CHAPTER-II

REVIEW OF LITERATURE
2.0 Introduction:

The aim of this chapter is to review briefly and critically the earlier empirical works relating to importance of financial ratios in predicting corporate failure/bankruptcy. A large number of studies have been carried out by the researchers in foreign countries as well as in India to examine the efficiency of various analytical prediction of corporate sickness using financial ratios as input. This chapter is divided in three parts:-

A) Foreign Empirical Work.
B) Indian Empirical Work.

A) Foreign Empirical Work:

Ramser and Foster (1931) were the first pioneers of quantitative studies into the potentiality of financial ratios to predict bankruptcy. They had analysed the trend of 11 different ratios of 173 firms with securities registered in the state of Illinois. The study reveals that less successful firms have poor financial ratios then successful firms. However two turnover ratios, viz, sale to net worth and sale to total assets exhibited an opposite tendency.

Fitz Patrick (1932) conducted a study taking equal number (19 companies each) of failed and successful. He selected the sample of failed companies which had failed during the period 1920-29 and matched the successful companies on the basis of asset size, sales volume, product line and fiscal year as matching criteria. 13 financial ratios for each pair of failed and successful companies was examined for a period prior 3 years of failure. Then ratios of both the groups were compared with the minimum level. It was found that most of successful companies surpassed the
minimum level, whereas the ratios of majority of failed remained below the minimum level. It was further observed that as the year of failure approach, the ratios of failed companies started deteriorating. The study claimed net worth to debt and net profits to net worth ratios as best indicators of failure.

Smith and Winakor (1935) in their study critically examined 183 firms which failed during 1923-31, for 10 years prior to the year of failure. The mean of 21 ratios for each firm were calculated for a period of 10 years to the event. It was marked that there were significant deterioration on average ratio values prior to failure. Net working capital to total assets ratio was found as the most accurate and steady indicator.

Merwin (1942) analysed ratio trend over 900 continuing and discontinuing small firms for a period of six years prior to failure during 1926-36. He adopted two methods of comparison. In the first method, he determined the high and low range for each ratio for every year. The other method was to use the estimated normal ratio for comparison. Comparing industry mean ratios of discontinuing firms against estimated normal ratios and the high-low range ratios, he found that ratios of discontinuing firms were below the estimated normal ratios and also out of the line of fixed high-low range, net working capital to total assets, current ratio and net worth to total debt were found to be extremely sensitive predictors of failure upto as early as four to five year before the event.

Moore and Atkinson (1961) used accounting data and financial ratios of failed firms only in determining the ability of firms to obtain trade credit. They found significance evidence
linking poor financial characteristics with difficulty in obtaining credit. They concluded that financial ratios provided an insight into the capability of the firm to service and repatriate the loan granted. Low current ratio and net worth to debt ratios were more prone to loan default.

**Beaver** for the first time in 1966 attempted to demonstrate that the failure of an enterprises can be predicted reliably through the combined utilisation of sophisticated quantitative techniques and financial ratio analysis. Beaver defined failure as a business defaulting on interest payment of its debt, over drawing its bank account or declaring bankruptcy. His sample consisted of 79 failed firm which failed during the years 1954-64 and were matched with same number of non-failed firms on the basis of industry and asset size of the firms. He calculated 30 ratios for each of the five years prior to failure and grouped them under six ratio categories. He conducted three major experiment; (i) comparison of mean values of ratio (ii) dichotomous classification test and (iii) analysis of likelihood ratios. He find the significant difference in the ratios of failed and non-failed firms. Cash flow to total debt ratio found to be the most useful predictor of failure while the poorest is current ratio.

In his second study in 1968 by using the same data he computed in the study of 1966, Beaver applied the concept of liquidity and compared the predictive ability of the ratios. He found three non-liquid assets ratio viz, cash flow to total debt, net income to total assets and total debt to total assets ratios are the best indicators. Also found that there was no market trend in the ratio of non-failed firms.
To overcome the shortcomings of the univariate model efforts were being made by the scholars to develop multivariate models to predict the corporate failure. The strategy for formulating multivariate models was pre-occupied with the selection of few important variables and the calculation of their respective weight on the basis of their significance in defining the event. Fisher was first to use the multiple discriminant analysis in his study in 1930's. In the earlier years, the discriminant analysis was mainly used in the biological and behavioural sciences.

Tamori's (1966) study was the first multivariate study in which weighted composite index of several ratios were used to indicate the possibility of failure. He introduced a few financial ratios in the model generally accepted in the literature and practice as indicators of financial soundness. These selected ratios were given certain weights according to their importance in the eyes of financial analysts, economists and creditmen. Profit trend and equity capital and reserves to total liabilities ratio were given maximum weights relatively showing that these ratios were considered to best indicator of failure. The main criticism leveled against his study was that he had chosen ratios and fixed the weight to them on arbitrary basis.

Altman in 1968 made a significant breakthrough in the area of business bankruptcy prediction by developing a model known as Z-score. He collected necessary data pertaining to bankrupt and non-bankrupt firms and thereby established their linear combination to derive a discriminant function for group separations. 
The discriminant function runs in the form of

\[ Z = V_1X_1 + V_2X_2 + \ldots + V_nX_n \]

Where \( Z \) = overall index

\( V_1, V_2 \ldots V_n \) = the discriminant co-efficient

\( X_1, X_2 \ldots X_n \) = independent variable (Ratios)

Altman used a paired sample consisting of thirty three failed and thirty three non-failed manufacturing firms, where industry and size were used as matching criteria. Twenty two (22) ratios were considered in various combinations as predictors of failure. The final set of ratios was determined by F-tests and computer runs analysing the possible alternatives. The following combination (i.e. discriminant function) of five ratios did the best overall job in discriminating between the failed firms and non-failed firms:

\[ Z = 0.012X_1 + 0.014X_2 + 0.033X_3 + 0.006X_4 + 0.999X_5 \]

Where \( Z \) = overall index

\( X_1 \) = Working capital /Total Assets (a liquidity measure)

\( X_2 \) = Retained Earnings / Total Assets

(a measure for reinvested earnings)

\( X_3 \) = EBIT / Total Assets (a profitability measure)

\( X_4 \) = Market value of Equity / Book value of Total Debt.

(a measure for the firms financial leverage)

\( X_5 \) = Sale/Total Assets (a measure for the sale generating ability)

His results show that prior to one year of bankruptcy, 95 per cent of the total firms were correctly classified. Type I error and Type II error were found to be 6 per cent and 3 per cent respectively. Altman found 2.675 as the optimum cut off point for Z-score values that discriminant between the bankrupt and bankrupt firms.
Z-score model did not give more accuracy as the lead time increases. In the third, fourth and fifth year prior to bankruptcy, it correctly classified the firms with 48%, 29% and 36% accuracy respectively.

In view of the high classifications error especially found in third, forth and fifth year prior to bankruptcy, Altman made some improvement to existing model in 1968 and tested his model on a secondary sample taken irrespective of its size and industry. He used MDA once again with both linear and quadratic structures and develop new Zeta model. The classification accuracy of firms for five years before the failure was 69.8% using zeta model and 36% using 1968 model.

*Ewert* investigated in 1968 on the basis of information supplied in the Dun and Bradstreet credit reports that ratios can predict non-repayment of receivables, keeping 62 per cent accuracy. His sample consisted 300 trade accounts of a California Manufacturing Concern. His 17 variables included only 2 ratios and the other 15 variable were non-ratios like, trade credit payment records, legal form of organisation, ownership of premises, etc. His sample consisted of small as well as large business concerns. By using multiple discriminant analysis, he found that non-ratio variable can do equally well in prediction of non-repayments.

*Meyer and Pifer (1970)* developed a linear regression model for the prediction of bank failures. They selected a sample of 78 banks consisting 39 failed banks (failed during 1948-1965) and 39 solvent matching banks. The financial information was used to work out 28 operating ratios and 4 balance sheet ratios. Financial ratios were computed for the period of six years prior to failure. A
stepwise regression programme, forward selection and backward reduction at each step was used. Model correctly predicted 80% of initial sample banks and 72% of the banks in the hold out sample with a lead time of one or two years before failure. Predictive ability decreases as the number of years prior to failure increases.

**Wilcox's (1971)** model was based on the objective that how to quantify the business risk through the gambler's ruin approach.\(^{12}\) He used important variable namely: (i) net liquidation value (NLV), (ii) average adjusted cash flow and (iii) size of bet (s) for predicting the business failure. His contention is that the smaller the NLV, the smaller the adjusted cash flow and larger the variation of adjusted cash flow, the greater the chance of failure. To determine how much NLV and average adjusted cash flow are needed for a given degree of safety, Wilcox introduced a concept 'size of bet' i.e. "S" where S is the adjusted cash flow at risk each year or as the simplest probabilistic process underlying the NLV cash flows.\(^{13}\)

So as to test his model, he selected 52 failed firms whose failure were recorded between 1955 and 1971 and each failed firm was matched with non-failed. Wilcox's classification accuracy result was very impressive. The original gambler's ruin rules one year before failure produced 94 per cent classification correct and 2\(^{nd}\) and 3\(^{rd}\) year before failure marked 89% each. 91% and 76% accuracy were achieved for the fourth and fifth years prior to failure respectively. Linear gambler's ruin score provided 94, 93, 83, 84 and 78 per cent accuracy for first year upto fifth year before failure. Wilcox concluded that gambler's ruin approach gives high degree of classification accuracy.
In an investigations of ratio analysis of business firms borrowings loans from the Small Business Administration (SBA) Edminister (1971) found that good prediction could be made by using a ratio functions. A business was defined as a failure if its SBA Loan was written off as a Loss: otherwise, the business was considered a success. He drew a sample of 21 borrowers who failed to repay and 21 borrowers who had not failed to repay, for a period of three years. He considered 19 ratios that were found significant in the studies conducted by Beaver, Altman, Ewert and Blum except the net operating income.

Edminister found that the discriminant model developed for small business demonstrated 92 per cent accuracy in the initial sample and 80 per cent accuracy in the validation sample. Ratio analysis may benefit by comparing industry average with the borrowers ratio and by using a small number of ratios representing different borrower's characteristics rather than one or few ratios describing very similar borrower's conditions. He also concluded that at least three consecutive financial statements are necessary for analysis. Edminister attempted to improve the quality of the ratio analysis by considering average ratio, ratio trend, ratio level and the interaction of trend and the level. He concluded that a linear combination of these variables can produce better prediction.

Deakin's (1972) study on business failure attempted to developed an alternative model to the once developed by Altman and Beaver. In the process he made a framework where he selected 14 variables of Beaver's study and applied Altman's multivariate approach to get the best result out of it. Deakin analysed 32 firms that failed between 1964 and 1970. Bankrupt
and insolvent firms were considered failed. He matched failed firms with non-failed firms on the basis of industry, asset size and year of financial data.

He could not derive linear discriminant function by using paired sample. So he selected a random sample of 32 non-failed firms drawn from Moody’s Industrial Manual for the years 1962-66. His study showed misclassification of less than 5 per cent for the first three years prior to failure. However, it increased to 21 per cent and 17 per cent in four and five years prior to failure. He concluded that the discriminant analysis can be used to predict business failure as far as three years in advance with a fairly high degree of accuracy and there was substantial asset expansion before failure mainly by debt. Cash to total assets, working capital to total assets and total debt to total assets ratios were found to be significant.

Chesser (1974) developed the discriminant model to predict the probability that a commercial loan customer would not be able to comply with his original loan agreement. He applied the discriminant analysis to loan analysis for discriminating acceptable risks and unacceptable risks. A loan was considered unsatisfactory if the borrowing firm failed to comply with the terms of its original loan agreement during the test period of 1962-71; the sample consists of 37 pairs and 21 pairs of the satisfactory and unsatisfactory loan for the first and second year before the event respectively. He used 15 ratios, divided into liquidity, leverage, activity and profitability groups. From the discriminant model he select six ratios and developed a mathematical model to estimate the probability that a loan customer would not be able to comply with terms of the original loan agreement. His model correctly classified 76 per cent of units in the initial sample for the first year.
data and 75 per cent on the secondary sample. As regards the two years before the non-compliance, the model classified 57.14 per cent of the units in this sample. He considered that this model is to be modified for implementation by introducing non-ratio variables such as measure of management performance, capacity utilisation, diversification of products and services, fluctuation of sales and general economic activity.

**Blum (1974)** developed a failing company model (FCM) to assess the probability of business failure. He defined failure as "entrance into a bankruptcy proceeding or an explicit agreement with creditors which reduced the debts of the company." His sample consists of 115 industrial firms which failed during 1954-68 (with liabilities greater than 1 million Dollars) and a paired sample of 115 non-failing firms being similar with respect to industry, annual sales, number of employees and financial year. Data up to eight years prior to failure were collected when available; however, five years of data prior to failure were found optimal. Based upon validation sample test, Blum concluded that his model had an accuracy of 93 to 95 per cent when failure accrued within one year of the statement date. The accuracy declined to 80 per cent for prediction three years prior to failure. Blum's primary contribution was the inclusion of ratio trends and variance as predictors. His best overall function contained twelve ratios variables of which five were measure of ratio trend or variance. Cash flow to total debt ratio got first position in prediction.

**Elam's (1975)** study mainly focused on the issue that whether there were any effect of lease capitalisation on financial ratios for enhancing the accuracy of failure prediction. To support this, he selected those failed firms whose lease information was
given on the footnotes of the financial statements at least one year prior to failure. He included 48 failed from 1966 to 1972. Each failed firm was matched with non-failed firm on the basis of fiscal year, standard industry classification, net sales in the fifth year prior to bankruptcy with industry class and reporting of uncapitalised long term lease. He selected 28 ratios for the study. When capitalised leases were added to each firm’s (i) net plant equipment, (ii) long term liabilities and (iii) total assets, it affects 13 ratios of the 28 ratios. His empirical finding shows that addition of capitalised leased data either single ratio or multiple ratio test did not significant improve the overall classification accuracy. Even in some cases the classification were less accurate when lease data were included.

The aim of Libby’s (1975) study was to know what extent the accounting ratios have the predictive ability and how for ratio information is useful for loan officer in evaluating the failure production. He selected 30 failed and 30 non-failed firms out of 64 firms from Deakin’s derivation sample. 14 ratio set of Deakin’s study were computed for 1 of the 3 years prior to failure. He select the set of five ratio from the rotated factor matrix. Model correctly classified 51 of the 60 firms based upon the derivation sample and 43 of the 60 firm using a “double cross validation” sample. For further testing of model, he made another experiment in which 431 banks loan officers participated from different large and small banks. Each loan officers was given 70 ratio data sets of five ratios each. The empirical results as experimented by loan officers on prediction accuracy was found to superior to random assignment i.e. fail and non-fail. Libby concluded that his reduced set of accounting ratios applies bankers with diverse backgrounds to make accurate prediction of business failure.
The purpose of Altman, Haldeman and Narayanan (1977) study was to construct, analyse and test a new bankruptcy classification model that explicitly considers recent methodological, accounting, statistical and bankruptcy development. They compute 28 ratio of 53 bankrupt and 53 non-bankrupt firms and applied various discriminant analysis procedures. The final set of seven variables used in discriminant function are: (i) return on assets (ii) stability of earnings, (iii) debt service (iv) cumulative profitability (v) liquidity (vi) capitalisation and (vii) size. Of these cumulative profitability shows a high degree of relative contribution in the scaled vector test.

They developed zeta model using financial ratios, they made linear and quadratic multiple discriminant analysis on both estimation and hold out sample. 93 per cent firms were classified accurate at the first year prior to bankruptcy in the estimation sample. The accuracy of the model for two, three, four and five year prior to failure was 89, 83, 79 and 76 per cent in hold out sample.

Taffler and Tisshaw (1977) developed a solvency model with the help of linear discriminant analysis. To them failed company means those firms entering into receivership, creditors voluntary liquidation, compulsory winding up by the court or government action undertaken as an alternative to the other unfortunate tastes. They examined 80 different ratios of 46 failed (1969-75) and 46 sound manufacturing companies. Final discriminant function resulted for the study for best discrimination between two groups is as follows:-

\[ Z = C_0 + C_1R_1 + C_2R_2 + C_3R_3 + C_4R_4 + \]

Where \( z \) = discriminant score.

\( C_0 \) = a constant
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C_{1} \ldots \ldots C_{4} = \text{the ratio weight}
R_1 = \text{Profit before the current liabilities}
R_2 = \text{Current Assets to total liabilities}
R_3 = \text{Current liabilities to total Assets}
R_4 = \text{No credit interval or acid test ratio}

Their empirical results had an overall classification of 97 per cent accuracy is the first year before the failure.

Frederikslust (1978) made an attempt to predict business failure based on testable financial theory of corporate failure. He defined failure as a negative cash balance. He identified the following observable failure prediction variables: liquidity, profitability, solvability, variability of liquidity and variability of profitability overtime, industry variables and general economic variables.\footnote{23}

A sample of 20 Dutch firms which failed during 1954 to 1974 and matching set of solvent firms was taken and the values of the prediction variables-liquidity and profitability were calculated for each of the five prediction years. The separate equation was computed by multiple regression computer programmes for every prediction year i.e.

\[
\begin{align*}
Y_1 &= .5293 + .4488 X_1 + .2863 X_2 \\
Y_2 &= .4885 + .4859 X_1 + .3789 X_2 \\
Y_3 &= .4086 + .5760 X_1 + 1.2731 X_2 \\
Y_4 &= .4215 + .3095 X_1 + 1.0977 X_2 \\
Y_5 &= .3808 + .2602 X_1 + .6986 X_2
\end{align*}
\]

\(X_1=\text{the liquidity Ratio}\)
\(X_2=\text{the profitability Ratio}\)
The two variables using data of one year before bankruptcy correctly classified 92.5 per cent of the total sample which reduced to 82.5, 77.5 and 70 per cent respectively when data of two, three, four and five year prior to bankruptcy were used.

**Walker, Stow and Morriarty (1979)** have done decomposition analysis of financial statements. They collected the data of eight failed firms which failed from 1966 to 1977 and compare them with equal number of nonailed firms. They used three decomposition measures viz, asset decomposition, liability decomposition and balance decomposition. They found that the decomposition measure are generally larger for failing firms. The liability decomposition measure is larger than the assets decomposition measure and decomposition measure have about the same bankruptcy prediction power as a good ratio.

**Norton and Smith (1979)** employed linear multiple discriminant analysis on historical data and general price level (GPL) data. They select the sample of 30 bankrupt and 30 non-bankrupt firms belonging to different manufacturing industries. They calculate 32 financial ratios on historical data as well as on general price level data. They employed linear MDA and found that both historical and general price level ratios exhibited the ability to predict bankruptcy. GPL data were shown to be consistently neither more nor less accurate than historical data for bankruptcy prediction.

**Dambolena and Khoury (1980)** constructed a model using stability and level of financial ratios as explanatory variables in the derivation of discriminant function. The basic purpose of this study was to test the effect of stability of financial ratios on prediction of corporate failure. 19 ratios were selected as predictor variables and
their measure of stability were used for the purpose of prediction in this stability model. A sample of 46 firms was taken and four measure of stability were computed for each of the 19 ratios and for each of the 46 firms for the period of 1969-75. The four measure of stability were: (i) the standard deviation of the ratios over three years period; (ii) standard deviation over four years period; (iii) its standard error of estimate around a four linear trend; and (iv) its co-efficient of variation over four years period. When empirically tested, the ratios with their standard deviation and ratios alone provided almost the same results for one year prior to failure. However the improvement was observed for three years before failure. When ratios alone were used, there was 70 per cent predictive accuracy of the model for five years before failures but on the other hand, it increased to 83 per cent when the standard deviation (stability measure) were introduced.

They concluded that the inclusion of stability of ratios in the analysis improved considerably the ability of the discriminant function to predict failure. The predictive accuracy of the model was 83 per cent on initial sample and 78 per cent on validation sample for five years prior to failure, which indicates an improvement over the results of previous studies.26

Ohlson (1980) developed a conditional logit model which pointed out that the fundamental estimation problem can be simply reduced to the following statement:

'Given that the firm belongs to some pre-specified population, what is the probability that the firm fails within some pre-specified time period'.27 The conditional logit model made no assumption regarding prior probability of failure and for the distribution of predictors.
He used a sample of 105 firms failed during 1970-76 and 2058 non-failed firms. Nine financial ratios were computed and tested to form an opinion about the discriminatory power of financial ratios. First he used profile analysis technique which explained that ratios deteriorate as one moves from two years prior to failure of firm. The standard deviation of the ratios were larger for bankrupts firms. Three set of estimate were computed for the conditional logit model. The results indicated that the four factors derived from financial statements were statistically significant in assessing the probability of bankruptcy. They are (i) size, (ii) the financial structure; (iii) profitability and (iv) current liquidity.

Gombola (1983) in his work include the sample of 52 failed and equal number of non-failed were taken from Dun and Bradstreete Business failure record. They use factor analysis on important cash flow variables. Resulting factor scores were used in linear discriminant and probit analysis. They found that cash flow factors significantly different between failed and non-failed firms only in first year prior to failure and probit model is significant only for first year prior to failure.28

Mensah (1983) use multiple discriminant analysis and logistic regression on specific price level adjusted financial ratios. He also used Lachen Bruch's 'U' method to evaluate the expost classification accuracy of the discriminant model. They found that specific price level model was the preferred one when discriminant analysis was used while the historical cost-specific price model was superior when logistic model was used. In overall sense the availability of specific price level (SPL) data may help to bankruptcy prediction.29
Casy and Bartczak (1985) work was concerned with the importance of cash flow in prediction of failure. They take the sample of 60 firms that has petitioned for bankruptcy during 1971-82 and 230 non-failed firm from the Compustat Industrial Take. Operating capital data for the non-failed firms were taken from periods contemporary to the failed firms. They used canonical correlation, Linear MDA and conditional step wise logit analysis for each year. Their results suggests that operating cash flow data do not provide incremental predictive power over accrual based ratios. It justified the omission of cash flow ratios in the bankruptcy studies of Altman (1968) and others.30

Frydman, Altman and Rao (1985) developed the Resursive Partitioning Algorithm (RPA) model. Their sample consist 58 bankrupt industrial companies which failed during 1971-78 and 142 Non-bankrupt manufacturing and retailing firms selected at random. Resursive Partitioning Algorithm is adopted by using 20 financial ratios which have been found significant in predicting business failure by Altman (1968) Deakin (972) and Altman (1977). RPA was found to possess the joint positive attributed of multivariate information content and univariate simplicity. The classification accuracy of RPA is superior to that of the traditional discriminant models.31

By taking the sample of 35 failed and non-failed firms located in Compustat Annual Industrial Research file, Gentry, Bold and Whitford (1985) used Linear discriminant analysis and probit and logit model analysis by using components of cash flow variables. They make the comparison between MDA and profit and logit model in predicting corporate failure. They found that MDA classification accuracy and predicted probabilities of failure were marginally better then prabit and logit analysis for original sample firms.32
Houghton and Woodliff (1987) incorporated the concept of human information process (HIP) with discriminant analysis to predict the failure. A sample of 48 companies consisting 12 failure cases and 36 non failure cases matched for time period and industry. They employed, discriminant analysis, using 5 ratios relating to income, liquidity, dividend policy, cash flow and leverage. In relation to failed firms discriminant function was found to outperform a proportional chance model. As for as the HIP is concerned both trained and untrained users significantly outperformed chance in a failure prediction context.33

Platt and Platt (1991) attempted to examine the effects of industry-relative financial and operating ratios and the change in industry output on the likelihood of corporate failure. They calculate 25 financial and operating ratios of 57 failed companies for the period 1972 to 1986 belongs to 13 different industries and same number of non-failed firms in their study. They reduced the number of ratios to 7 for logistic analysis. They convert the 7 ratios into industry relative ratio. The classification accuracy of the model was 90 per cent in case of adjusted ratios whereas it was 78 per cent for unadjusted ratios. They found that model built with industry-relations ratios is more effective in classification of firms in failed and non-failed groups.34

Ginoglou, Agorastos and Hatzigagias (2002) have taken the sample of 40 industrial firms in two groups 20 from healthy firms and 20 from problematic firms (under the productive law of 1386/83) during the period 1981-85 in the Greece. For each firms 16 accounting ratios were calculated. They used multivariate discriminant analysis at first and then comparisons were made with other bankruptcy models as Linear Probability Model (LMP)
as well as Logit and Probit Model. For MDA model the overall successful classification rates for problematic firms are 75 per cent for the year 1981, 1982, 1983 and 1984 while it was 85 per cent in 1985. While comparing MDA with other models the results are similar.35

B) Indian Empirical Works:

Very few studies on prediction of industrial sickness have been carried out in India, though the sickness in this country has posed serious threats to the national economy. Some of the important studies on corporate sickness prediction are reviewed below:

Sarma and Rao (1971) were the first Indian researcher who have applied multiple discriminant analysis in India on 30 failed and 30 non-failed Indian manufacturing companies. They apply the Altman’s (1968) model in the Indian situation they found that net worth to total assets ratio, debtor turnover ratio, working capital to total assets ratio, retained earning to total assets ratio and earning before interest and tax to sale ratios have significant predictive power. But like Altman model the predictive ability of the model decreases as the number of years prior to failure increases.36

Kaveri (1976) attempted to predict the borrower's health by utilising financial ratios as predictor variables. His sample consists of good, irregular and sick small scale industrial units.37 He selected 22 variables for the study. Putting them under several tests, viz., t-test, analysis of variance, discriminant analysis, and scaled vector, he selected 5 variables one from each ratio category for developing final discriminant model. He found that the ratio stock to cost of goods sold has the highest predictive power than
the other four ratios namely current ratio, current assets to net sale, net profit to capital employed and net worth to total liabilities. At one year advance to sickness 76 per cent classification accuracy was achieved for initial sample. The holdout sample provided 69 per cent classification accuracy before one year of sickness.

A combination of operational, technical and financial parameters were used by Srivastva and Yadav (1981) to discriminate between sick and non-sick units. He developed a linear discriminant function comprising seven ratios parameters-Five financial ratio, one technical ratio and one operational ratio. These ratios were Net worth / Total Assets, Net Block / Net Worth, Net Profit / Total Assets, Total liabilities / Net Worth, current ratio, capacity utilisation ratio and plant utilisation ratio. Initially a computer model was built up using three financial ratios and predictive accuracy was computed.

The classification error rate was 15 per cent of this linear discriminant functions which reduced to 10 per cent when only five ratios were applied. It further reduced to 5 per cent when first three ratios were combined with technical and operational ratio. The model was enlarged to include all the seven variables which resulted in 100 per cent predictive accuracy.

Bhattachrya (1982) attempted to developed a model using multiple discriminant analysis in order to identity the different symptoms which explain the sickness phenomenon, their relative contribution in determining the propensity of sickness. He selected 28 sick companies from six different industries which were listed sick by IDBI and 26 healthy units belonging to the same set of industry. The data relate to the four years 1975 to
1978 were taken. He constructed two sets of models. Both the models have shown identical classification result. The first model correctly classified the observations with 80 per cent accuracy while the second model achieved 78 per cent classification accuracy in the first year prior to sickness. Bhattachrya claimed that his first model is superior to second one on the basis of less number of misclassifications.

Gupta (1983) has made an attempt to examine, both, statistically and internally, a wide variety of ratios and determined the best set of ratios. These are best not only for the specific purpose of identifying potential sick firms but also for the more general purpose of ordering firms according to financial health. A simple non-parametric test for measuring the relative differentiating power of the various financial ratios was used. He selected 56 ratios and classified them under two groups i.e. profitability ratios and balance sheet ratios. To test the magnitude of each ratio, he made an array of sample of sick and non-sick companies and determined the optimum cut off points for each ratio. The least minimum misclassification number / percentage was chosen as the deciding parameter.

His samples consisted of 20 sick and 21 non-sick textile companies, the later was matched on the basis of product, age, size, assets and sales. Ratios for each samples company was calculated and tested in each year for a period covering 13 years i.e. from 1962 to 1974. Five profitability ratios were finally selected which had shown the possession of high degree of predictive power under the test when applied to a homogenous groups. He observed that companies having low or inadequate equity base (reserve strength) are more prone to sickness. His study also pointed out that liquidity ratios had poor showing relating to corporate health.
To assess the quality of financial ratios, Yadav R.A. (1986) has developed an analytical technique to evaluate the performance of business enterprises and has analysed the role of financial ratios and developed a multiple-ratio model performing the best overall job in the prediction of corporate sickness. Thirty six financial ratios have been empirically tested univariately as well multivariately on a sample of 78 companies (39 failed and 39 non-failed). On the basis of univariate analysis cash flow to total assets ratio has been found possessing highest predictive power. A multi-ratio discriminant model, was also developed containing four variables i.e. EBIT / Total Assets Ratio, current ratio, sale to total assets ratio and defensive assets to total operating expenditure ratio. The model classify 95 per cent firms accurate for one year before the failure and 78 per cent for six year before the failure.

Misra (1990) has developed model for textile enterprises takes into account nine-five profitability and four balance sheet ratios for computation of 'Z' score. His sample consisted 30 sick and 30 non-sick textile companies. The ranking of financial ratios as per scaled vector suggests that total liabilities to net worth, operating profit to net sales, net sales to total assets and net profit to net sale ratios occupy the top ranks. This reveals that the adverse debt equity ratio and low level of profitability are the main contributors to the impending industrial sickness.

In their study “The critical Appraisal of Industrial Sickness”, Sahu and Mishra (1992) have developed multiple discriminant analysis with the help of six variables (i) Cash flow to total liabilities, (ii) Net income to total liabilities, (iii) Total liabilities to total assets (iv) Net working capital to total assets (v) Quick ratio and (vi) Net worth to net sales. They take initial sample of 30 sick
companies which fall sick during 1980 to 1985 and 30 non-sick companies and calculate 30 financial ratios. They applied t-test, t-test and scaled vectors analysis for the selection of final variables. The classifications accuracy of the model for the first year before the sickness was 86.66 per cent in case of initial sample where it was 90% in hold out sample. They found that the profitability ratios displayed high capacity in discrimination and predicting corporate health as compare to liquidity ratios. The liquidity ratios have poor predictive ability.43

To examine the characteristics of business failure in India and in order to specify and quantify the variables which are effective indicators of corporate sickness, a set of five financial ratios has been used for prediction of corporate sickness by adopting multiple discriminant analysis by Aggarwal and Joshi (1992). They have taken the sample of 25 sick companies (which fall sick during 1987 to 1989) and 25 non-sick companies, and calculate 63 ratios for all the three years. The five most significant ratios were selected by using Wilks Lambda (U-statistics) and univariate F- ratio test are (i) PBDIT / Total Assets (ii) PAT / Net sale, (iii) Dividend to profit before tax, (iv) Total liabilities to total assets and (v) PBIT / Interest. Their model achieved 94% correct classification rate.44

An attempted has been made by Dr. Vijay (1996) to determine the short term liquidity position in the context of the selected sugar industry in Tamil Nadu during the period 1984-85 to 1993-94. He has applied a discriminant analysis approach to assess the liquidity of 10 units (five under cooperative sector and five under private sector) on the basis of two ratios only i.e. current ratio and liquidity ratio. Comparison was made for classification
of units into good and poor risk industry as per the criteria of current and liquid ratio and as per the discriminant score to determine the combined result of two ratios. Discriminant analysis was found more reliable.45

The unique feature of Sahoo, Mishra and Satpathy (1996) study is development of factor cum discriminant prediction model in Indian context. Since the financial ratios have both time specific and location specific predictive capacities, the dynamic approach to have a static model is unscientific.46 The Model improves the decision system of predicting sickness in short run leading to non-proliferation of industrial sickness in the corporate world. In their sample of 40 companies from different industry (20 sick and 20 non-sick) which have fallen sick during 1983 to 1993 they have calculated 30 various financial ratios and selected only six ratios for the final model on the basis of factor cum discriminant analysis. These ratios are Current Asset / Total Assets, Cash flow to Net Sale, EBDIT/Net sale, EBIT/ Interest, Sale / Total Assets, and Working Capital / Total Assets. Model was applied on initial and validation sample and result was almost equal and states that the model is more effective for short run period than for long run period.

The study of Misra and Biswasroy (1997) has been undertaken with selected sample of manufacturing public limited companies in the private corporate sector whose sickness was reported during 1980-85. The sample comprises 60 companies i.e. 30 sick and 30 non sick, matched on the basis of industry, size and year. 30 financial ratios have been selected and calculated for a period of 5 years. The statistical tools namely, t-test, and Dichotomous classification test have been used. Three parameters
REVIEW OF LITERATURE

viz., cash position, working capital, and net worth should be positive for healthy company\(^*\). Cash flow/Total liabilities, Net income/Net working capital, Total liabilities/Total Assets, Net working capital/Total assets, Current ratio and Net worth to Net sale ratios were considered best.

Based on the secondary data from a sample of 100 non-financial, non-government public limited companies in Eastern India for a span of ten years, Sahu (2000) attempted to measure the profitability of a firm by a single index. 20 profitability ratios under different heads were calculated. To study the degree of relationship between the profitability ratios under a particular head, the Spearman's rank correlation co-efficient (\(r_k\)) has been computed for the first, last and middle year. To discriminate between ratio a cut off point has been fixed (\(r_k = +0.85\)). High degree of correlation was found between the profitability ratios under each main head are partly due to common elements found in both the ratios and are influenced by the common economy-wide and industry wide factors. The ratio of EBDIT to G.T.A. is highly correlated with all the ratios coming under the main group.\(^*\)

Taking the instance of paper industry and using financial ratios as input Aggarwal and Singla (2001) developed a single index of financial performance through the technique of multiple discriminant analysis. 28 companies are selected out of these (based on operating profit) 14 companies are profit making and 14 are loss making. Out of 11 financial ratios calculated for the year March, 1997; only four ratios i.e. Net profit / Total assets, Interest coverage ratio, Earning per share and Stock-turnover ratio were included in the final discriminant function on the basis of t-value and simple correlation co-efficient and found that MDA not only
classify the companies as profit making and loss making but also indicate the important financial ratios which are inter-related, as stock turnover ratio will derive interest coverage and net profit and ultimately the earning per share.\(^4^9\)

**Chundawat, Shurveer and Bhanawat (2002)** has tried to compare all the studies, undertaken in the field of prediction of industrial sickness since 1932 to 1998 to fill in the communication gap between the academia conducting the research and the business community. They concluded that financial ratios are good indicators of a firm's financial performance but there is no absolute test for the importance of variables, and the significance of particular variables.\(^5^0\)

An attempt is made by **Chandra Mohan (2002)** in the direction of refined utilisation of a few selective financial parameters to assess corporate health and to predict stock market price trends by taking the sample of 70 companies making use of various methods such as univariate analysis, multivariate analysis, multiple valuation, multiple regression, recursive partitioning, logit analysis, probit analysis and Linear goal programming. Different kind of 25 ratios such as conventional ratios, unconventional ratios relating to the general conduct of business, current cost accounting ratios, historic cost accounting ratios etc. to choose a better combination of those ratios to truly represent the company's health state. Finally 7 ratios i.e. Debt/Total liabilities, Long-term liabilities to debt, Working capital/assets, Bank-borrowings/Working capital gap, Net sale/Stock EBIDT/Interest and EBIT/Total assets were included in the final model to calculate the z-score. The prediction efficiency of the model was 82 per cent.\(^5^1\).
Lastly all the studies have been summarised in the Table 2.1 as given below:

### Table 2.1: Studies on Prediction of Corporate Failure

<table>
<thead>
<tr>
<th>S.N.</th>
<th>Scholar</th>
<th>Data used</th>
<th>Methodology</th>
<th>Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.</td>
<td>Fitzpatrick (1932)</td>
<td>19 failed &amp; 19 non failed firms.</td>
<td>Trend of 13 financial ratios</td>
<td>Significant difference in the trend of ratios for the two groups at least three years prior to failure. NP/NW, NW/TD and NW/FA ratios found to be the best indicators.</td>
</tr>
<tr>
<td>3.</td>
<td>Winakor &amp; Raymond (1935)</td>
<td>Data of 183 failed firms subsequently</td>
<td>Prior trend of the means of 21 financial ratios</td>
<td>Significant deterioration of average ratio values prior to failure. NW/TA ratio found as the most accurate indicator.</td>
</tr>
<tr>
<td>4.</td>
<td>Merwin Charles L (1942)</td>
<td>Data for continuing and discontinued firms, also industry ratios</td>
<td>Six year trend of unspecified number of financial ratios with mean industrial ratios</td>
<td>Significant decline in the ratio trend continuously even up to six years before failure. WC/TA, NW/TD and CA/CL were found to be extremely sensitive.</td>
</tr>
<tr>
<td>5.</td>
<td>Moore GH, Atkinson TR &amp; Seiden (1961)</td>
<td>Accounting data for failed firms only</td>
<td>Financial ratios in determining the ability of the firm to get trade credit</td>
<td>Significant evidence linking poor financial characteristics with difficulty in obtaining trade credit.</td>
</tr>
<tr>
<td>6.</td>
<td>Beaver (1966)</td>
<td>79 paired failed &amp; non failed firms as used in the 1966 study</td>
<td>Compared the predictive ability of different ratios</td>
<td>Three non liquid assets ratio viz. CF/TD, NI/TA &amp; TD/TA ratios are the best indicators. Also found that there was no market trend in the ratio of non failed firms.</td>
</tr>
<tr>
<td>7.</td>
<td>Tamari's Model (1966)</td>
<td>Compared the index of risk of failed companies against risk index of all the industrial companies</td>
<td>Weighted composite index number using several ratios</td>
<td>Profit trend and equity capital and reserve to total liabilities ratios were given maximum weights.</td>
</tr>
<tr>
<td>8.</td>
<td>Altman (1968)</td>
<td>Sixty six firms in general</td>
<td>Used MDA to discriminate the failed &amp; non failed firms on the basis of weighted combination of five ratios</td>
<td>Weighted combinations of five ratios viz. WCT/L, RE/TA, EBIT/TA, E(mv)/TD, ST/TA is able to predict bankruptcy with 95% accuracy. But the predictive ability of the model declines rapidly as the number of years prior to failure increases.</td>
</tr>
<tr>
<td>9.</td>
<td>David Ewert (1968)</td>
<td>300 trade accounts of a California manufacturing company</td>
<td>17 variables out of which only 2 were financial ratios</td>
<td>Found that ratios can predict non-repayment of receivables. Keeping 82 per cent accuracy.</td>
</tr>
<tr>
<td>10.</td>
<td>Mayer &amp; Pifer (1970)</td>
<td>Solvent &amp; insolvent banks on a comparative basis.</td>
<td>Used linear probability involving regression with financial ratios as independent variables.</td>
<td>Data one or two years prior to failure to classified failure with 80% accuracy. Predictive ability decreases as the number of years prior to failure increases.</td>
</tr>
<tr>
<td>11.</td>
<td>Wilcox (1971)</td>
<td>52 bankrupt &amp; same number of non bankrupt firms.</td>
<td>Statistics derived from a binomial process with an absorbing state. Used gamblers' ruin approach.</td>
<td>Failure prediction up to 5 years before bankruptcy. Adjusted cash position, mean adjusted cash flow &amp; variance of adjusted cash flow were found to be the important variable.</td>
</tr>
<tr>
<td>12.</td>
<td>Sarma &amp; Rao (1971)</td>
<td>Failed &amp; non failed firms of 30 each</td>
<td>MDA using various financial ratios. Replication of Altman's (1966) model in the Indian situation.</td>
<td>Found that NWTA, DTR, WC/TA, RE/TA, EBIT/TA ratios have significant predictive power. But as Altman's model, the predictive ability decreases as the number of years prior to failure increases.</td>
</tr>
<tr>
<td>13.</td>
<td>Edminster (1971)</td>
<td>Tri-annual sample of 42 borrowers and mono annual sample of 552 borrowers all small firms.</td>
<td>Step wise MDA using seven financial ratios.</td>
<td>Found that the discriminant function classified failed &amp; non failed firms with substantial accuracy. But the data for at least three consecutive years are necessary.</td>
</tr>
<tr>
<td>14.</td>
<td>Deakin Edward (1972)</td>
<td>32 pair-wise failed &amp; non failed firms.</td>
<td>Comparative assessment of 13 financial statement items. MDA of 14 financial ratios.</td>
<td>There was substantial asset expansion before failure, mainly by debt and preferred stock. Cash/TA, WC/TA, &amp; TD/TA ratios were found to be significant. Predictive ability decreases over the years.</td>
</tr>
<tr>
<td>16.</td>
<td>Delton &amp; Chesser (1974)</td>
<td>37 pairs and 21 pairs of satisfactory and unsatisfactory loan for first and second years.</td>
<td>MDA and probability model based on 15 financial ratios.</td>
<td>His model correctly classified 76 per cent units in first year 75 per cent in second year.</td>
</tr>
<tr>
<td></td>
<td>Author(s)</td>
<td>Sample Description</td>
<td>Method</td>
<td>Conclusion</td>
</tr>
<tr>
<td>---</td>
<td>--------------------</td>
<td>-------------------------------------------------------------------------------------</td>
<td>------------------------------------------------------------------------</td>
<td>-----------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>17</td>
<td>Libby (1975)</td>
<td>30 failed and 30 non failed from Deakin's sample</td>
<td>Principal component analysis on 14 ratios.</td>
<td>Concluded that his five financial ratios applies bankers with diverse backgrounds to make accurate prediction of business failure.</td>
</tr>
<tr>
<td>18</td>
<td>Elam (1975)</td>
<td>48 pair-wise failed &amp; non failed firms for first to fifth year prior to bankruptcy.</td>
<td>Considered inclusion of lease data given in the footnotes and used both single ratio and multiple ratio models.</td>
<td>The inclusion of lease data does not improve the predictive power of either single ratio or multiple discriminant models.</td>
</tr>
<tr>
<td>19</td>
<td>Altman, Haldeman, and Narayanan (1977)</td>
<td>66 firms in general without distinction between failed &amp; non failed ones.</td>
<td>Developed Zeta model using financial ratios used MDA with both linear &amp; quadratic structure.</td>
<td>Firms were classified into bankrupt &amp; non bankrupt with 69.8% degree of accuracy 3 years prior to bankruptcy.</td>
</tr>
<tr>
<td>20</td>
<td>Taffler &amp; Tisshaw (1977)</td>
<td>Two groups of failed &amp; non failed firms of 46 in each group.</td>
<td>MDA-Z scored as used by Altman, Haldeman and Nar-ayanan (1977) using various financial ratios.</td>
<td>Supported Altman (1968)'s findings. EBIT/TL, CATL, CL/TA etc. were found to be the significant ratios. But the study does not provide any theoretical explanation.</td>
</tr>
<tr>
<td>21</td>
<td>Frederkslust's Work (1978)</td>
<td>A sample 20 Dutch firms which failed during 1954-1974 and matching set on non-failed firms.</td>
<td>Multiple regression using one liquidity and one profitability ratio.</td>
<td>He defined failure as a negative cash balance and achieve 92.5 per cent accuracy in predicting bankruptcy by using only two variables.</td>
</tr>
<tr>
<td>22</td>
<td>Walker, Stowe &amp; Moriarty (1979)</td>
<td>Data for eight failed &amp; non failed firms from 1966 to 1977.</td>
<td>Used three decomposition measures viz., asset decomposition, liability decomposition &amp; balance decomposition.</td>
<td>Decomposition measures are generally larger for failing firms. The liability decomposition measure is larger than the assets decomposition measure &amp; the decomposition measure have about the same bankruptcy prediction power as a good ratio.</td>
</tr>
<tr>
<td>23</td>
<td>Norton &amp; Smith (1979)</td>
<td>Paired sample of 30 bankrupt &amp; non bankrupt firms belongs to different manufacturing industries.</td>
<td>Employed linear MDA using 32 financial ratios, both historical cost &amp; general price level (GPL).</td>
<td>Both historical &amp; general price level ratios exhibited the ability to predict bankruptcy. GPL data were shown to be consistently neither more nor less accurate than historical data for bankruptcy prediction.</td>
</tr>
<tr>
<td>27.</td>
<td>Bhattacharya (1982)</td>
<td>28 sick and 26 healthy companies from different industry relate to four years i.e. 1975-1978.</td>
<td>Multiple discriminant analysis, two model were tested.</td>
<td>Found that the first model which is same as developed by Altman, predict failure with 80 per cent accuracy and 78 per cent by the second model.</td>
</tr>
<tr>
<td>28.</td>
<td>Gombola (1983)</td>
<td>Two groups of 52 failed &amp; non failed firms were taken from Dun &amp; Bradstreete Business failure record.</td>
<td>Factor analysis of important cash flow variables. Resulting factor scores used in linear discriminant &amp; probit analysis. Paired analysis by size &amp; industry classifications.</td>
<td>Cash flow factors are significantly different between failed &amp; non failed firms only in first year prior to failure &amp; probit model significant only for first year prior to failure.</td>
</tr>
<tr>
<td>29.</td>
<td>L.C. Gupta (1983)</td>
<td>Data for 20 sick &amp; 21 non sick companies from the textile industry.</td>
<td>Differentiating power of 56 financial ratios were measured by using of simple non-parametric test.</td>
<td>The predictive power of traditional liquidity ratio was very poor. Operating cash flow to sales ratio turned out to be more important in his study.</td>
</tr>
<tr>
<td>30.</td>
<td>Mensah (1983)</td>
<td>Expost samples of 60 firms and exante sample of 45 firms. A matched pair designed was used &amp; 35 non bankrupt firms were selected for the ex post sample.</td>
<td>Multiple discriminant analysis &amp; logistic regression using specific price level adjusted financial ratios. Also Lachen bruch's (1968) U method to evaluate the ex post classification accuracy of the discriminant model.</td>
<td>Found that specific price level model was the preferred one when discriminant analysis was used while the historical cost-specific price level model was superior when logist model was used. In overall sense the availability of SPL data may help to improve bankruptcy prediction.</td>
</tr>
<tr>
<td>31.</td>
<td>Casey &amp; Bartczak (1985)</td>
<td>60 firms that has petitioned for bankruptcy during 1971-82 and 230 non failed firms from the compustat industrial tape.</td>
<td>Operating capital data for the non failed firms were taken from periods contemporary to the failed firms. Used canonical correlation, linear MDA &amp; conditional step-wise logit analysis for each year.</td>
<td>The results suggest that operating cash flow data do not provide incremental predictive power over accrual based ratios. It justifies the omission of cash flow ratios in the bankruptcy studies of Altman (1968) &amp; others.</td>
</tr>
<tr>
<td>32.</td>
<td>Frydman Altman &amp; Rao (1985)</td>
<td>58 bankrupt industrial companies which failed during 1971-78 &amp; selected at random 142 non bankrupt manufacturing &amp; retailing firms.</td>
<td>Recursive partitioning algorithm is adopted by using 20 financial variable which have been found significant in predicting business failure by Altman (1968) Deakin (1972) &amp; Altman (1977).</td>
<td>Recursive partitioning algorithm was found to possess the joint positive attributes of multivariate information content &amp; univariate simplicity. The classification accuracy of RPA is superior to that of the traditional discriminant models.</td>
</tr>
<tr>
<td>33.</td>
<td>Gentry,bold &amp; whitford (1985)</td>
<td>35 failed &amp; non failed firms located in compustat annual industrial research file.</td>
<td>Used linear discriminant probit &amp; logit analysis by using components of cash flow variables.</td>
<td>MDA classification accuracy &amp; predicted probabilities of failure were marginally better than probit and logit analysis for original sample firms.</td>
</tr>
<tr>
<td></td>
<td>Authors</td>
<td>Sample Description</td>
<td>Methods</td>
<td>Results/Findings</td>
</tr>
<tr>
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<td>------------------------------------------------------------------------------------</td>
<td>-----------------------------------------------------------------------------------------------</td>
<td>---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>34.</td>
<td>Srivastava &amp; Yadav (1986)</td>
<td>Two groups of sick &amp; non sick companies (Indian context)</td>
<td>Discriminant analysis using seven financial ratios from B/S &amp; P/L a/c.</td>
<td>Classification made with 100% accuracy when 7 ratios viz. NWITA, Net Block/NW, NPITA, T/NW, CA/CL, Capacity utilisation ratio &amp; plant utilization ratios taken together.</td>
</tr>
<tr>
<td>35.</td>
<td>Houghton &amp; Woodliff (1987)</td>
<td>A sample of 48 companies consisting 12 failure cases &amp; 36 non failure cases matched for time period &amp; industry.</td>
<td>Employed discriminant analysis using 5 ratios relating to 1 income, 2 liquidity, 3 dividend policy, 4 cash flow &amp; 5 leverage. Incorporated the concept of human information process (HIP).</td>
<td>In relation to failed firms discriminant function was found to outperform a proportional chance model. As far as the HIP is concerned both trained &amp; untrained users significantly outperformed chance in a failure prediction context.</td>
</tr>
<tr>
<td>37.</td>
<td>Misra Banarasi (1990)</td>
<td>30 sick and equal number of non-sick textile companies.</td>
<td>Z-score model using five profitability ratio and four balance sheet ratios.</td>
<td>Suggests that T/NW, operating profit/NS, ATR and net profit to net sale ratio occupy the top rank. Adverse D/E ratio &amp; low level of profitability ratios leads to sickness.</td>
</tr>
<tr>
<td>38.</td>
<td>Sahu &amp; Misra (1992)</td>
<td>30 sick (during 1980-1985) and 30 non sick industrial units.</td>
<td>t-test, F-test, scaled vector analysis and MDA with the help of six ratios.</td>
<td>Found that profitability ratios displayed high capacity in discriminating as compared to liquidity ratio.</td>
</tr>
<tr>
<td>40.</td>
<td>Vijay Kumar (1996)</td>
<td>10 units in Sugar Industry in Tamil Nadu (5 from cooperative &amp; 5 from Private Sector)</td>
<td>MDA on the basis of current and liquid ratio to examine the liquidity of the firms.</td>
<td>Found that combined results of CR &amp; LR through MDA are better than the separate results given by these two ratios.</td>
</tr>
<tr>
<td>41.</td>
<td>Sahu, Misra Sajithy (1996)</td>
<td>40 companies from different industry (20 sick and 20 non sick) during 1983 to 1993.</td>
<td>Initially calculate 30 ratios and factor cum discriminant prediction model selecting only six ratios.</td>
<td>The best ratios are CA/TA, OCF/NS, EBIT/NS, EBIT/Int, ATR and WC/TA ratio. Model is more effective for short run period than for long run period.</td>
</tr>
<tr>
<td>42.</td>
<td>Ginoglou, Thomas, &amp; Agorastos (2002)</td>
<td>40 Industrial firm - 20 healthy and 20 problematic in Greece.</td>
<td>Developed logit and probit models (LPM) and compare with MDA.</td>
<td>Found that MDA is a more advance than LPM method and provide better results.</td>
</tr>
<tr>
<td>43.</td>
<td>Misra &amp; Biswasroy (1997)</td>
<td>30 financial ratio of sixty companies (30 sick and 30 non sick) for the period 1980-1985.</td>
<td>t-test and Dichotomous Classification Test.</td>
<td>Proves that three parameters, viz., cash position, working capital and net worth should be positive for healthy unit.</td>
</tr>
<tr>
<td>44.</td>
<td>Sahoo R.K. (2000)</td>
<td>100 non-financial, non-government public limited companies in Eastern India.</td>
<td>Study the Spearman's rank correlations. Coefficient (r) among 20 profitability ratios.</td>
<td>Found that EBDIT/G.T.A. is highly correlated with all other profitability ratios.</td>
</tr>
</tbody>
</table>
45. Aggarwal & Singla (2001)
Calculate 11 financial ratios of 14 profit making and 14 loss making companies for the years 1997-1999. 
t-test, simple correlation coefficients and MDA to develop single index of financial performance of companies.
Find that stock turnover ratio will derive interest coverage and net profit and ultimately the earning per share.

46. Chandra Mohan (2002)
Sample of 17 companies for different industries.
Using 25 ratios univariately, multivariately, multiple regression recursive partitioning logit & probit analysis.
Found that 7 ratios namely D/TL, LTL/debt WC/TA, Bank borrowing/WC Gap, ITR, EBDIT/Int and EBIT/TA are best indicators.

C) Evaluation of Empirical Work:

The foregoing empirical studies attempt to examine the health status of the firms in advance before they become sick or failure. These studies has unearthed the fact that financial ratios have the ability to predict the survival or failure of business undertaking. In most of the above mentioned studies on prediction of financial sickness or soundness of the firm, the researcher have explored a number of financial ratios as predictors of corporate failure in their predictive models. In brief, the purpose of these studies have been:

1. To investigate whether financial ratios are the significant variables to predict the survival or failure of firm and
2. To detect the ratios or a set of ratios taken together, which are goods predictors or indicators of such an event.

However, the evidence of these studies clearly indicates that with a few financial ratios, the survival or the failure of the firm can be predicted at least five years prior to the date of failure. Table-2.2 given below indicate the results of few selected studies which have pointed out that the failure of the firm can be predicted five years earlier.
Table 2.2

Percentage Classification Error Rates for Predicting Failure

<table>
<thead>
<tr>
<th>Year before failure</th>
<th>Beaver's Model</th>
<th>Altman's Model</th>
<th>Edward Deakin's Model</th>
<th>Mark Blum's Model</th>
<th>Sirvastva's Model</th>
<th>Kaveri's Model</th>
<th>Sahu &amp; Mishra's Model</th>
<th>Fzeder-Iksult's model</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>13.00</td>
<td>05.00</td>
<td>03.00</td>
<td>07.00</td>
<td>05.00</td>
<td>24.00</td>
<td>13.33</td>
<td>07.50</td>
</tr>
<tr>
<td>2</td>
<td>21.00</td>
<td>28.00</td>
<td>04.50</td>
<td>20.00</td>
<td>13.00</td>
<td>30.58</td>
<td>18.33</td>
<td>17.50</td>
</tr>
<tr>
<td>3</td>
<td>23.00</td>
<td>52.00</td>
<td>04.50</td>
<td>30.00</td>
<td>14.00</td>
<td>33.33</td>
<td>23.33</td>
<td>22.50</td>
</tr>
<tr>
<td>4</td>
<td>24.00</td>
<td>71.00</td>
<td>21.00</td>
<td>NA</td>
<td>18.00</td>
<td>38.13</td>
<td>25.00</td>
<td>27.50</td>
</tr>
<tr>
<td>5</td>
<td>22.00</td>
<td>64.00</td>
<td>17.00</td>
<td>NA</td>
<td>21.00</td>
<td>35.00</td>
<td>28.33</td>
<td>30.00</td>
</tr>
</tbody>
</table>

Observed evidence for five years prior to failure supports the view that financial ratios can be used in prediction of failure.

Their conclusions, however, differ regarding the question of which ratio or set of ratios perform well as indicators of failure. This might be partly on account of the use of different research methodology used by the above mentioned researchers, for example, Beaver used univariate approach while multivariate approach has been used by Altman. The major criticism leveled against most of these studies is on account of consensus regarding the inclusion of ratios in the final profile as indicator or predictor of failure, the results of the above mentioned model cannot be generalized and therefore require further verification of their applicability.

Another criticism of the above model is that they have applied single model in all the years, ignoring the facts that significance of a ratio or variable may vary in different years due to variation in the market and economic conditions. For example, there may be a good liquidity condition in the economy in the particular year and may be poor in the other, which may lead to increase or decrease the liquidity position of the company and accordingly the significance of liquidity ratios also affected by it.
The studies conducted for predicting company failure are scanty in India. Very little progress has been made in empirical testing of financial ratios with a view to showing which of them really reflect a company's state of health, its chances of survival or failure in Indian contest specially after liberalisation and globalisation of Indian economy. As well as the scope of Indian studies have been limited to a particular industry and the size of the sample are very small and can not be generalized. Thus more studies in this area are to be follow before generalising them for practical application.

Since no serious and systematic attempt has be made in this direction an attempt, therefore is made in this study to show the way towards a more systematic and scientific financial ratio analysis for predicting the chances of survival or failure of accompany. The very purpose of the study is to investigate the potential ratios that can give indications about the survival or failure of companies in different industries and the selection of best sect of ratios that can predict the event at high degree of accuracy. This become possible, as seen earlier studies, with the use of discriminant analysis along with financial ratios.
REFERENCES


