysis can be extended to explore the determinants of ROE as follows.

  3-component disaggregation:

$$ROE = \frac{Return}{Equity}$$

$$= \frac{Return}{Sales} \times \frac{Sales}{Assets} \times \frac{Assets}{Equity}$$

= (Margin on Sales) x (Asset Turnover) x (Capital Structure/ Financial Leverage)

Thus, ROE is a combination of three kinds of ratios – a profitability ratio (i.e., margin on sales), an *activity* ratio (i.e., asset turnover) and a *solvency* ratio (i.e., financial leverage). The analysis of the components of ROE, commonly known as the *Dupont model*, enables the analyst to determine the contribution of each factor to the change in ROE. The ratio can, therefore, be improved by improving – (a) margin on sales ratio either by increasing selling prices (which is not always possible in a competitive market) or by reducing and controlling costs; or (b) asset turnover ratio either by increasing sales volume or by raising the productivity of capital invested in assets through their optimum utilization; or (c) financial leverage ratio by enhancing the extent of internal (i.e. equity) financing of assets; or (d) a combination of the above.

5-component disaggregation:

$$ROE = \frac{EBIT}{Sales} \times \frac{EBT}{EBIT} \times \frac{PAT/EAT}{EBT} \times \frac{Sales}{Assets} \times \frac{Assets}{Equity}$$

Indicates→ { Operational Efficiency} {Interest burden on earnings} {tax burden on earnings} {asset utilization} {leverage multiplier}

where EBT = Earnings Before Tax
EAT = Earnings After Tax

Solve Problem 5 [Ref. Financial Analysis – illustrations.pdf]

Profitability in relation to valuation of the firm

- Earnings Per Share (EPS) - shows the profitability of the firm on a per share (equity) basis, i.e. the amount of earnings allocated to one share of common (i.e., equity) stock which includes both dividend distribution and retention per share. It is calculated as follows.

$$\text{Basic EPS} = \frac{\text{Earnings available for equity shareholders}}{\text{Weighted average number of equity shares outstanding during the period}}$$

$$= \frac{\text{Net Income (i.e. PAT) – Preferred Dividend (if any)}}{\text{Weighted average number of equity shares Outstanding during the period}}$$

Since the number of equity shares outstanding at any point of time during the period under consideration may vary from those that were outstanding at the beginning of the period due to issue of equity shares (either as bonus issue or rights issue or as public issue) or buyback of shares, a time weighting factor is used to calculate the denominator of the above ratio. That is, the number of equity shares outstanding is multiplied by the proportion of the number of days/months for which the specific shares have remained outstanding out of the total in the period in order to determine weighted average number of shares.

However, the presence of potential dilutive securities like convertible securities (i.e., convertible bonds or convertible preference shares) or options and warrants in the capital structure of a firm may result in dilution (lowering) of EPS as calculated above upon conversion of such securities into equity shares. Since such conversion is likely to increase the number of shares outstanding without a proportionate increase in income attributable to equity shareholders, the potential dilution of EPS may be measured as follows –

$$\text{Diluted EPS} = \frac{\text{Adjusted earnings available for equity shareholders}}{\text{Weighted average number of common and potential Common shares outstanding during the period}}$$

When convertible securities are converted into equity shares, interest and preferred dividend payments would no longer have to be made to those security holders and hence the income available for distribution to common shareholders will increase by the amount of dividend on convertible preference shares, or after-tax interest on convertible debt resulting from such conversion and hence the numerator earnings figure in Basic EPS calculation needs to be adjusted accordingly.

- $\text{Dividend Payout Ratio} = \frac{\text{Amount of Dividend paid to Equity shareholders}}{\text{Net Income – Preferred dividend (if any)}}$

A low dividend payout ratio indicates a growth firm as most of its earnings are retained to finance future expansion. On the other hand, more established and mature firms tend to have higher payout ratios.

- Dividend Yield $= \dfrac{\text{Dividend per share (equity share)}}{\text{Market Value per share}}$

and Earnings Yield or Earnings – price (E/P) ratio $= \dfrac{\text{Earnings per Share}}{\text{Market Value per Share}}$

The dividend yield and earnings yield evaluate the common shareholders' return in relation to the market value of the share and hence help the shareholders in their investment decision making.

- Price-Earnings (P/E) Ratio $= \dfrac{\text{Market Value per Share}}{\text{Earnings per Share}}$

Since stock prices, used in the calculation of P/E ratio, generally reflect the investors' expectations regarding future earnings of the firm, the P/E ratios of companies with prospects of a high earnings growth will be higher (other things remaining equal) than those of companies with lower growth prospects. Differences in P/E ratios for a given firm over time and/or across firms will therefore reflect differences in investors' expectations regarding the future earnings growth of the firm.

- Price – to – Book (P/B) Ratio $= \dfrac{\text{Market Value Share}}{\text{Book Value per Share}}$

P/B ratio <1 indicates that as the actual returns earned by the common shareholders are lower than their expected returns, the company's shares are being traded at a price below the book value. On the contrary, when actual returns exceed expected returns of the shareholders, the firm's shares sell at a price above the book value thereby resulting into P/B ratio >1. Since management's objective is to meet the expectations of the shareholders, it is likely that firms with low P/B ratios shall have higher stock returns than firms with high P/B ratios subsequently. Thus, P/B ratio acts as a predictor of future stock returns.

- Tobin's Q Ratio = $\frac{\text{Market Value of the Firm}}{\text{Book Value of the Firm on a replacement cost basis}}$

Q values below 1 (i.e., market value being less than the replacement book value) indicates that the firm earns less than the required rate of return and such poor performers become prime targets for takeover or merger. Thus, investors would be willing to invest when Q is greater than 1 but would be reluctant when Q is equal to or less than 1.

Cash Flow Analysis

There is no doubting the fact that a firm must always operate with an optimum balance of cash. Excess of cash reserves may make the firm less profitable as idle cash yields no return while shortfall in cash may eventually lead the firm to bankruptcy. If cash flows into the business at a much faster pace than it is being disbursed, the company must seek some temporary investment outlets for the accumulated excess cash reserves. On the other hand, in times of cash deficit the company must make arrangements for raising the required amount from outside sources. It must however be noted that the above steps can be taken by the management only if they are aware of the movement of cash of the business during the accounting period. But the income statement and balance sheet may fail to present a clear picture of the cash flows of the business. These financial statements are prepared on accrual basis and so may consider several non-cash items of revenues (e.g. accrued income etc.) and expenses (e.g. depreciation etc.) while determining profit of the business. As a result, a situation may arise where the statements say that the firm is operating profitably, yet, in reality, the firm finds it difficult to meet its commitments like payment of wages, taxes, debt interest, dividend etc. Because of the inclusion of several non-cash items in accounting profit, the actual cash surplus may be far less than the profit earned during the period in such situations. Due to the above-mentioned limitations, it becomes necessary to prepare a cash flow statement separately.

A *cash flow statement* shows the changes in financial position of a firm on cash basis. In other words, it shows the net effect of the various transactions of a firm during a period on cash and explains the causes of changes in the cash position of a firm between two balance sheet dates. Cash flow statement supplements the information provided by the income statement and balance sheet as it links the two consecutive balance sheets. The primary purpose of a cash flow statement is to provide information on all cash receipts and payments (classified among operating, investing and financing activities) of the firm for a specified period and their impact on the ending cash balance. It also discloses that period's non-cash investing and financing activities.

The classification of cash flows among operating, financing and investing activities is essential to the analysis of cash flow data. This is because net cash flows i.e., change in cash and cash equivalents during a period has little informational content by itself; it is the classification and individual components that are informative.

The cash flow statement provides information about -

- a firm's ability to generate cash out of production and sale of goods and services;
- the capacity of a firm to meet its obligations like payment of wages, expenses, interest, taxes etc. and pay dividends;
- the amount of cash used up to acquire fixed assets, investments and other businesses in order to maintain a firm's current operating capacity and to provide capacity for future growth;
- the amount of cash received from sale or disposal of fixed assets, investments as well as segments of the business;
- the cash flow consequences of the firm's financing decisions i.e., capital structure (debt-equity mix) decisions like issue of shares, repurchase of equity, incurrence and repayment of debt etc., and dividend policy decisions i.e., returns to shareholders in the form of dividends;
- trends in each of the above cash flow components;
- the extent of increase or decrease in cash during any period and hence the amount of ending cash balance, and
- the difference between net profit and net cash flows from operations.

The specific format for preparation of Cash Flow Statement in accordance with Accounting Standard, and calculation of cash flow statement based ratios and their interpretation can be better understood by doing the following exercise.

Solve Problem 4 of Year 2019 CU Question Paper [Ref. Financial Analysis – illustrations.pdf]

Unit 4: Liquidity and Solvency Analysis

Liquidity Analysis

By *liquidity* we mean the availability of company's resources to meet its short-term obligations i.e., cash requirements. Thus, liquidity indicates the ability of a company to convert its short-term assets into cash or to obtain cash. A firm should ensure that it neither suffers from lack of liquidity, nor it has excess liquidity. The failure of a company to meet its maturing obligations due to lack of sufficient liquidity signifies that the company is unable to take advantage of its profitable business opportunities. This, in turn, will result in poor creditworthiness. loss of creditors' confidence, forced sale of investments and long-term assets, and even in legal battles ultimately leading to closure of the company. On the other hand, a very high degree of liquidity is also undesirable as it implies the existence of idle and unproductive assets which yield nothing. The company's funds, in such a case, will be unnecessarily tied up in short-term i.e., current assets. Thus, it is necessary to strike a proper balance between high liquidity and lack of liquidity. The liquidity position of a firm can be judged based on accounting ratios or by using some additional liquidity measures like Liquidity Index and conducting Motaal's Comprehensive Test of liquidity. The accounting ratio based measures of liquidity may be categorized as follows.

- Working Capital Based Measures of Liquidity

The concept of working capital is dependent on the classification of assets and liabilities into 'current' and 'non-current' categories. The distinction between current and non-current assets and liabilities is based on a maturity of less than one year or one operating cycle of the company, whichever is longer. The operating cycle of a company refers to the total number of days for which investment of one unit of money remains blocked in the normal course of operations till its recovery out of revenue. Thus, by definition, an item of current asset or current liability has a maturity (i.e., the expected date of conversion to cash in case of an asset and the expected date of liquidation for cash in case of a liability) of less than one year or one operating cycle of the company, whichever is longer.

A company's balance sheet typically comprises five categories of current assets :

- Cash and cash equivalents (i.e., investments in low-yielding securities)
- Marketable securities (i.e. investment securities with returns exceeding those for cash equivalents)
- Trade receivables (i.e., debtors and bills receivables)
- Inventories (i.e. stock levels)
- Prepaid expenses

'Quick or liquid assets' are ones that can be converted into cash reasonably soon without much loss of value. Of all the above items of current assets, cash is obviously the most liquid one. Other current assets which are

considered to be relatively liquid and included in quick assets are trade receivables, cash and cash equivalents and marketable securities. Inventories are considered to be the least liquid of all current assets and hence are excluded from quick assets. This is because inventories normally take some time for being realized into cash. Also, their values tend to fluctuate as more managerial discretion is involved in their valuation than required for any other current assets and as a result the extent of conversion of inventory to cash becomes less certain. Prepaid expenses are also excluded from quick assets on the ground that they can never be realized in cash as they reflect past cash outflows rather than expected inflows.

'Near-cash assets' refer to those items of current assets which can be converted into cash almost immediately at a negligible loss of value and it includes cash and cash equivalents and marketable securities.

Current liabilities include short term debt, trade payables (i.e., creditors and bills payables) and accrued liabilities. Therefore, by 'working capital' we mean the net working capital i.e. the excess of current assets over current liabilities.

The popular working capital based accounting ratios are –

- $\text{Current ratio} = \dfrac{\text{Current Assets}}{\text{Current Liabilities}}$

The current ratio, therefore, measures the *margin of safety* provided by current assets relative to short-term maturing obligations against unexpected losses, uncertainties and random shocks to a company's cash flows. Accordingly, the higher the current ratio, the greater the margin of safety i.e., the larger the amount of current assets available in relation to current liabilities and hence the more the firm's ability to absorb shocks and meet its current obligations. Thus, a current ratio of *greater than one* is desirable so that the firm has more current assets than current liabilities.

- $\text{Quick Ratio} = \dfrac{\text{Current Assets} - \text{Inventories} - \text{Prepaid Expenses}}{\text{Current Liabilities} - \text{Bank Overdraft (not payable on demand)} - \text{Income Received In Advance}}$

Alternatively,

$$\text{Quick Ratio} = \frac{\text{Cash} + \text{Cash Equivalents} + \text{Marketable Securities} + \text{Trade Receivables}}{\text{Current liabilities} - \text{Bank Overdraft (not payable on demand)} - \text{Income received in advance}}$$

Bank overdraft is deducted from current liabilities while calculating quick ratio if such overdraft is not payable on demand. Moreover, income received in advance is also deducted from current liabilities as neither any immediate nor any deferred payment (i.e., cash outlay) is associated with such an item of current liability.

The quick or acid-test ratio is a more stringent test of liquidity than current ratio because if current assets include a high slow-moving inventory figure, it may show a favourable current ratio but give a misleading picture of liquidity. However, we must be cautious in using quick ratio too because there may be inventories which are more liquid than slow-paying receivables. Thus, quick ratio should be studied along with current ratio and liquidity of individual components of current assets while analyzing the overall liquidity position of a firm.

- Operating Activity Based Measures of Liquidity

Liquidity analysis is not independent of activity analysis which evaluates the efficiency with which the firm manages and utilizes its assets. The activity ratios, also known as turnover ratios, indicate the speed with which assts needed to support a firm's level of operations are being converted or turned over into sales and hence activity ratios describe the relationship between sales and assets. The importance of examining liquidity ratios in conjunction with activity ratios lies in the fact that obsolete or slow-moving items of current assets may seriously limit the usefulness of current and quick ratios. A combined analysis may, thus, enable one to make a near perfect assessment of liquidity of a firm. The common activity ratios for judging liquidity of a firm are –

- Inventory Turnover

$$\text{(- in value)} = \frac{\text{Cost of Goods Sold}}{\text{Average Inventory}}$$

$$\text{(- in units)} = \frac{\text{Number of Units sold}}{\text{Average Inventory (In Units)}}$$

The inventory turnover ratio gives an indication of the company's ability to use and dispose of its inventories. That is, it measures the rapidity with which inventories are converted into receivables or cash through sales. A higher ratio signifies that the firm's inventory does not remain in warehouses or on the shelves for long but are turned over rapidly from the time of its acquisition or production to sale thereby indicating efficiency in the firm's inventory management. Thus, analysis of inventory turnover ratio may be complemented by 'days to sell inventory ratio' which measures the number of days a company takes in selling average inventory during a year and is computed as follows:

$$\frac{365 \text{ days}}{\text{Inventory Turnover}}$$

However, a decrease in inventory turnover ratio over time or a lower ratio than the industry norm suggests excessive inventory levels than warranted by production/acquisition and sale activities or weak demand or non-saleability or slow-moving or obsolete inventory. On the other hand, too high a turnover ratio may be because of very low level of inventory and hence may result in frequent stock outs and too many small inventory replacements. Thus, too high and too low inventory turnover ratios are undesirable.

- Debtors Turnover = $\frac{\text{Credit Sales}}{\text{Average Debtors}}$

The debtors turnover ratio indicates how often, on an average, debtors revolve i.e., are received and collected during the year. Generally, the higher the debtors turnover ratio, the greater the number of times debtors are turned over during the year and hence the more efficient is the credit management by the firm. Thus, debtors turnover ratio measures the efficiency and effectiveness of a firm's credit management and indicates the level of investment needed in debtors to maintain the firm's sales level. In order to measure the effectiveness of a firm's credit policy, the debtors turnover ratio can be converted into days of sales tied up in debtors i.e., average number of days for which debtors remain outstanding till they are collected in cash. Thus, average collection period for the debtors may be computed as below:

$$\text{Average Collection Period} = \frac{365 \text{ days}}{\text{Debtors Turnover}}$$

The average collection period can be compared with the credit terms allowed by the company in order to assess the extent of customers paying on time and hence judge the company's credit and collection efficiency. However, a company must guard against too long or too short a collection period. An excessively long collection period implies too liberal and inefficient credit and collection performance of the firm as it results into delays in cash collection from debtors, increases the chances of bad debt losses and impairs the firm's liquidity. On the other hand, too short a collection period indicates a very restrictive credit and collection policy. Because of the fear of bad debt losses, the firm may sell only to those customers whose financial conditions are sound and who are prompt in making payments, a reflection of shorter collection period. Although such a policy may succeed in avoiding the bad debt losses, but it may severely curtail sales and hence reduce the

profit potential of the firm. Therefore, a comparison of the company's debtors turnover ratio and average collection period with the industry average would help ascertain the efficiency, or otherwise, of the firm's credit management vis-à-vis that of the competitors.

- Cash Based Measures of Liquidity

Since cash is the most liquid asset of all current assets, this ratio category measures the cash adequacy of a company to pay off its current obligations. The ratios are –

- Cash to Current Assets ratio = $\frac{\text{Cash + Cash Equivalents + Marketable Securities}}{\text{Current Assets}}$

It measures the degree of current asset liquidity. The larger this ratio, the more liquid are the current assets and the lower is the risk of insufficiency of cash and its equivalents.

- Cash to Current Liabilities Ratio = $\frac{\text{Cash + Cash Equivalents + Marketable Securities}}{\text{Current Liabilities}}$

This ratio is a severe test of liquidity of a firm ignoring the refunding nature of current assets and current liabilities. The importance of this ratio lies in the fact that over the years there have been several examples of corporate failures where the companies had sizeable non-cash assets (both current and non-current) but were unable to meet their liabilities due to inadequacy of cash.

- Defensive Interval = $\frac{\text{Cash and cash equivalents + Marketable securities + Trade receivables}}{\text{Projected Expenditures}} \times 365$

It compares the currently available quick/liquid sources of cash (i.e., cash and cash equivalents, marketable securities and trade receivables) with the estimated daily cash outflows needed to operate the firm i.e., daily, projected expenditures which usually include cost of goods sold, selling and administrative and general expenses excluding depreciation and other non-cash expenditures on a daily basis. The defensive interval gives an indication of the number of days that a company can maintain its current level of operations with its existing liquid resources if there is no further generation of cash resources in the future. Thus, defensive internal is the most conservative estimate of a firm's liquidity.

Additional Liquidity Measures

Liquidity Index

Liquidity index refers to the weighted average number of days taken by trade receivables and inventories together for their conversion into cash. It is expressed in days and its computation is a weighting mechanism. Its usefulness depends on the validity of assumptions implicit in the weighting process. Increase in liquidity index from year to year signifies a deterioration in liquidity while a decrease signifies improved liquidity. Computation of liquidity index is shown in the following illustration.

Illustration:

The current assets' composition of a firm for two years 2018 and 2019 are as given below. In addition, it is reported that conversion of inventories into trade receivables takes on an average 50 days and the conversion of receivables into cash takes 40 days on an average. Compute the liquidity index of the firm for the years 2018 and 2019 and analyse the liquidity position of the firm.

Solution:

Year 2018:

Computation of Liquidity Index

Particulars	**Amount (Rs.)**	**Days taken for conversion into cash**	**Product (Amount X Days)**
Cash	40,000	-	-
Trade Receivables	60,000	40 days	24,00,000
Inventories	50,000	90 days (50 + 40 days)	45,00,000
Total :	(a) 1,50,000		(b) 69,00,000

$$\therefore \text{ Liquidity Index } = \frac{b}{a} = \frac{69,00,000}{1,50,000} = 46 \text{ days}$$

Year 2019:

Particulars	**Amount (Rs.)**	**Days taken for conversion into cash**	**Product (Amount X Days)**
Cash	30,000	-	-
Trade Receivables	50,000	40 days	20,000
Inventories	80,000	90 days (50 + 40 days)	72,00,000
Total :	(a) 1,60,000		(b) 92,00,000

$$\therefore \text{ Liquidity Index } = \frac{b}{a} = \frac{92,00,000}{1,60,000} = 57.5 \text{ days}$$

Thus, it can be said that as liquidity index of the firm has increased in the year 2019 relative to 2018, its liquidity has deteriorated over the same period.
It must, however, be remembered that the liquidity index should be interpreted with caution. The index is just a number without direct meaning. It becomes meaningful only when it is compared over the years or when the index of one company is compared with that of another. Thus, the liquidity index is best used as a measure of period – to – period change in liquidity of a company or as a company – to – company comparison of relative liquidity.

Motaal's Comprehensive Test of Liquidity
It is a comprehensive rank sum test used in evaluating the liquidity position of the firm. It involves a process of ranking in which the individual ranks of three liquidity ratios – working capital to current assets, stock to current assets and liquid assets to current assets, are combined or summed into a composite rank score to interpret the liquidity position of the firm over the years or across firms.
In case of working capital to current assets and liquid assets to current assets, since a higher value indicates a better liquidity position, ranking is done in descending order of the values for these two ratios. However for stock to current assets ratio, since a lower value indicates a better liquidity position, ranking is done in ascending order of the values for this ratio. Overall, the above three rank values are summed for each year / firm and the lower the rank sum value, the higher the ultimate rank assigned to the year or firm.

Solve Problem on Motaal's Comprehensive Test of Liquidity [Ref. Financial Analysis – illustrations.pdf]

Solvency Analysis

While liquidity measures the short-term ability of a company to meet its dues, *solvency* refers to a company's long run financial viability i.e., its ability to cover long-term obligations. This is usually evaluated on the basis of an analysis of a firm's capital structure. The capital structure of a company indicates the mix of funds provided by the owners and lenders to meet the total capital requirements of the firm. A *leveraged firm* (i.e., a firm using more of debt than equity in financing its total capital requirements) has the ability to magnify returns to its shareholders provided it earns a return on total capital employed in the business higher than the cost of

debt. This practice is technically known as *trading on equity*. However, the benefits of financial leverage bring additional risks. The fundamental risk with a leveraged capital structure is the risk of inadequacy of cash under conditions of adversity. Debt involves a commitment to pay fixed charges in the form of interest and principal repayments which cannot be postponed even in times of cash shortages without adverse repercussions to the company's shareholders and creditors. The inability to meet these fixed obligations can ultimately lead to legal action by the debt holders and possible bankruptcy. Besides, a leveraged capital structure also runs the risk from loss of financing flexibility. The owners equity is considered as a safety margin by the creditors / debt holders and so their risks increase when the equity base in the total capital structure becomes thin. Accordingly, a company's ability to raise further capital gets severely impaired when it has a highly leveraged capital structure, especially in periods of adverse market conditions. Accordingly, solvency analysis is done using *capital structure ratios* (i.e., leverage ratios), which relate the components of capital structure to each other or to their total. Capital structure ratios primarily focus on the risk of a company's capital structure, and they serve as screening devices which help to decide whether risk inherent in a company's capital structure requires further analysis of a company's *earnings coverage* or earnings power to meet its interest and principal repayments. That is, should capital structure ratios reveal debt as a significant part of total capitalization, the company's coverage ratios, which focus on the availability of cash flows to service a company's debt, must be examined to substantiate the solvency analysis of the firm.

- <u>Capital Structure / Leverage Ratios</u>

  - Debt – Equity (D/E) Ratio =

$$\frac{\text{Long Term Debt}}{\text{Equity}} \quad \text{or} \quad \frac{\text{Total Debt}}{\text{Equity}}$$

Long-term debt includes items like debentures/bonds, long-term borrowings from financial institutions and banks, public deposits and any other interest bearing long-term loan. *Total debt* includes both short term and *long term debt*. *Short term debt* includes those borrowings which are repayable within one accounting year or one operating cycle, whichever is longer. *Equity* used in the computation of D/E ratio refers to shareholders' fund i.e., net worth of the company. Since characteristics of debt are more reflected in preference share capital like requiring a fixed rate of dividend, redemption after a certain period of time, carrying no voting right and getting priority over equity shareholders regarding payment of capital at the time of liquidation of the company, inclusion of preference share capital as part of total debt, instead of equity, in D/E ratio gives rise to *capital gearing ratio* i.e., the ratio between fixed income bearing capital and variable income bearing capital of the firm.

The debt-equity ratio describes the relationship between lenders' contribution and owners' contribution towards financing the total capital requirement of the business. The higher this ratio, the greater the proportion of debt relative to equity and hence the higher is the riskiness of the firm. Conversely, the lower this ratio, the better is the picture of solvency but it arises at the cost of trading on equity. Hence, a balance may be struck in deciding about the judicious mix of debt and equity in the capital structure of a company.

- Total Debt Ratio = $\frac{\text{Total Debt}}{\text{Total Capital}}$

where, total debt = long term debt + short term debt including current liabilities

total capital = total debt + stockholders' equity including preference capital

This ratio indicates the proportion of total capital that is financed by debt. A higher total debt ratio signifies that there is little margin of safety for lenders and hence the greater the risk of insolvency, while a lower ratio implies that the owners contribute a larger share of the total financing of the firm.

- Proprietary or Equity Ratio = $\frac{\text{Net Worth}}{\text{Total Assets}}$

This ratio, being converse to total debt ratio, shows the proportion of claim of equity holders in total assets of the business. A higher proprietary ratio indicates that the company has relied more on shareholders' funds to finance a major portion of its total assets. Thus the higher this ratio, the better is the picture of solvency. But as a higher proprietary ratio deprives the business of the benefits of trading on equity, a balance need to be struck between proprietary and total debt ratios in financing the business' assets.

- <u>Earnings Coverage Ratios</u>

- Interest Coverage Ratio = $\frac{\text{EBITDA}}{\text{Interest or Finance Expenses}}$

where EBITDA = Earnings Before Interest, Taxes, Depreciation and Amortization

This ratio considers the interest on debt as the fixed charge needing earnings coverage. Since interest on debt is paid before tax, interest coverage is calculated in relation to before tax earnings i.e. EBITDA.
The interest coverage ratio shows the number of times the interest charges are covered by funds that are ordinarily available for their payment and hence is also known as *times-interest-earned ratio*. This ratio thus indicates the extent to which a firm's earnings can decline without causing any embarrassment to the firm regarding the payment of interest on debt. A higher interest coverage ratio is obviously desirable; but too high a ratio indicates that the firm is very conservative in using debt and that it is not using credit to the best advantage of shareholders. On the other hand, a lower interest coverage ratio indicates excessive use of debt or inefficient operations. The firm should therefore make efforts to improve the operating efficiency or to retire debt in order to have a comfortable interest coverage ratio.

An important limitation of interest coverage ratio is that it deals with the earnings coverage of interest only and fails to address the debt holders' fear of losing the principal value of debt. This limitation has been overcome by the following ratio.

- Debt Service Coverage Ratio (DSCR) $= \dfrac{\text{EBITDA}}{\left(\text{Interest} + \text{Annual funds required for repayment of principal value of debt} \times \dfrac{1}{(1-t)}\right)}$

where 't' is the tax rate applicable to the firm. Since principal value of debt is repaid out of after-tax earnings of the firm, the funds required annually for repayment of principal is converted to before tax basis by dividing it by (1 – tax rate) in order to determine the before-tax earnings coverage of interest and principal repayment.
Also known as *fixed charges coverage ratio*, this ratio indicates the debt servicing ability of the business. Thus the higher this ratio, the better is the debt servicing ability of the firm and the greater is the security of the lenders. Accordingly, a DSCR > 1 indicates a sound solvency position of the business. But too high a ratio indicates unused debt capacity and must be avoided.

Solve Problem 11 on Debt Service Coverage Ratio [Ref. Financial Analysis – illustrations.pdf]

An important factor in evaluating coverage ratios is the behaviour of earnings and cash flows across time. The more stable the earnings or cash flow patterns of a company or industry, the lower is the required level of

coverage. As for example, a lower coverage ratio may be accepted for a utility concern which faces little economic downturns or upswings but it may not be acceptable to cyclical companies like machinery manufacturers.

References :

- Bernstein and Wild, *Financial Statement Analysis: Theory*, *Application and Interpretation*, McGraw Hill.
- Subramanyam and Wild, *Financial Statement Analysis*, McGraw Hill.
- White, Sondhi and Fried, *The Analysis and Use of Financial Statements*, John Wiley & Sons.

Illustration (1): Year-to Year Change Analysis

(observing the rules of analysis)

Financial Statement Items	Amount (Rs. '0,00,000) in Year 1	Year 2	Year-to Year Change Absolute	Percentage
Profit (loss) for the year	(4500)	1500	6000 [1500-(-4500)]	— (1)
Tax expenses	2000	(1000)	(3000) [-1000-2000]	— (2)
Cash	10	2010	2000	20,000% [$\frac{2010-10}{10}\times 100$] (3)
Trade payables	—	8000	8000 [8000-0]	— (3)
Trade receivables	10,000	—	(10,000)	(100%) [$\frac{0-10,000}{10,000}\times 100$] (4)
Tangible assets	50,000	60,000	10,000	20%

Rules: (1) & (2): When there is a negative amount in base (previous) year and a positive amount in next year or vice-versa, % change or index number trend cannot be determined.

(3): When there is no amount for the base (previous) year, % change or index number trend cannot be determined.

(4) When the base (previous) year has a value, but there is no value for the next year, % decrease is 100% and index number trend value is 0.

(5) When the base (previous) year's value is too small, % change and index number trend ~~which is~~ can be calculated but both take a very high value signifying a large change and hence the results must be interpreted with caution.

Illustration (2): Index Number Trend Analysis

	Amount (Rs. '000,000) Year 1	Year 2	Year 3	Year 4
Cash	12,000	18,000	9,000	(1000)
Index Number Trend Value (Base Year = 1)	100	150 [$\frac{18,000}{12,000}\times 100$]	75 [$\frac{9000}{12000}\times 100$]	— (cannot be calculated)
% Change w.r.t. Base Year	—	50%	(-)25%	—
% Change in Successive Years	—	50% [$\frac{150}{100}\times 100$]	(-)50% [$\frac{75}{150}\times 100$] or [$\frac{75-150}{150}\times 100$]	

Year 5: 600; Year 6: 0

INDEX NUMBER TREND ANALYSIS

Problem (1): Compute increases (decreases) in percents for both years 2 and 3 by entering all missing data in the table below. Analyse and interpret any significant results revealed from this trend analysis.

Particulars	Year 3 Index No.	Year 3 Change in percent	Year 2 Index No.	Year 2 Change in percent	Year 1 Index No.
Net Sales	---	29%	100	---%	90
Cost of Goods Sold	139	---	100	---%	85
Gross Profit	126	----	100	---%	80
Operating Expenses	----	20 [28]	100	----%	65
Income before Tax	----	14 [(5)]	100	----%	70
Net Income	129 [109]	----	100	----%	75

Solution: It is clear from the problem that Year 2 is considered as the 'base year' as all the financial variables for Year 2 have been assigned the value '100' in index number trend analysis. Accordingly, percent change in Year 2 w.r.t. Year 1 can be determined as —

$$\left[\frac{\text{Year 2 value} - \text{Year 1 value}}{\text{Year 1 value}} \times 100\right].$$

Year 3's change in percent is simply calculated as [Year 3 index value − Year 2 index value i.e. 100] while Year 3's index no. can be calculated as [Year 2 index no. i.e. 100 ± magnitude of change in percent].

March 28 - 31, 2011

Particulars	Year 3 Index No.	Year 3 Change in Percent	Year 2 Index No.	Year 2 Change in Percent	Year 1 Index No.
Net Sales	129 [100+29]	29%	100	11.11% [$\frac{100-90}{90}$ x100]	90
Cost of Goods Sold	139	39% [139-100]	100	17.65% [$\frac{100-85}{85}$ x100]	85
Gross Profit	126	26% [126-100]	100	25% [$\frac{100-80}{80}$ x100]	80
Operating Expense	120 [100+20] 128 (100+28)	20% 28	100	53.85% [$\frac{100-65}{65}$ x100]	65
Income Before Tax	114 [100+14] 95 (100-5)	14% (5)	100	42.86% [$\frac{100-70}{70}$ x100]	70
Net Income	129 [109]	29% [129-100] 9	100	33.33% [$\frac{100-75}{75}$ x100]	75

Comment: It is clear from the above index number trend analysis that both net sales and cost of goods sold have increased from Year 1 to Year 3, but cost of goods sold has risen by greater percentage points than net sales as a result of which gross profit has increased by a meagre 1% from Year 1 to Year 3. However, the rate of increase in operating expenses, income before tax and net income in between Years 1 and 2 has been greater than the increase from Year 2 to Year 3. [Compare between Yrs. 2 & 3 primarily as Yr. 1 is atypical; difference b/w Net Income and Income before Tax % could be attributed to deferred tax assets resulting into reduction of tax expenses]

COMMON SIZE ANALYSIS (for Inter-firm Comparison)

Problem (2): The following balances are extracted from the Profit and Loss statements of X Ltd. and Y Ltd. for the year ended 31st March 2015. Compare their performance based on their common-size income statements.

(₹, in crore)

Particulars	X Ltd.	Y Ltd.
Total Revenue	801·20	1220·10
Less: Cost of Goods Sold	(586·40)	(860·30)
Gross Profit (A)	214·80	359·80
Less: Operating expenses:		
– General Administration expenses	(105·0)	(200·10)
– Selling and Distribution expenses	(45·60)	(74·30)
Total Operating expenses (B)	(150·60)	(274·40)
Operating Profit (A–B)	64·20	85·40
Less: Finance Costs and other Expenses	(11·40)	(16·40)
Profit before exceptional items and tax	52·80	69·0
Add ~~Less~~: Exceptional items – Exchange ~~Loss~~ Gain (net)	1·30	83·50
Profit before tax	54·10	152·50
Less: Tax expenses	(33·60)	(32·40)
Profit for the year	20·5	120·10

Department of Commerce, University of Calcutta
March 28 - 31, 2011

Solution:

Common-size Income Statements of X Ltd. and Y Ltd.

For the Year ended 31st March, 2015

Particulars	X Ltd.		Y Ltd.	
	Rs. in crore	Common-size (as % of total revenue)	Rs. in Crore	Common-size (as % of total revenue)
Total Revenue	801·20	100	100	1220·10
Less: Cost of Goods Sold	586·40	(73·2)	(70·5)	(860·30)
Gross Profit (A)	214·80	26·8	29·5	359·80
Less: Operating expenses:				
– General Administration expenses	(45·60)	(13·1)	(16·4)	(74·30)
– Selling and Distribution expenses	(105·0)	(5·7)	(6·1)	(200·10)
Total Operating Expenses (B)	(150·60)	(18·8)	(22·5)	(274·40)
Operating Profit (A–B)	64·20	8·0	7·0	85·40
Less: Finance Costs and other Expenses	(11·40)	(1·4)	(1·3)	(16·40)
Profit before exceptional items and tax	52·80	6·6	5·7	69·0
Less: Tax expenses	(33·60)	(4·2)	(2·7)	(32·40)
Net Profit from ordinary/normal activities	19·20	2·4	3·0	36·60
Add: Income from exceptional items – exchange gain	1·30			83·50
Net Income from both normal and exceptional activities	20·50			120·10

Comment: A comparison of common-size income statements of X Ltd. and Y Ltd. for FY 2014-2015 reveals that for every rupee of sales or total revenue, X Ltd. has spent more (i.e. 73·2 paisa) on COGS than Y Ltd. (70·5 paisa) thereby resulting into a higher gross

margin on sales (i.e. 29·5%.) for Y Ltd. than for X Ltd. (26·8%). However, X Ltd. could cut down on all its operating expenses than Y Ltd. as a result of which higher % of operating expenses on Sales has more than off-set ~~this~~ the higher gross margin of Y Ltd. and has resulted into lower pre-tax income from ordinary sources for Y Ltd. Of the two operating expenses, selling and distribution expenses of Y Ltd. is much higher than general administration expenses as % of Sales in comparison to X Ltd. thereby signifying that Y Ltd. has spent aggressively on advertising and marketing to combat increasing competition. But, due to higher pre-tax income as % of Sales for X Ltd., its tax expense as % of sales is also high than Y Ltd. thereby resulting into a lower % net income from ordinary activities on Sales for X Ltd. Thus it may be concluded that operating performance of X Ltd. has been better than that of Y Ltd. for financial year 2004-2005, assuming that the accounting methods used by the two companies are similar. Quite strikingly, in absolute terms, both operating profit and pre-tax income from ordinary sources for Y Ltd. are higher than that of X Ltd. This indicates that impact of size / ~~and~~ scale differences in inter-firm comparisons as in terms of common-size that controls for size differences X Ltd.'s operating performance has been better than that of Y Ltd.

Problem (5): Du Pont Analysis of Disaggregating ROE

The following balances are extracted from statement of profit and loss and balance sheet of XYZ Ltd. for the year ended 31st March 2015.

	Amount (₹)
Sales	7120
Depreciation	230
Interest expense	10
Pre-tax income	2550
Tax expense	900
Net Income	1650
Current Assets	4850
Fixed assets, net	2400
Total assets	7250
Current liabilities	3290
Long-term debt	100
Shareholders' equity	3860
Total liabilities & shareholders' equity	7250

(i) Calculate return on common equity for the year using year-end balances and assuming no preferred dividend.

(ii) Disaggregate return on common equity into its five components and comment on the use of financial leverage by the firm.

Solution: (i) Return on Common Equity (ROCE) = $\frac{\text{Net Income}}{\text{Closing shareholders' equity}} \times 100$

(Assuming no preferred dividend and using year-end balances instead of average)

$\therefore$ ROCE = $\frac{1650}{3860} \times 100 = 42.75\%$

(ii) 5 component disaggregation of ROCE

$$\text{ROCE} = \frac{\text{Net Income}}{\text{Shareholders' equity}} = \left[\frac{\text{Net Income}}{\text{Pre-tax income}} \times \frac{\text{Pre-tax income}}{\text{EBIT}} \times \frac{\text{EBIT}}{\text{Sales}}\right] \times \frac{\text{Sales}}{\text{Total Assets}} \times \frac{\text{Total Assets}}{\text{Shareholders' equity}}$$

EBIT = Pre-tax income + Interest expense

= ₹(2550 + 10) = ₹2560

$\therefore$ & Impact of Tax on Earnings: $\frac{\text{Net Income}}{\text{Pre-tax income}} \times 100 = \frac{1650}{2550} \times 100$

$= 64.7\%$

$= 0.647$

X Impact of Financing on Earnings: $\frac{\text{Pre-tax income}}{\text{EBIT}} \times 100 = \frac{2550}{2560} \times 100$

$= 99.61\%$

$= 0.9961$

X Impact of Operations on Earnings: $\frac{\text{EBIT}}{\text{Sales}} \times 100 = \frac{2560}{7120} \times 100$

$= 35.96\%$

Also so by $\left[\frac{\text{Net Income}}{\text{Sales}} \times 100 = \frac{1650}{7120} \times 100\right] =$ 23.17%

X Total Asset Turnover $\left[\frac{\text{Sales}}{\text{Total Assets}} = \frac{7120}{7250}\right] =$ 0.98 times

X Financial Leverage $\left[\frac{\text{Total Assets}}{\text{Shareholders' equity}} \times 100 = \frac{7250}{3860} \times 100\right] =$ 1.88 times

ROCE = 42.68%

Comment: It can be seen from above analysis that XYZ Ltd.'s return on common equity (ROCE) is moderate at 42.7%, having a high impact of tax burden and financing ~~cost~~ on profitability of the firm. However, the impact of financing costs on profitability of the firm is quite low, due to its total assets being financed more by shareholders' equity than debt. This is supported by the fact that as total assets ÷ shareholders' equity is 1.88 times, debt-equity ratio of the firm is just 0.88:1. Such low degree of use of financial leverage by the firm could be due to its lower operating profitability and hence the firm is unable to derive the benefits of trading on equity. But due to its mod to boost ROCE.

(as pre-tax income is 0.9961 out of Re 1 of EBIT)

(which stands at a meagre 35.96% on sales, as a result of)

Problem (7): Kendall's Coefficient of Concordance

Given below are the values of Current ratios, fixed assets turnaver, interest coverage and return on assets of X Ltd. over a 10 year period.

Years	Current ratio (times)	Fixed Assets Turnover (times)	Interest Coverage (times)	Return on Assets (%)
2006-07	4·64	2·78	10·94	62·38
2007-08	3·25	2·32	8·20	45·52
2008-09	2·45	2·32	4·93	35·08
2009-10	2·45	2·32	7·11	47·96
2010-11	1·94	1·98	5·10	26·11
2011-12	1·28	2·05	5·10	29·35
2012-13	1·44	1·92	5·10	41·59
2013-14	3·99	2·81	42·43	129·12
2014-15	3·65	2·61	73·01	38·78
2015-16	2·78	2·61	82·35	49·42

Use an appropriate measure of statistic to examine the statistical significance of the rankings of the above four ratios over the 10 year period.

[Given $\chi^2_{9,0.05} = 16.919$; $\chi^2_{9,0.01} = 21.666$ and $\chi^2_{9,0.10} = 14.684$

$\chi^2_{dof,\alpha}$]

Answer: Since the similarity/dissimilarity of sets of rankings of more than two variables are to be tested, Kendall's Coefficient of Concordance measure is to be used in which

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Theme: Research Methodology in Business Studies
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March 28 - 31, 2011

Kendall's 'W' statistic can be calculated using the following formula, given that a look at the values of the variables suggest a tie in the ranks.

$$W = \frac{12S}{K^2(N^3 - N) - KT}$$

where $S = \sum_{j=1}^{N} (R_j - \bar{R})^2$

R_j = sum of all 'K' sets of ranks of each of 'N' objects

$\bar{R}$ = Overall mean sum of ranks of all 'K' sets across 'N' objects

K = No. of variables = 4

N = No. of years under consideration = 10

$T = \sum_{g} (t^3 - t)$

where g = groups of tied ranks for each 'K' variables

t = No. of years in each group of tied ranks

The statistical significance of the above 'W' statistic is tested using χ^2 test statistic with (N-1) degrees of freedom (dof) based on following Null hypothesis.

Null Hypothesis (H_0): The calculated value of Kendall's 'W' is statistically insignificant i.e. there is no agreement among the ranks of the four variables

$\chi^2 = K(N-1)W$ with dof = N-1 = 10-1 = 9

Statement showing Calculations for Kendall's W

Years (1)	Current Ratio		Fixed Assets Turnover		Interest Coverage		Return on Assets	
	Value (times) (2)	Rank (3)	Value (times) (4)	Rank (5)	Value (times) (6)	Rank (7)	Value (%) (8)	Rank (9)
2006-07	4·64	1	2·78	2	10·94	4	62·38	2
2007-08	3·25	4	2·32	6	8·20	5	45·52	5
2008-09	2·45	6·5	2·32	6	4·93	10	35·08	8
2009-10	2·45	6·5	2·32	6	7·11	6	47·96	4
2010-11	1·94	8	1·98	9	5·10	8	26·11	10
2011-12	1·28	10	2·05	8	5·10	8	29·35	9
2012-13	1·49	9	1·92	10	5·10	8	41·59	6
2013-14	3·99	2	2·81	1	42·43	3	129·12	1
2014-15	3·65	3	2·61	3·5	73·01	2	38·78	7
2015-16	2·78	5	2·61	3·5	82·35	1	49·42	3
g	–	1	–	2	–	1	–	–
t	–	2	–	3; 2	–	3	–	–
t^3-t	–	6	–	24+6 = 30	–	24	–	–

R_i $3+5+7+9=(10)$	$(R_i-\bar{R})_{(11)}$	$(R_i-\bar{R})^2_{(12)}$
9	(−13)	169
20	(−2)	4
30·5	8·5	72·25
22·5	0·5	0·25
35	13	169
35	13	169
33	11	121
7	(−15)	225
15·5	(−6·5)	42·25
12·5	(−9·5)	90·25

$$\bar{R} = \sum_{i=1}^{N} \frac{R_i}{N}$$

$$= \frac{220}{10}$$

$$= 22$$

$$S = \sum_{i=1}^{N} (R_i - \bar{R})^2$$

$$= 1062$$

$$T = \sum_{g} (t^3 - t) = 6 + 30 + 24 = 60$$

$$\therefore W = \frac{12S}{K^2(N^3 - N) - KT}$$

$$= \frac{12 \times 1062}{4^2(10^3 - 10) - (4 \times 60)}$$

$$= \frac{12744}{(16 \times 990) - 240}$$

$$= \frac{12744}{15600} = 0.8169$$

$$\chi^2 = K(N-1)W = 4(10-1)0.8169$$

$$= 29.408$$

Kendall's W is quite high at 0.8169 which points towards a high level of agreement among the rankings of the four variables.

As calculated χ^2 (29.408) > Table value of χ^2 (21.666) at 1% Level of significance with 9 dof, the null hypothesis that there is no agreement among the rankings of the four variables can be rejected at a very high confidence level i.e. 99%. This suggests that the four variables which measure different aspects of financial performance of X Ltd. especially liquidity and profitability are strongly associated.

(c) What does debt service coverage ratio indicate? 6+2+2

4. Based on the following extracted information from Statement of Profit and Loss and Balance Sheet of a manufacturing company Y Ltd. for the year ended 31st March 2019, prepare a Cash Flow Statement of Y Ltd. for the same period under indirect method and interpret the financial position of the firm using ratios based on Cash Flow Statement.

	Amount (₹)
Surplus in Profit and Loss Statement	1,30,000
Depreciation and Amortization expense	1,80,000
Finance Costs	72,000
Interest Income	6,500
Dividend Income	4,500
Profit on sale of Investments	20,000

Purchase of PPE	4,50,000
Sale of Investments	1,20,000
Taxes Paid	32,500
Dividend Paid	97,500
Issue of Equity Shares	5,00,000
Redemption of 7·5% Preference Shares	3,00,000
Equity Share Capital (₹10 each)	15,00,000
Reserves (including Surplus for FY 18-19)	10,00,000
12% Debentures	12,00,000
Changes in Current Assets (other than Cash)	(50,000)
Changes in Current Liabilities	(1,00,000)
Current Liabilities	6,30,000
Cash and Cash Equivalents	2,32,500
Total Assets	43,30,000

Q 4) Cash Flow Statement of YLtd.
For the year ended 31st March 2019
(under Indirect Method)

Particulars	Amount (Rs.)	Amount (Rs.)
(A) Operating Cash Flows (OCF)		
Profit Before Tax (PBT) as per Statement of Profit & Loss [(Surplus as per P/L + Tax Expense) = ₹ (1,30,000 + 32,500)]	1,62,500	
Add/Less: Adjustments for non-cash, non-operating and extraordinary items of income and expenses:		
(+) Depreciation & Amortization expense	1,80,000	
(+) Finance costs (since YLtd. is a manufacturing company)	72,000	
(-) Interest income (since YLtd. is a manufacturing company)	(6500)	
(-) Dividend income (since YLtd. is a manufacturing company)	(4500)	
(-) Profit on sale of investments	(20,000)	
OCF before Working Capital Changes	3,83,500	
Add/Less: Adjustments for changes in Working Capital		
(+) Changes in Current Assets (Decrease)	50,000	
(-) Changes in Current Liabilities (Decrease)	(1,00,000)	

Particulars	Amount (Rs.)	Amount (Rs.)
Cash Flow from Operations	3,33,500	
Less: Taxes paid	32,500	
Net Cash Flows from Operating Activities (A)	3,01,000	3,01,000 (3,01,000)
(B) Investing Cash Flows (ICF)		
Sale of Investments	1,20,000	
Interest income	6500	
Dividend income	4500	
Purchase of PPE	(4,50,000)	
Net Cash Used in Investing Activities (B)	(3,19,000)	(3,19,000)
(C) Financing Cash Flows (FCF)		
Issue of Equity Shares	5,00,000	
Redemption of 7.5% Preference Shares	(3,00,000)	
Finance Costs	(72,000)	
Dividend paid	(97,500)	
Net Cash Flows from Financing Activities (C)	30,500	30,500
Net Increase/Decrease in Cash & Cash Equivalent [A + B + C]		12,500
Add: Opening Cash & Cash Equivalent (balancing figure)		2,20,000
Closing Cash & Cash Equivalent		2,32,500

2 marks +

1 mark +

1½ mark +

½ mark

5 marks

Cash Flow based Ratios

(A) Liquidity Ratio

(1) Cash Flow Ratio = $\frac{\text{OCF}}{\text{Current Liabilities}} \times 100$

$= \frac{3,01,000}{6,30,000} \times 100$

$= 47.78\%$

It implies that Y Ltd. can meet 47.78% of payment on Current liabilities out of operating cash flows during FY 18-19 thereby signifying a moderate liquidity position of the firm.

↳ 1/2 mark +

(B) Coverage Ratios / Solvency Ratios

(2) Interest Coverage Ratio = $\frac{\text{Cash Flow from Operations}}{\text{Interest/Finance Costs}}$

$= \frac{3,33,500}{72,000}$

$= 4.63$ times

(3) Dividend Coverage Ratio = $\frac{\text{OCF} - \text{Interest}}{\text{Dividend paid}}$

$= \frac{(3,01,000 - 72,000)}{97,500}$

$= \frac{2,29,000}{97,500} = 2.35$ times

(4) Debt Coverage Ratio = $\frac{\text{OCF} - \text{Interest} - \text{Dividend}}{\text{Total Debt}}$

- using only Long term Debt = $\frac{(3,01,000 - 72,000 - 97,500)}{12,50,000}$

$= \frac{1,31,500}{12,50,000} = 0.11$ times

- using Long term debt & current liabilities $= \frac{(3,01,000 - 72,000 - 97,500)}{(12,00,000 + 6,30,000)}$

$= \frac{1,31,500}{18,30,000} = 0.07$ times

The above operating Cash flow coverage ratios indicate that coverage for dividend, interest and debt paying ability of the firm are not quite satisfactory.

→ 1½ marks +

(c) Quality of Income Ratio

(5) Quality of Profit ratio $= \frac{\text{Cash Flow from Operations}}{\text{EBITDA}} \times 100$

$= \frac{3,33,500}{\text{PBT} + \text{Depreciation \& Amortization Expenses} + \text{Finance Costs}} \times 100$

$= \frac{3,33,500}{1,62,500 + 1,80,000 + 72,000} \times 100$

$= \frac{3,33,500}{4,14,500} \times 100 = 80.46\%$

The above ratio signifies that there has been a very high realization of earnings in the form of cash.

→ ½ marks +

(D) Capital Expenditure Ratios

(6) Degree of Dependence on Internal funds for financing capital expenditure $= \frac{\text{OCF} - \text{Increase in Cash \& Cash Equivalent during the year}}{\text{Investing Cash Flows (ICF)}} \times 100$

$= \frac{3,01,000 - 12,500}{3,19,000} \times 100$

$= \frac{2,88,500}{3,19,000} \times 100 = 90.44\%$

This suggests that Y Ltd. has depended heavily on internal funds for financing capital expenditure as external dependence of funds is only 9.56%.

↳ 1/2 mark

(E) Cash Return Ratios

(7) Cash return on Total Assets $= \frac{OCF}{\text{Total Assets}} \times 100$

$= \frac{3,01,000}{43,30,000} \times 100$

$= 6.95\%$

(8) Cash return on Net Worth $= \frac{OCF - Interest}{\text{Net Worth}} \times 100$

$= \frac{3,01,000 - 72,000}{(\text{Eq. Share Capital} + \text{Reserves})} \times 100$

$= \frac{3,01,000 - 72,000}{15,00,000 + 10,00,000} \times 100$

$= \frac{2,29,000}{25,00,000} \times 100 = 9.16\%$

(9) Cash Flow per share $= \frac{OCF - Interest - \text{Preferred Dividend}}{\text{No. of equity shares}}$

$= \frac{3,01,000 - 72,000 - (7.5\% \text{ of } 3,00,000)}{15,00,000 \div 10}$

$= \frac{3,01,000 - 72,000 - 22,500}{1,50,000}$

$= \frac{2,06,500}{1,50,000} = ₹ 1.38/\text{share}$

flow
The cash based profitability measures, as above, are not quite satisfactory for the firm, though the firm has the advantage of deriving benefits of trading on equity as cash return on net worth > cash return on total assets.

Overall, the firm significantly needs to improve its solvency position, more specifically coverage ratios, and then make effort to improve liquidity and cash return ratios.

↳ 1 1/2 mark

↳ 1/2 mark

= 5 marks

Problem: Motaal's Comprehensive Test of Liquidity

The following information are extracted from the annual reports of P Ltd. for the years ended 31st March 2013, 2014, 2015 and 2016.

(₹ '000)

	31.3.2013	31.3.2014	31.3.2015	31.3.2016
Working Capital	150	150	150	150
Current Assets	300	300	300	300
Stock	120	130	110	140

Looking at the above figures, the accounts manager of P Ltd. asserts that the liquidity position of the firm has remained the same over the four year period. Do you agree with the accounts manager's assertion? Justify in the light of Motaal's argument.

Q 3) Statement showing Motaal's Test of Liquidity

~~(₹ '000)~~

Particulars	Year Ended			
	31.3.2013	31.3.2014	31.3.2015	31.3.2016
1. Working Capital (₹ '000)	150	150	150	150
2. Current Assets (₹ '000)	300	300	300	300
3. Stock (₹ '000)	120	130	110	140
4. Liquid Assets (₹ '000) [Current Assets − Stock] [i.e. 2 − 3]	180	170	190	160
5. Working Capital / Current Assets [1 ÷ 2]	0·5	0·5	0·5	0·5
6. Rank of WC/CA (higher value → better rank)	1	1	1	1
7. Liquid Assets / Current Assets [4 ÷ 2]	0·6	0·57	0·63	0·53
8. Rank of LA/CA (higher value → better rank)	2	3	1	4
9. Stock / Current Assets [3 ÷ 2]	0·4	0·43	0·37	0·47
10. Rank of Stock / CA (lower value → better rank)	2	3	1	4
11. Sum of ranks (6 + 8 + 10)	5	7	3	9
12. Ultimate rank (lower value → better rank)	2	3	1	4

↳ ~~(1/2 × 9) = 4 1/2~~ +

Based on Motaal's Comprehensive Test of Liquidity, it is clear from the abave table that the liquidity position of P Ltd. is not same for all 4 years under investigation as asserted by the accounts manager, but liquidity position was the best in the year ended 31st March 2015, followed by 2013, 2014 and 2016 on the basis of ultimate rank. According to Motaal, it is not just the amount of current assets or working capital, but the distribution of current assets that help in evaluating liquidity position of the firm more precisely and this is adequately supported by the abave analysis which makes the account manager's assertion wrong.

Problem (11): Debt Service Coverage

X Ltd. has submitted the following projections. You are required to work out the yearly debt service coverage ratio and the average value of the ratio over the five years

[Rs. in lakhs]

Year	Profit Before Tax for the year	Interest on term loan during the year	Repayment of term loan in the year
1	21·67	19·14	10·70
2	34·77	17·64	18·00
3	36·01	15·12	18·00
4	19·20	12·60	18·00
5	18·61	10·08	18·00
6	18·40	7·56	18·00
7	18·33	5·04	18·00
8	16·41	NIL	18·00

The profit before tax has been arrived at after charging depreciation of Rs. 17·68 lakh every year and assume a corporate tax rate of 50%

Solution: Statement showing Determination of Debt Service Coverage Ratio

Year	Profit Before Tax (₹, lakhs)	Depreciation (₹, lakhs)	Interest on term loan (₹, lakh)	EBDIT (₹, lakh)	Repayment of principal amount of term loan (₹, lakh)	Before-tax fund required for principal repayment (₹, lakh) [7 = 6 ÷ (1 − t)] where t = tax rate = 50%	Total Debt Obligation (₹, lakh) (8 = 4 + 7)	Debt Service Coverage Ratio (DSCR) [9 = 5 ÷ 8]
(1)	(2)	(3)	(4)	(5 = 2 + 3 + 4)	(6)			
1	21·67	17·68	19·14	58·49	10·70	21·40	40·54	1·44
2	34·77	17·68	17·64	70·09	18·00	36·00	53·64	1·31
3	36·01	17·68	15·12	68·81	18·00	36·00	51·12	1·35
4	19·20	17·68	12·60	49·48	18·00	36·00	48·60	1·02
5	18·61	17·68	10·08	46·37	18·00	36·00	46·08	1·01
6	18·40	17·68	7·56	43·64	18·00	36·00	43·56	1·002
7	18·33	17·68	5·04	41·05	18·00	36·00	41·04	1·0002
8	16·41	17·68	NIL	34·09	18·00	36·00	36·00	0·95

Average DSCR over 8 year period

$$= \frac{\sum \text{Col. } 9}{8} = 1{\cdot}14$$

DSCR is an indicator of long term solvency position of the firm, and the higher the ratio, the better such position. Also DSCR > 1 indicates a sound solvency position as in case of X Ltd. because it means that the firm generates more than sufficient earnings to service all its debt obligations, both interest and principal.

Financial Analysis: Module II Unit 1

Contributing Faculty Member: Dr. Swapan Sarkar

Efficient Capital Market

Concept of Random Walk Hypothesis, Efficient Capital Market Hypothesis, Conditions of EMH – As discussed in the class (notes already provided)

Forms of Market Efficiency:

Though market efficiency essentially implies that any new information will get impounded in the security prices instantaneously, there can be alternative levels of efficiency depending upon the information set actually incorporated. In this respect Eugene Fama(1970) classified efficient capital markets into the following three forms:

a) Weak Form Efficiency:

The information set available in such a market is past sequence of security prices. Since past price data cannot be used to predict future security prices as these are already impounded in the stock prices, evidences on random walk hypothesis (i.e. independence of successive price changes) would generally confirm the weak form of efficiency in capital markets. As a value implication the so called chartist techniques (popularly known as the Technical Analysis) will be totally useless in earning any above normal return to the investors.

b) Semi-strong Form Efficiency:

In a market efficient in semi-strong form stock prices will instantaneously adjust to both past information and also all other publicly available information such as annual earnings announcements, stock splits, interim dividend etc. As a result trading strategies based on even publicly available price sensitive information will fail to yield superior risk adjusted return. In other words Fundamental Analysis will be completely useless in a semi-strong form efficient market.

c) Strong Form Efficiency:

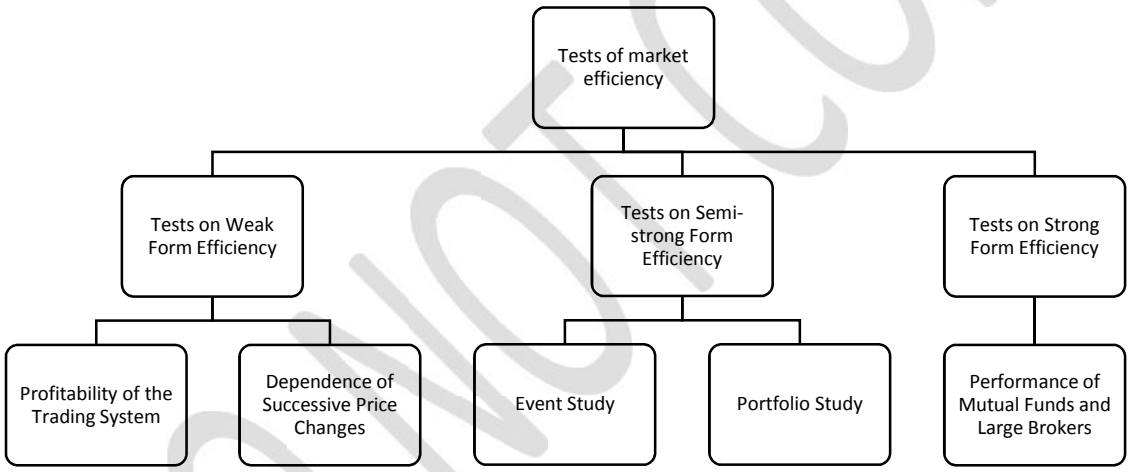
The information set available in such a market is all information both publicly available as well as inside information.Hence a strong form of efficiency will imply that the stock price will

incorporate all information be it past, publicly available or even inside information. Thus in such a market even insider trading will fail to earn excess return.

Since different forms or levels of efficiency require progressively more amount of information impoundment, various customized test techniques are applied to confirm such forms.

Tests on Market Efficiency:

Over the years researchers proposed various customized test techniques to identify the appropriate level of efficiency of a market. They can broadly be classified as follows:



- ***Tests on Weak Form of Efficiency: -***

Weak form tests were mainly concerned with two major issues-

1. Profitability of the Trading System: Since any mechanical trading system based on past price data cannot be profitable in a weak form efficient market, the profitability of the trading system of the speculators can be used to test this form of market efficiency. Researchers in this respect used 'filter rules' to confirm the profitability of the trading system.

- Filter Rule Test: Under Filter Rule Test, an n % filter rule may be defined as follows: If the closing price of a particular stock increases by at least n%, buy the stock and hold until the

price decreases by at least n % from the highest price following the purchase. At this time simultaneously sell the holding and go short. Maintain the short position until the daily closing price rises at least n % above a subsequent low. At this point of time cover the short position and go long. Price movements of less than n % in either direction should be ignored. If the market is inefficient in weak form, this filter rule will generate supernormal returns. This is because, here it is taken for granted that initial increase in price of shares will invite further increase in price till the price reaches the peak and then it will start declining gradually. Alternatively, in an efficient market the returns of a normal buy and hold strategy will be no different than that following filter rule.

2. Extent of Dependence of Successive Stock Price Changes: Technically in a market efficient in weak form security prices are bound to follow a random walk. As a natural implication, successive price changes, in such a market, will be independent. Hence any test to assess the extent of dependence among successive price changes can well be considered an important criterion in identifying a weak form efficient market. There are a number of test techniques available in this regard.

a) Traditional Test Techniques: These include Serial Correlation Test and Run Test.

- Serial Correlation Test:

  The serial correlation (also called Auto-correlation) measures the correlation between price changes in consecutive time periods whether hourly, daily or weekly and is a measure of how much the price change in any period depends upon the price change over the previous period. A serial correlation of zero (0) would therefore imply that price changes in consecutive time periods are uncorrelated with each other establishing the hypothesis that investors can't learn about future price changes from past ones. Alternatively, a price change that is non-zero and statistically significant would imply that returns in a period are more likely to depend on the prior period's returns and hence price movements are not random which is a clear indication of market inefficiency in the weak form. Serial Correlation Tests include Serial Correlation Coefficient Test and Ljung-Box Q Statistic. These tests are parametric tests.

Numerical Problem on Serial Correlation Coefficient Test

Steps of Serial Correlation Coefficient Test:

1. Set the Null Hypothesis:

Null Hypothesis: H_0 (There is no significant serial correlation in successive price changes i.e. r = 0)

2. Set the Alternative Hypothesis:
   Alternative Hypothesis: H_1 (There is significant serial correlation in successive price changes i.e. r ≠ 0)
3. Identify the distribution:
   Here r follows 't' distribution.
4. Value of test statistic:
   Value of t = $\frac{ACF}{STANDARD\ ERROR}$
   Where S.E = $\frac{1}{\sqrt{n-k}}$ = where n= No. of observations and k= No. of lag
5. Critical Region:
   It depends on the level of significance and degree of freedom = n-k
6. Decision:
   If $|t|_{observed} \geq |t|_{tabulated,}$ null hypothesis is rejected. Thus serial correlation coefficient is found to be statistically significant and consequently weak form efficiency is also rejected.

Example: The serial correlation coefficient obtained at lag 1 from return data for last 30 trading days is found to be 0.465. Can this be said that the market is efficient in the weak form? Conduct a serial correlation coefficient test. Critical value at 5% level is given as 2.045 for both tail test with 29 d.f.

Solution:

Null Hypothesis: H_0 (There is no significant serial correlation in successive price changes i.e. r = 0)

Alternative Hypothesis: H_1 (There is significant serial correlation in successive price changes i.e. r ≠ 0)

It follows t distribution.

Here, Value of t = $\frac{0.465}{0.186}$ = 2.5, as S.E = $\frac{1}{\sqrt{30-1}}$ = 0.186

$|t|$ = 2.5

Critical value of at 5% level for both tail test with 29 d.fis given as $|t|$= 2.045

Since $|t|_{observed}$ is greater than $|t|_{tabulated}$ the null hypothesis is rejected at 5% level. So, there exists statistically significant correlation between successive price changes. Hence the market is not efficient in weak form.

- Run Test: Under Run Test, a run occurs when there is no difference between the sign of two changes. To test a series of price changes for independence the number of runs in that series is compared against the number of runs expected in a purely random series of the same size. If actual number of runs does not differ significantly from the expected number of runs, efficiency is confirmed. Alternatively, existence of inefficiency is indicated by a test statistic value higher than the critical value. Run Test is a non-parametric test.

Numerical Problem on Runs Test

Steps of Run Test:

1. Set the Null Hypothesis:
   Null Hypothesis: H_0 (Actual no. of runs = Expected no. of runs)
2. Set the Alternative Hypothesis:
   Alternative Hypothesis: H_1 (Actual no. of runs ≠ Expected no. of runs)
3. It is a non-parametric test.
4. Value of test statistic:
   Value of $Z = \frac{r - E(r)}{\sigma r}$
   Where, $E(r) = \frac{2n_1 n_2}{n_{1+}\ n_2} + 1$ *and* $\sigma^2_r = \frac{2n_1 n_2(2n_1 n_2 - n_1 - n_2)}{(n_{1+}\ n_2)^2(n_1 + n_2 - 1)}$ where n_1 = No. of increase and n_2 = No. of decrease
5. Critical Region:
   At 5% level critical value for both tail test is 1.96 and at 1% level it is 2.58
6. Decision:
   If $|Z|_{observed} \geq |Z|_{tabulated,}$ null hypothesis is rejected. Thus price movements are found to not following random walk and consequently weak form efficiency is also rejected.

Example: The following information is obtained from a run analysis on price movements in a market.

Actual no. of runs = 35, No. of increase = 37 and no. of decrease = 43. Conduct a run test and verify whether the price movements are random? Can the market be said efficient in weak form?

Solution:

Null Hypothesis: H_0 (Actual no. of runs = Expected no. of runs)
Alternative Hypothesis: H_1 (Actual no. of runs ≠ Expected no. of runs)
It is a non-parametric test.
Here, actual no. of runs = r = 35
No. of increase = n_1 = 37 and no. of decrease = n_2= 43
So, E(r) = 40.775 and σ_r = 4.42
So, Z = (35-40.775)/4.42 = -1.31 i.e.$|Z| = 1.31$
At 5% level critical value for both tail test is 1.96 and at 1% level it is 2.58
Since,$|Z|_{observed} \leq |Z|_{tabulated,}$ null hypothesis is accepted at 5% level. Price movements follow random walk. The market is efficient in the weak form.

b) Advanced Tests:

Advanced tests on market efficiency are based on the concept of stationarity of time series data. A time series is called stationary if its mean and variance are time invariant i.e. same over the time. Thus, a time series is called non-stationary is its mean and variance vary over time. Hence, non-stationary time series data cannot be modelled. They follow random walk. Therefore, price changes if non-stationary are random and the market is efficient in weak form. The test which is used to identify whether a data is non-stationary or not is called Unit Root Test. There are

different types of Unit Root Tests. Some popular unit root tests include Advanced Dicky Fuller (ADF) Test and Philips-Perron (PP) Test.

Tests on Semi-Strong Form of Efficiency:

In order to test whether the market is efficient in semi-strong form generally two test are applied. These are – Event Study and Portfolio Study. These are discussed below -

- **Event Study:**

An event study examines the market reactions to and the excess market returns around a specific information event like bonus issue, right issue, acquisition announcement or stock split. Since a market efficient in the semi-strong form will ensure instantaneous incorporation of any publicly available price sensitive information, excess returns on and around the event announcement date are likely to be zero. Hence presence of excess return will clearly indicate market inefficiency in the semi-strong form. The steps of event study are discussed below –

1. Select a sample period and decide the announcement event on which the study is to be conducted. Identify the companies making such announcement during the sample period.
2. Consider the announcement date as the event date (t = 0)
3. Decide an 'event window' which represents a period range with equal no. of trading days prior and post the event date. For example, a 41 days event window will range from t = -20 to t = +20.
4. Decide an 'estimation window' comprising of a range of sufficiently large no. of trading days prior to the start of the event window. For example, a 180 days estimation window will range from t = -200 to t = -21.
5. Calculate the actual return from the stock of the company making such announcement for each of the trading days under 'event window'. It is denoted as R_{it}.
6. Calculate the actual return from the stock of the company and of the relevant index for each of the trading days under 'estimation window'.

7. Apply a regression model like CAPM or Market Model and identify a regression equation between stock return (R_i) and market/index return (R_m). Say, $R_{it} = \alpha + \beta.R_{mt}$ based on estimation window data.
8. Use the above relation and calculate expected return of the stock for each of the trading days under 'event window'. It may be denoted as $E(R_{it})$.
9. Calculate Abnormal Return = $AR_{it} = R_{it} - E(R_{it})$.
10. Calculate average abnormal return = $AAR_t = \sum AR_{i,t}/N$ where N = No. of sample firms.
11. Finally, to test the statistical significance of the Abnormal Return and Cumulative average abnormal return we use t statistic as follows:

    For Abnormal Return, $\mathbf{t = AAR_t/S.E}$; where $\mathbf{S.E} = \sqrt{\frac{\sum(AR_{it}-AAR_t)^2}{N-1}}\sqrt{\frac{1}{N}}$
12. If the calculated value of t-statistic of AAR_t exceeds the critical value of t at a chosen level of significance (α = 1% or 5%) and for (N-1) degree of freedom, the null hypothesis is rejected denoting statistically significant average abnormal return being generated by the stocks on and around the event day and hence pricing inefficiency of the market in its semi-strong form is confirmed.

Now let us take an example of event study on bonus announcement.

Suppose the sample period is from 01.01.2011 to 31.12.2015. Say during this period 50 companies have made bonus announcement. Also suppose that out of these 50 companies only 5 companies belong to SENSEX. So they constitute the final sample.

Now suppose that the event window is of 41 days (i.e. t = -20 to t = +20 including t = 0, the event day) and estimation period is of 180 days (t = -200 to t = -21).

Now for the first company we shall calculate actual stock return (R_{it}) and market return (R_{mt}) using the usual return formula $\frac{P_{t-P_{t-1}}}{P_{t-1}}$ for each of the trading days under event window and estimation window. Now using the R_{it} and R_{mt} during estimation period we shall form an equation $R_{it} = \alpha + \beta * R_{mt}$. Based on the equation we shall now calculate the estimated return i.e. $E(R_{it})$ of the company's stock during event window by putting the R_{mt} values of event window. Next we shall calculate the abnormal return for each of the 41 trading days under event window by the formula, $AR_{it} = R_{it} - E(R_{it})$.

Similarly for other four companies also we shall have the AR_{it}. Now we have 5 such AR_{it} for each of the 41trading days. So for each day we can calculate $AAR_t = \sum AR_{i,t}/5$. Similarly for each day we calculate S.E =

Now for each day we calculate $t = AAR_t/S.E$ and if the observed value is found to be statistically significant we conclude that the market is semi-strong form inefficient.

Numerical Problem on Event Study

A financial analyst of a mutual fund wanted to test whether Indian Stock Market is efficient in the semi-strong form. He decided to conduct an event study based on the stock split announcements by companies. Accordingly, he selected three companies namely A Ltd, B Ltd and C Ltd that had made stock split announcements during the last year. He calculated the characteristic lines for a period of three years on a weekly basis up to fourth week before announcement. The relationship between returns of the three companies and that of the selected index are given below:

$r_{A,t} = 3.40\% + 1.05 \times r_{m,t}$

$r_{B,t} = 3.06\% + 1.08 \times r_{m,t}$

$r_{C,t} = 3.84\% + 1.02 \times r_{m,t}$

Where r_A, r_B, r_C, r_M are the respective weekly returns of the companies and the market. The analyst considered a 7week event window for which the following data is available.

Week	Actual Return on Company Stocks (%)			Market Return
	$r_{A,t}$	$r_{B,t}$	$r_{C,t}$	$r_{m,t}$
-3	23.80	24.08	23.64	20.00
-2	27.00	27.34	26.84	22.30
-1	25.94	26.24	25.76	21.76
0	26.86	27.20	26.62	21.80
+1	25.00	25.24	24.82	20.10
+2	26.18	26.50	25.98	22.10
+3	29.02	29.42	28.74	24.30

Conduct the event study and comment on the level of market efficiency. Approximate expected return up to 2 decimal places.

[Given, $t_{0.025,2} = 4.31$ and $t_{0.005,2} = 9.925$]

Solution:

N.H: There is no abnormal return on and around the event date and hence the market is efficient

A.H: There is abnormal return on and around the event date and hence the market is not efficient

Expected returns are calculated as:

$E(r_{A,t}) = 3.40\% + 1.05 \times r_{m,t}$

$E(r_{B,t}) = 3.06\% + 1.08 \times r_{m,t}$

$E(r_{C,t}) = 3.84\% + 1.02 \times r_{m,t}$

Abnormal returns are calculated by the formula: $AR = r_{A,t} - E(r_{A,t})$ for firm A for each day and so on…

$AAR_t = \sum AR_t / N$ for each day when N = 3

S.E = $\sqrt{\frac{\sum(AR_t - AAR_t)^2}{N-1}} \sqrt{\frac{1}{N}}$ for each day

Calculation for expected return, abnormal return and average abnormal return

Week	$E(r_A)$	$E(r_B)$	$E(r_C)$	AR(A) = $r_A - E(r_A)$	AR(B) = $r_B - E(r_B)$	AR(C) = $r_C - E(r_C)$	AAR	S. E	t = AAR/SE
-3	24.4	24.66	24.24	-0.6	-0.58	-0.6	-0.59333	0.0071	-83.10
-2	26.815	27.144	26.586	0.185	0.196	0.254	0.211667	0.0208	10.10
-1	26.248	26.5608	26.0352	-0.308	-0.3208	-0.2752	-0.30133	0.0122	-24.59
0	26.29	26.604	26.076	0.57	0.596	0.544	0.57	0.0173	32.95
1	24.505	24.768	24.342	0.495	0.472	0.478	0.481667	0.0058	82.76
2	26.605	26.928	26.382	-0.425	-0.428	-0.402	-0.41833	0.01	-42.00
3	28.915	29.304	28.626	0.105	0.116	0.114	0.111667	0.0058	18.96

Critical value for both tail test with 2 d.f at 1% level of significance is $|t| = 9.925$

Since all observed values of $|t|$ are higher than the tabulated values of $|t|$, N.H is rejected for all weeks. Thus, there is abnormal market return (i.e. reaction) present in all days. Hence, the market is not efficient in semi-strong form.

- **Portfolio Study:**

Under Portfolio Study, the main focus is to examine the possibility of earning superior risk adjusted returns by trading on any observable characteristic of a firm like Price-Earning (P/E) ratio, Price to Book Value (P/BV) ratio, Dividend Yield ratio etc. Thus in this study a portfolio having the observable characteristic (such as P/E ratio) is created and tracked over time to see whether it earns superior risk adjusted returns. Presence of such excess returns is considered as a clear indication of market inefficiency in the semi-strong form. Conversely an excess returns tending to zero or statistically insignificant confirms market efficiency.

The steps of Portfolio Study are as follows –

1. Define the variable (or characteristic) on which firms will be classified. Note that the variable must be observable, but not necessarily numerical. Example: price-earnings ratio, company size, price-book value ratio, bond ratings, and so on. Also select a study period.
2. Classify firms into portfolios based upon the magnitude of the variable. Collect data on the variable for every firm in the defined universe at the beginning of the period and use that

information for classifying firms into different portfolios. For example, if the price-earnings ratio is the screening variable, classify firms on the basis of the price-earnings ratio portfolios from the lowest price-earnings class to the highest price-earnings class. The size of the universe will determine the number of the classes.

3. Collect information on the returns for each firm in each portfolio for the testing period and calculate the return for each portfolio, assuming that the stocks included in the portfolio are equally weighted (preferable but not mandatory) .
4. Calculate excess return (ER) of each portfolio. Excess return is the difference between actual return (R) and estimated returns (R′). Estimated return I usually calculated by applying the formula, $R'_{jt} = \beta_j * R_{mt}$, where –

   R'_{jt} = Estimated return of portfolio j at time t, β_j = Risk factor of portfolio j and R_{mt} = Market return at time t.

   Note that the beta of a portfolio is estimated the average of betas of individual stocks in the portfolio or by regressing the returns on the portfolio against market returns over some period (for example, the year before the testing period).

5. Assess whether the average excess returns are different across the portfolios. For this purpose several statistical tests are available to test whether the average excess returns differ across these portfolios. Some of these tests are parametric and some non parametric. If it is found that superior risk adjusted returns of the portfolios are statistically insignificant then we may conclude that the market is efficient in the semi-strong form and vice-versa.

Tests on Strong Form of Efficiency:

Strong form of market efficiency essentially requires incorporation of even non-public information in the security prices. Consequently, any trading based on such information is not likely to earn above normal returns in such a market. Therefore, in order to test strong form efficiency one has to compare the returns between persons who are supposed to possess non-public information and that of ordinary or retail investors. If it is found that the former group fails to earn any statistically significant excess returns the market may be considered as efficient in the strong form.

In this respect it is worthy to mention the contribution of Prof. Samuelson to test the strong form of efficiency. Samuelson identified 3 groups of investors who are expected to possess certain information which is otherwise not available to a retail investors.

These groups are –

a) Top management of a company and officers connected with the top management.
b) Large and established stock brokers (with huge money at their disposal, efficient network and superior analytical skills this group is expected to earn some hidden information about the company).
c) Top managers of large mutual fund (like brokers, mutual fund managers) have large amount of money, good connection and perhaps the best analysts of the country at their disposal that give them a chance to obtain additional information about the company which is beyond the reach of a retail investor.

Legally the first group is prohibited to trade in the share of their own company. The second group would seldom disclose the true and accurate figures of their earnings. So no comparative analysis of returns is possible here. However, all mutual funds publish their annual reports and disclose their earnings. So earnings of top mutual funds and that of the retail investors can be compared easily.

Samuelson argued that in order to test strong form efficiency of the market, earnings of top mutual funds should be compared to reach to any conclusion. He empirically examined the strong form efficiency of NYSE and found that after adjustment of transaction costs and risks the earnings of these two groups were almost identical. This made him to conclude that NYSE was efficient even in the strong form.

……To Be Continued……..

Financial Analysis: Module 2 Unit 2

Contributing Faculty Member: Prof. Swagata Sen

DISTRESS ANALYSIS

INTRODUCTION

Corporate failures have been one of the most important factors that significantly hindered the growth of corporations in India and across the globe. As a result, significant research attempts were made over the years to device a mechanism that can predict the failure well in advance so that focused corrective actions can be made to safeguard the interest of the stakeholders caused by a sudden failure.

Therefore, in this chapter we shall try to conceptualize the existing theories associated with corporate failure and its prediction models which will help us to build a customized model of our own to be applied under a given industry situation.

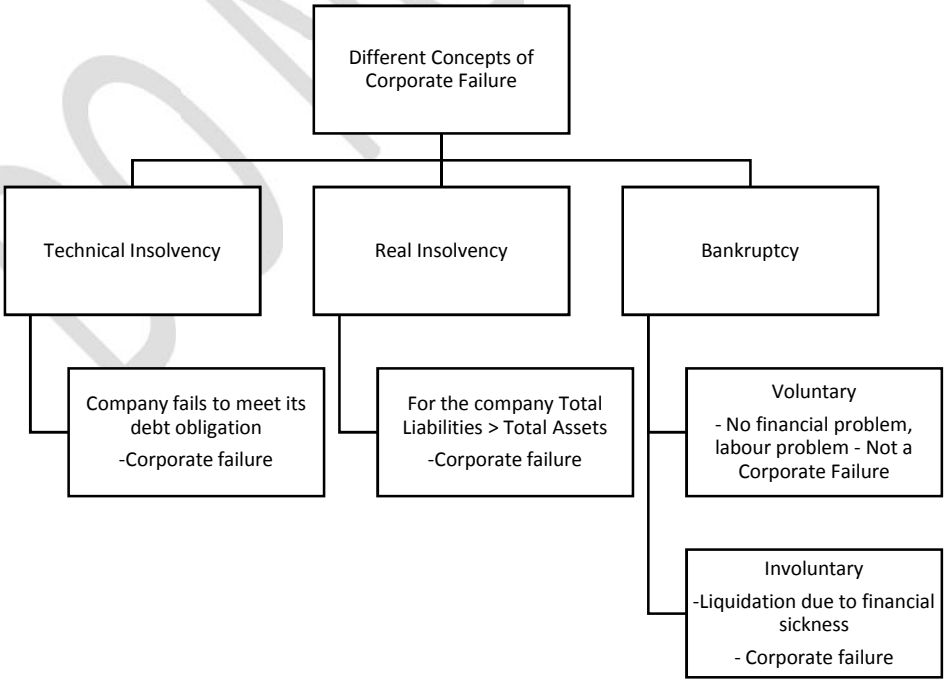
ALTERNATIVE TERMINOLOGY

In the context of corporate failure, a number of terms are used interchangeably, though all of them may not indicate the same meaning.

For example, the term 'sickness' is mostly used in the Indian subcontinent, whereas in western literature we find the term 'distress' to get preference. However, both of them mean the same.

Again, the term 'sickness' is used to indicate failure from economic point of view where possibility of revival may not be outweigh completely, whereas, the term 'bankruptcy' has got more legal connotation to mean situation more severe and leading towards a formal winding up.

GENERAL CONCEPT OF CORPORATE FAILURE:



Failure may mean any one of the following three alternatives –

1. It may refer to a situation where a firm is unable to meet its maturing obligations i.e. payment of preference dividend or payment of interest on debt capital. This kind of failure is also known as 'Technical Insolvency'.
2. Failure may also mean real insolvency i.e. an irrecoverable state of solvency where a firm's liabilities exceed the total value of all assets.
3. Corporate failure may also be interpreted in the strict legal sense of bankruptcy whereby a firm ceases its operations voluntarily or involuntarily.

   At this stage a relationship may be drawn between financial distress and bankruptcy. By financial distress we mean severe liquidity problems that cannot be resolved without a sizable re-scaling or re-organization of firm's operation or structure.

	Non-financially distressed	Financially distressed
Non-bankrupt	Case I	Case II
Bankrupt	Case III	Case IV

Figure: Bankruptcy vs. Financial Distress

In the above 2*2 matrix, Case I represents going concern business. Case II is firms which are financially distressed but not bankrupt. These firms have a chance of survival through re-organization of its structure and operations such as selling some of its unproductive asset base etc. or by rearranging a merger with a financially strong firm. Case III are firms that are not financially distressed but voluntarily entered into bankruptcy to force labour unions to accept a lower hourly wage rate etc. Case IV is firms that enter into involuntary bankruptcy because of severe financial distress and hence represent real insolvency cases.

Thus, corporate failure may be broadly defined as severe financial and or operational difficulties reflected in either insolvency or involuntary bankruptcy.

In distress analysis our objective is to assess whether firms in case II will proceed to case IV or not.

DEFINITION OF SICKNESS IN INDIA

The Reserve Bank of India has defined a sick unit as one "which has incurred a cash loss for one year and is likely to continue incurring losses for the current year as well as in the following year and the unit has an imbalance in its financial structure, such as, current ratio is less than 1:1 and there is worsening trend in debtequity ratio."

The State Bank of India Study Group has defined a sick unit as one "which fails to generate an internal surplus on a continuous basis and depends for its survival upon frequent infusion of funds."

Sick Industrial Companies Act of 1985, also known as The Sick Industrial Companies (Special Provisions) Act, 1985 (currently not in force), defined a sick industrial unit as one

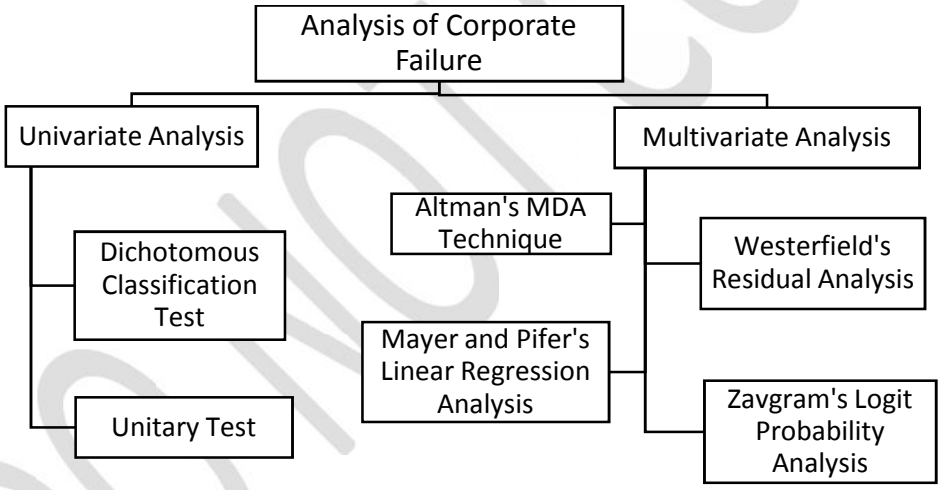
that had existed for at least five years and had incurred accumulated losses equal to or exceeding its entire net worth at the end of any financial year.

Currently, in India, sickness and insolvency cases are mostly covered by Insolvency and Bankruptcy Code 2016.

MODEL DEVELOPMENT FOR PREDICTION OF CORPORATE FAILURE:

Early prediction of corporate failure is important from the point of view of both industry and society as a whole, since it helps avoid or at least minimize the misuse and misallocation of resources. Preventive measures can be taken earlier. The management may change the operating policy, reorganize the financial structure. Investors may shift their funds from one organization to another organization. In this context, failure or sickness will be widely defined as severe financial crisis leading to technical or real insolvency or bankruptcy.

The analysis of financial statement of a firm and comparing it with that of other firms can give an indication of failure. The analysis can focus on a single financial variable known as Univariate Analysis or on a combination of financial variables known as Multivariate Analysis. Thus model development for prediction of corporate failure can be done either by Univariate Analysis or by Multivariate Analysis. The popular test techniques used under these two approaches are as follows:



Univariate Corporate Failure Prediction Model:

The key assumptions in Univariate Model are as follows:

1. The distribution of the financial variable of a failed firm differs systematically from the distribution of the variable for non-failed firms i.e. the mean and variance of the two distributions will differ if the distributions are assumed to be normal distribution.
2. This systematic distribution differences can be used to predict failure.

The most commonly used financial variable in several univariate models is financial ratios. Some of the early research works that compared financial ratios between failed and non-failed firms are –

Ramser and Foster (1931), Fitzpatrick (1932), Mervin (1942) and Moore and Atkinson (1961).

All these research studies had observed that there were systematic differences in financial ratios between failed and non-failed firms and this difference persisted for as back as six years prior to failure. These studies had further found that net income to net worth and net worth to total debt ratios were the best predictor of corporate failure. However, these studies failed to address the problem of failure prediction. Beaver (1966) study was the first to focus on the ability of the financial ratios to predict corporate failure. However, non-accounting data were ignored in Beaver's Study.

Misclassification or Error in Corporate Failure Prediction:

While predicting the bankruptcy status of a firm based on any given model, there may arise two types of errors – Type I and Type II errors.

Type I error arises when a firm which is actually bankrupt is predicted as Non-bankrupt based on the analysis. On the other hand, when an actually sound firm is predicted as bankrupt the error is called Type II error. This can be shown in the following matrix –

		Actual Status: Non-Failed	Actual Status: Failed	
Predicted Status	Non-failed	No Error	Type I Error	
	Failed	Type II Error	No Error	

There is some cost differential between the two types of errors. Type I errors are relatively risky as in this case an investor investing in monetary terms in the entity will ultimately loose his everything.

In order to overcome the above cost differential in arriving at any conclusion weighted average number of errors can be taken. In this case two types of errors will be given two different weightage and based on the weighted average number of errors the optimal cut-off point may be decided.

Dichotomous Classification Test (Used in Beaver's Study): A Hypothetical Examples.

Case Study 1:

A sample consisting of 10 firms (5 failed and 5 non-failed) is first divided into two sub samples of randomly selected 5 firms. The first sub sample is known as estimation sample and the second sub sample is known as validation hold-out sample. The values of 'total debt to total asset' ratio were determined for each of the two sub-sample and their actual status i.e. failure or non-failure was examined. The following results were obtained.

	Firms	Total Debt/Total Asset (mean)	Actual Status
Estimation Sample	I	0.50	NF

	II	0.45	F
	III	0.40	F
	IV	0.35	NF
	V	0.30	NF
Validation Sample	VI	0.480	F
	VII	0.440	F
	VIII	0.385	NF
	IX	0.297	NF
	X	0.250	F

Here NF stands for non-failed firms and F stands for failed firms.

Determine the optimal cut-off point and percentage misclassification.

Solution:

Calculation of optimal cut off point based on estimation sample

Firm	TD/TA ratio	Mid-point of two successive ratios	Actual Status	Type I error	Type II error	Total Error
I	0.50		NF			
		0.475 i.e. (0.5+0.45)/2		2	1	3
II	0.45		F			
		0.425		1	1	2
III	0.40		F			
		0.375		0	1	1
IV	0.35		NF			
		0.325		0	2	2
V	0.30		NF			

Since the more the TD/TA ratio the higher is the chance of failure, we have classified a firm as failed if its ratio is higher than the cut off (i.e. mid-point) point and classified a firm as non-failed if its ratio is lower than the cut-off point.

Type I error arises for misclassifications on the lower side of the cut off point and Type II error arises for misclassifications on the upper side of the cut-off point.

Since total error is minimum at the cut-off point 0.375, this is the optimal cut-off point.

Now, let us calculate the percentage misclassification in the validation sample as follows:

	Actual Status: NF	Actual Status: F
Predicted status: NF	IX (No error)	X (Type II error)
Predicted status: F	VIII (Type I error)	VI and VII (No error)

Total error = 02 and percentage error = 2 out of 5 i.e. 40%

Case Study 2:

A sample consisting of 10 firms (5 failed and 5 non-failed) is first divided into two sub samples of randomly selected 5 firms. The first sub sample is known as estimation sample and the second sub sample is known as validation hold-out sample. The values of 'cash flow to total debt' ratio were determined for each of the two sub-sample and their actual status i.e. failure or non-failure was examined. The following results were obtained.

	Firms	Cash Flow/ Total Debt (mean)	Actual Status
Estimation Sample	I	0.35	NF
	II	0.30	NF
	III	0.25	F
	IV	0.20	F
	V	0.15	F
Validation Sample	VI	0.22	F
	VII	0.19	NF
	VIII	0.176	NF
	IX	0.130	F
	X	0.120	NF

Determine the optimal cut-off point and percentage misclassification.

Solution: DUE

Calculation of optimal cut off point based on estimation sample

Firm	CF/TD ratio	Mid-point of two successive ratios	Actual Status	Type I error	Type II error	Total Error
I	0.35		NF			
		0.325 i.e. (0.35+0.30)/2		0	1	1
II	0.30		NF			
		0.275		0	0	0
III	0.25		F			
		0.225		1	0	1
IV	0.20		F			
		0.175		2	0	2
V	0.15		F			

Since the less the CF/TD ratio the higher is the chance of failure, we have classified a firm as failed if its ratio is lower than the cut off (i.e. mid-point) point and classified a firm as non-failed if its ratio is higher than the cut-off point.

Type I error arises for misclassifications on the upper side of the cut-off point and Type II error arises for misclassifications on the lower side of the cut-off point.

Since total error is minimum at the cut-off point 0.275, this is the optimal cut-off point.

Now, let us calculate the percentage misclassification in the validation sample as follows:

	Actual Status: NF	Actual Status: F
Predicted status: NF	------	-----
Predicted status: F	VII, VIII, X (Type II error)	VI and IX (No error)

Total error = 03 and percentage error = 3 out of 5 i.e. 60%

Additional Question:

Which, of the two ratios, is the better predictor of corporate sickness?

Solution: Since the percentage error is lower for TD/TA ratio, it is the better predictor between the two ratios.