Chapter 2
Review of Relevant Literature

2.1 Introduction

The introduction of various complex financial instruments has led to the augmentation of risk elements and the major cause of concern has been to resolve the issue of credit risk. The empirical works have focussed on the risk aspects of banks and other financial institutions, industries and so on. However, there is paucity of research on examining the financial health of the listed firms in India. The issue got heightened with the collapse of one of the leading listed firms’ Satyam computer services on report of falsified accounts. The scandal raised questions on the accounting standards in India as a whole with the feeling that similar facts might lie buried elsewhere too. Nonetheless, very few studies have been carried out with regard to the evaluation of the financial health of the listed firms. As a background to the present study, an attempt is made in this chapter to review the relevant literature. The review is planned in three sections covering the firm intrinsic credit scoring model, evaluation of firm performance using efficiency as a parameter and effects of macroeconomic factors on financial health of corporations. The review covers the relevant past studies in India as well as those using global data.

2.2 Firm Intrinsic Credit Scoring Model

The use of credit scoring models to predict corporate distress has been widely studied across the world. Since credit score are expected to be an important tool for analysing the
probability of default, researchers are engaged to further their understanding of how credit scores can be used to engulf a broad spectrum of diverse economies across the world. In the current scenario of ongoing global meltdown, it becomes imperative for the companies to have a healthy risk culture to immune themselves from bankruptcy in the long run.

This part of the review covers the firm intrinsic credit scoring models used by various researchers. The developments of empirical models that discriminate failing firms from the surviving entities started in the mid 1960s.

Beaver (1966) emphasized upon the financial ratios as predictors of failure. His study focussed on providing an empirical verification of the usefulness of accounting data. The failed firm were characterised by a name change, merger, liquidation, lack of public interest and most importantly failure. He took paired sample and paired analysis for selection of non-failed firm based on the asset size and industry. The ratios used were – cash flow to total debt, net income to total assets, total debt to total assets, working capital to total assets, current ratios and no-credit interval. The findings of the study suggested that financial ratios can be useful in the prediction of failure for at least five years prior to the event.

Beaver (1968) was an extension of the former study (Beaver, 1966). However, one aspect of the data was not explored in the earlier study and that is the ratios cannot be chosen indiscriminately. The findings of the study indicate about the difference in the predictive ability of the ratios.

Altman (1968) used the Multiple Discriminant Analysis (MDA) technique along with financial ratios to predict corporate bankruptcy. He took 33 failed and 33 non-failed firms.
The failed group were the manufacturers who filed a bankruptcy petition under chapter X of the National Bankruptcy Act during 1946-1965. Group 2 consisted of a paired sample of manufacturing firms chosen on a stratified random basis. The variables used were classified into five standard ratio categories, including liquidity, profitability, leverage, solvency and activity ratios. The discriminant function yielded a score called Z score and on the basis of this a cut-off was found for classifying firms as failed, non-failed or under zone of ignorance. Based on the empirical results it was suggested that the bankruptcy prediction model is an accurate forecaster of failure up to two years prior to bankruptcy and that the accuracy diminishes substantially as the lead time increases. The Z score model has retained its reported high accuracy and is still robust despite its development over the years.

Deakin (1972) replicated Beaver (1968) study by using the same ratios. He applied the dichotomous classification test on his sample of 32 failed and an equal sample of non-failed firms during the period 1964-1970. He also used the discriminant analysis and found that it can be used to predict business failure from accounting data as far as 3 years in advance with a fairly high accuracy.

Altman (1973) used Linear Discriminant Analysis with published financial data representing discriminant variables for predicting railroad bankruptcies in America. He took bankrupt railroads on one hand and industry averages on the other. This diagnostic model was accurate in predicting two years prior to bankruptcy.

Altman and McGough (1974) attempted to develop criteria to aid the auditor in identifying situations where the status of a company as a going concern becomes doubtful, by analysing the relationship between bankrupt companies and auditor’s report prior to
bankruptcy. Thirty four American companies that had entered bankruptcy since 1970 were selected for the sample and the data were collected from the annual reports for the two years prior to the date of bankruptcy. The analysis indicated the superiority of discriminant model in signalling going concern problems earlier than an auditor’s opinion, up to two years prior to bankruptcy. The analysis revealed that bankruptcy model could serve as an effective aid for the auditor to form his/her judgement regarding the company’s ability to continue operations.

Shashua and Goldschmidt (1974) evaluated the overall performance of a firm relative to any other firm in the same industry for Israel. The study used a measure that provided a rating having a probabilistic meaning build on a utility function. The method of analysis was such that various indicators were combined into one index yielding the relative level of success. Both profitability indicators and financial indicators were used. The data was drawn from the financial statements of 216 firms. The index was validated in that it was accepted and adopted by the various agencies working with the agricultural firms in Israel.

Sarma and Rao (1976) applied Multiple Discriminant Analysis (MDA) to financial characteristics of 60 cotton textile industry members in India. The sample of unsound firms consisted of 18 firms taken over by various textile corporations set up by the concerned governments and 12 firms whose net worth was negative for the period 1968-1972. Twenty six ratios representing liquidity, profitability, leverage, solvency and activity were considered. The analysis revealed that given favourable external factors, the firms’ soundness is reflected by its earning power, dividend policy, management of current assets and net worth. The test of predictive accuracy showed that 95 percent of the firms were classified correctly. The model seemed to be accurate for periods as early as three years prior to failure.
Taffler (1976) took 23 bankrupt companies mainly manufacturers and 16 non-failed companies to predict bankruptcy in UK corporations. The application of Z score model to the failed sample for prior years showed 9 of the 23 companies appearing sound on the basis of penultimate accounts and only 8 having failure characteristics four years before failure. However, this study has been commented as being more concerned with theoretical issues for developing a Z score model.

Tisshaw (1976) analysed the unquoted privately owned manufacturing companies using Z score technique. The failed sample consisted of 31 privately owned manufacturing companies and each of these were matched by size, industry and year end with two ‘healthy’ live companies on the Jordan Dataquest database to provide the solvent group. So, it was possible to analyse the unquoted companies in UK using Z score technique.

Altman (1977) examined the financial problems in the Savings and Loan (S & L) association industry using a quadratic discriminant analysis. There were three groups of S & L’s depicting chronically ailing, temporarily unhealthy and consistently healthy characteristics. The results of the study show that a 12-variable econometric system is both accurate and practical for at least three semi-annual periods preceding the serious problem data.

Altman et al. (1977) constructed a second generation of model with several enhancements to the original Z score approach. It was termed as ZETA model. 53 bankrupt and 58 non-bankrupt entities were taken. The sample consisted of manufacturers and retailers and a 7 variable model was built. The ZETA model tests included quadratic as well as linear
discriminant models. The model appeared to be accurate for up to five years prior to failure. The findings showed that the inclusion of retailing firms in the same model as manufacturers does not seem to affect the results negatively.

Altman et al. (1979) studied the business failure experience in Brazil by using the bankruptcy classification model developed by Altman (1968). A sample of 23 serious-problem firms was compared with a slightly larger control sample of healthy firms. The four variable model successfully classified 88 percent of the firms one year prior to serious problems and as much as 78 percent three years prior.

Satyanarayana (1979) examined the relevance of Altman’s model (1968) in the context of Indian industry. The Z scores were calculated for three particular Indian companies and a group of 486 profit-making and 185 non-profit making companies. Companies were found to be continuing their operations even after several years of continuous losses mainly due to the financial assistance from banks and other government controlled financial institutions. The study concluded that although the Altman’s model was not useful in predicting the collapse of an industry, it was certainly helpful in determining and predicting the health of a company. It would also help to know whether it was borrowing beyond its capacity. The results showed that the impact of interest was very significant on the values of Z.

Kaveri (1980) tried to predict the health of borrowers using financial ratios. The data were collected for 524 small units belonging to paper, leather, engineering, textile and chemical industrial groups covering the period from 1967 to 1973. Five ratios belonging to five different categories were selected on the basis of their statistical significance in
discriminating units, possessing higher predictive ability and banker’s acceptability. The model projected higher degree of prediction in the short run than in the long-run. The study suggested that there should be periodic appraisals of the model and it should be updated using additional information or by introducing new variables, if necessary.

Ohlson (1980) used conditional logit analysis to examine corporate bankruptcy. Four factors were identified to have statistically significant relationship with probability of failure viz., (a) size of the company, (b) a measure of financial structure, (c) a measure of performance, and (d) a measure of current liquidity. The sample consisted of 105 bankrupt and 2058 non-bankrupt firms and data was obtained from 10-K financial statements. Size appeared to be an important predictor in this study. The study concluded that the predictive power of any model depended upon the available financial information.

Altman and Levallee (1981) constructed a failure prediction model for Canadian firms by combining traditional financial analysis with a multivariate statistical technique. The sample comprised of 54 publicly traded Canadian firms; half bankrupt and half continuing firms. Data from the bankruptcy date showed that the Canadian Z score was accurate for 2 years prior to failure but accuracy fell dramatically as data became more remote.

Betts and Belhoul (1982) developed a summary statistic that can be computed from published company balanced sheets and depending on the value that the statistic assumes the company can be classified as a going concern or having a failed company profile. The sample consisted of 26 failed companies and 131 going concerns sampled randomly from the EXSTAT tape. They suggested that such a statistic can be very effective in anticipating
failure and thereby the government can take necessary action to prevent the company from failing.

Betts and Belhoul (1983) introduced ratio stability measures and balance sheet decomposition index of Lev (1971) and Moyer (1977) to predict company failure. The sample consisted of 50 failed and 93 non-failed companies randomly from the EXSTAT tape. The balance sheet decomposition measure indicated that a firm approaching failure undergoes great structural changes and the stability measure indicated that companies near the point of failure show a great instability in their quick assets to current assets, working capital to net capital employed and day creditor’s ratios.

Betts (1983) showed how the Z score analysis using the MDA technique could be used as a screening device to identify companies at risk of failure. He took 26 failed firms and 131 going concerns as sample. He concluded that Z score helped to identify companies in a poor financial position.

Using 56 ratios, Gupta (1983) attempted to find out the best set of financial ratios which would not only identify potentially sick firms but also order them according to their financial health. The sample consisted of 21 non-sick and 20 sick companies which were not visibly sick up to 1964. The data were collected from 1962-1974 from sick textile companies. Ordered arrays of the sample companies were prepared according to the values of each ratio for each year. The cut-off point was determined which divided an array into two distinct zones of sick and non-sick companies. The point was determined so as to minimise the number of misclassifications in the array.
Betts and Belhoul (1984) extended his works further by making a new model and comparing it with the earlier ones. In this model he used semi-variance stability measures which were an improvement over his earlier studies. The sample and the financial ratios were the same that were used in the 1983 study.

Stein and Ziegler (1984) used balance sheet analysis, current account analysis and assessment of management for prognosis and surveillance of corporate credit risks. He considered 119 failed and 327 non-failed companies. Eight components were selected on basis of earning power, permanent capital, medium-term liquidity, personnel cost intensity, inventory intensity, repayment power, liquidation risk and cash liquidity. The findings showed that the analysis of the accounts data can contribute to an early warning system for risks of commercial credit borrowers.

Izan (1984) developed a five variable business failure classification model for Australia by using industry-relative approach instead of using traditional ratio analysis. This approach took into account differences across industries. The sample comprised of 53 failed and 53 non-failed firms. The model seemed to be sufficiently robust so as to be applicable across a broad cross section of firms and industries and appropriate for analysing firms of all sizes.

Takahashi et al. (1984) used both Principal Components Analysis (PCA) and discriminant analysis to predict corporate bankruptcy in Japan. So far as PCA was concerned it indicated that failed firms in Japan could be classified into two groups – a group having negative financial structures and a group having a declining flow of funds within a relatively
short period of time. Besides, they could also be classified into two groups from the time series change i.e., those showing some improvement during two years before, and those showing improvement in the last year prior, due to some successful rescue operations undertaken by the firms before failure. The discriminant analysis indicated that by using as predictor variables both ratios and absolute amounts based on cash base financial statement data 3 years before failure, improved prediction accuracy could be obtained. There were 36 failed and an equal sample of non-failed firms in the discriminant analysis. The study showed that banks have great influence over the fate of Japanese corporations and that the auditors reports should be taken into account while studying the financial statement data. The study also confirmed the necessity and desirability of using both the financial statement data for two or more years before failure, and indices relating to short-term flow of funds to make accurate corporate bankruptcy predictions.

Lincoln (1984) examined the usefulness of accounting ratios to describe the levels of insolvency risk. The study covered four different industries: manufacturing, retail, property and finance. 90 non-failed firms and 41 failed were taken. The model in the study established two main characteristics of a firm with a high level of insolvency risk in the manufacturing and retail industries: - firstly, it is close to the limits of its borrowing capacity because of a decline in cash flow from trading operations, a build up of stocks and debtors caused due to inefficient management and a policy of placing greater reliance on debt finance than is normal for the industry. Secondly, it lacks accumulated profits because of a poor profit record or of a policy of high-dividend payouts. The findings of the study place greater reliance on financial statements as all the factors influencing the success of a company gets reflected in it. Moreover, the study suggests that the size and age variables of a firm do not have anything to do with failure.
Micha (1984) analysed the business failures in France by using the discriminant model. The sample comprised of 1,150 companies taken as normal companies and 520 failed companies identified by judicial proceedings, by merger or takeover and voluntary winding up. The use of the discriminant function in France by the Central Balance Sheet Data Office has been mainly to prevent business failures and to find out the non-bankrupt companies. Analysis of score distribution showed that although big corporations succeed in looking less vulnerable, they nevertheless tend to suffer equally in business fluctuations.

Tamari (1984) used the forecasting model to analyse the corporate behaviour in Israel. In this study, the Israeli manufacturing corporations were ranked according to a multivariate index of risk based on five financial ratios that have been shown to successfully predict financial distress 3 years prior to the actual failure. The findings of this study show that the greater use of supplier credit and recourse to more than one bank are significantly linked to a higher degree of risk as measured by the index. The firms with high ranking in the index of risk extend more credit to their customers than do those with a low index. The growth rate of sales does not seem to be significantly and unambiguously related to the risk status of the firm.

Ariyo (1986) used a consensus approach for bankruptcy prediction. The subjects for the study were 31 bank managers and officers of financial institutions in Nigeria. Based on eight previous studies, 15 financial variables were considered relevant for the experiment. The findings of the study indicate that there was a consensus on short-term liquidity ratios being consistent predictors of financial distress. The level of experience of the manager had also an important bearing on the choice of variables used in predicting bankruptcy. There
were 3 ratios i.e. quick assets to current liabilities, current assets to current liabilities and cash available to current liabilities that were found to be important in predicting financial distress.

Srivastava and Yadav (1986) collected data from the financial statements of sick and non-sick companies belonging to the private manufacturing corporate sector, one to six years prior to the event. A sample of 39 companies which became sick during 1966 to 1980 was classified according to industry and size, measured by the paid-up capital and capital employed. Similarly 39 non-sick companies were also chosen. A set of 36 financial ratios representing profitability, liquidity, solvency and turnover were selected. Both univariate as well as multivariate – factor and discriminant analysis – were adopted. The discriminant analysis included 15 variables. Profitability and turnover ratios emerged to be significant discriminators. The model gave encouraging results for two years prior to failure. It was observed to predict well for short period.

Yadav (1986) also attempted to develop a comprehensive and scientific early warning system. The sample covered 39 failed and an equal number of non-failed companies, representing the manufacturing public undertakings in the private corporate sector in India during 1966-1980. Failed companies were identified from the Directory of Joint Stock Companies that have been notified to have gone into liquidation. A set of 36 financial ratios representing cash flow, income, solvency, liquidity and turnover were chosen for the preliminary analysis. The study presented the results of both the univariate and multivariate methods. The t-test and the dichotomous classification tests were also applied.

Queen and Roll (1987) examined firm mortality using market indicators. The variables were size of firm, price as given by closing price, total return, variance of return and
beta given by the relative volatility of the stock as compared with a market index (beta). Total mortality was calculated as the number of companies merged, exchanged, liquidated, delisted, halted and suspended by the exchange divided by the total number of companies. The favourable mortality rate was calculated as number of companies merged, exchanged or liquidated divided by the total number of companies. The unfavourable mortality rate was calculated as number of companies delisted, halted or suspended by the exchange divided by the total number of companies. The findings of the study revealed that the size of the firm remained statistically significant for both types of mortality, price predicted favourable mortality but is insignificant for unfavourable mortality, return predicted unfavourable not favourable mortality, total variance had a strong positive association with unfavourable mortality and not favourable mortality and beta is no longer significant for either of the two mortality.

Koh and Killough (1990) examined the problems faced by the external auditor in assessing the going-concern status of his/her clients and suggested that a failure-prediction model based on MDA technique could be used by the auditor in making going-concern judgements. 22 ratios representing liquidity, profitability, leverage, activity, returns and market conditions were taken. The sample consisted of 35 failed and 35 non-failed firms. The findings of the study showed that apart from being an effective analytical tool, failure-prediction model could also be used at the beginning of the audit to help the auditor in making necessary audit procedures.

Joshi and Ramani (1991) used the multiple discriminant analysis to determine the most relevant set of financial measures to control the company level performance by taking the Paint industry in India as a case study. Seven companies in the Paint industry were
selected and data on 27 financial ratios were obtained for the period 1981 to 1987 from the BSE directory. Both the canonical loadings and standardised discriminant weights produce the similar results indicating that the liquidity and sales turnover are the variables which discriminate most for the financial productivity and profitability of the Paint industry.

Altman and Fleur (1993) managed to avert a severe situation of bankruptcy in the GTI Corporation during the 1970s. Keeping a close watch on the Z score, a series of management decisions were taken which succeeded in foiling this prediction within five years. The model signalled underutilised assets to be a major contributor to the company’s deteriorating financial condition. As a follow up, the following strategies had been implemented step by step to eliminate the excess assets: (1) excess inventory were sold at the earliest; (2) corporate staff expenses were reduced through various measures; (3) all capital programs were frozen; (4) company’s creditors were asked for additional short term credit; and (5) inventories were placed under strict control. The employees were also actively involved in the process of its successful reorganisation. With continued strategies, GTI climbed higher ranges of success by 1979 and has been working as a financially sound company, pursuing new avenues to controlled growth. This study showed how Z score model could be used as a management tool with substantial success.

Panigrahy and Mishra (1993) discussed the various approaches for predicting the phenomenon of sickness in industries and presented a multivariate cash flow model to predict corporate sickness. The sample comprised of 45 sick and 45 non-sick companies. The sample of sick companies was prepared from BSE official directory for the period 1977-87 and the list of these companies were identified broadly based on the definition given by SICA, 1985. In addition, companies which had not paid dividend for several years and with low market
value of shares were also included in the sample. They were matched with the non-sick companies on the basis of size, age, nature of industry and fiscal year of comparison. 16 cash flow ratios were calculated from the financial statements and MDA along with scaled vector technique and multivariate F test were used for predicting corporate sickness. The seven variable discriminant model was able to predict sickness with 78.89% accuracy for three years prior to sickness. The findings of the study indicated that cash flow ratios were good indicators of corporate health.

Altman et al. (1995) introduced a scoring system called EMS model for emerging markets corporate bonds, which was an enhanced version of Z score model. Unlike the original Z score model, this was meant for application to both manufacturing and non manufacturing companies as well as for privately held and publicly owned firms. This model combined fundamental credit analysis and rigorous benchmarks together with analyst-enhanced assessments to have a modified rating, which could be then compared to agency ratings and market levels. It was applied to Mexican companies and was found to be flexible in terms of future modifications depending on the operating and financial environment and sovereign risk.

Crouhy et al. (2000) reviewed the Credit Value-at-Risk methodologies. First, the credit migration approach, as proposed by JP Morgan with Credit Metrics based on the probability of moving from one credit quality to another, including default within a given time horizon and second, the option pricing, or structural approach, as initiated by KMV and based on the asset value model originally proposed by Merton were reviewed. Then the actuarial approach as proposed by Credit Suisse Financial Products (CSFP) with Credit Risk+ and finally, McKinsey’s Credit Portfolio View which is a discrete time multi-period model
where default probabilities are conditional on the macro-variables like unemployment, the level of interest rates, the growth rate in the economy, etc were looked into. It was not clear that the proposed methodology of KMV and CreditPortfolioView performed better than a simple Bayesian model where the revision of the transition probabilities would be based on the internal expertise accumulated by the credit department of the bank, and the internal appreciation of where we are in the credit cycle given the quality of the bank’s credit portfolio. These two approaches were somewhat related since the market value of the firm’s assets depends on the shape of the economy.

Altman (2002) reviewed Z score and KMV’s EDF models. The paper discussed the important implications of Basel 2’s proposed capital requirements on credit assets and the enormous amounts and rates of defaults and bankruptcies in the US in 2001-2002. Both models were assessed with respect to default probabilities in general and in particular to the infamous Enron debacle. The study concluded that in order to be effective these and other credit risk models should be utilised by firms with sincere credit risk culture.

Mulla (2002) used the Z score analysis to evaluate the financial health of a textile mill in India. The case study was done by taking Shri Venkatesh Cooperative Textile Mills Limited, Annigeri of the Karnataka state and the required accounting information for the analysis was obtained from the annual reports of the textile mill under study covering a period of seven years. The findings of the study suggest that the textile mill under study was just on the verge of financial collapse and some type of managerial incompetence accounted for almost all failures.
Selvam et al. (2004) conducted a case study to predict financial health of India Cements Ltd using Z score analysis. The company was located in Tamil Nadu and it was a public limited company. The required accounting information about the company was obtained from the Prowess Corporate Database of CMIE, Chennai for a period of 5 years. The findings of the study revealed that the company faced the problem of under trading owing to excess working capital, under utilisation of available capacity led to failure of desired sales target and excess debt also led to poor financial health.

Aziz and Dar (2004) provided a critical analysis of methodologies and empirical findings of applications of various corporate bankruptcy prediction models across 10 different countries. The study’s empirical exercise found that predictive accuracies of different corporate bankruptcy prediction models were, generally, comparable. Artificially Intelligent Expert System (AIES) models performed marginally better than statistical and theoretical models. Overall, the use of Multiple Discriminant Analysis (MDA) dominated the research followed by logit models. Based on the observations of this study, it seems logical to admit that almost all models of corporate bankruptcy prediction are capable of doing their job. However, the usefulness of a particular model is dependent on the particular research objective.

Altman (2005) was an extension of the earlier EMS model of Altman (1995). Here there was a description of Mexican company credits first prior to the Mexican crisis (1994) then followed by more recent data.

Bandyopadhyay (2006) used MDA technique to develop Z score models for predicting corporate bond default in India. The variables used in the model were working
capital over total assets, cash profits to total assets, solvency ratio, operating profits over total assets and sales over total assets. He took a sample of 104 listed corporations from CRISIL. Logistic regression was also employed to directly estimate the probability of default using non-financial factors like age of firm, group ownership, ISO quality certification and control industry variables along with financial variables. The findings of the study showed that the Z model developed outperformed both Altman’s original and Emerging Markets model. The empirical results of the logit analysis revealed that the inclusion of both financial and non-financial factors leads to more accurate default prediction.

Bandyopadhyay et al. (2007) attempted to empirically calibrate the default and asset correlation for large companies in India and elaborate its implications for credit risk capital estimation for a bank. The authors estimated default probabilities and default correlations of long-term bonds of 542 Indian corporates using rating transitions and pair-wise migrations over ten year cohorts of firms. Further, the implicit asset correlation from the estimated default correlations and default thresholds were derived using the asymptotic single risk factor approach. It was found that default correlations are time variant and vary across rating grades and industries. The highest correlations are observed between companies within the same rating grades (systematic risk impact) and within the same industry (industry specific impact). The findings of the study showed no significant smooth monotonic relationship between the probability of default (PD) and asset correlation as prescribed by the Basel II IRB document (2006). Moreover, it was found that the asset correlation range for Indian corporates do not match with what was prescribed for corporate exposures by BCBS.

Bandyopadhyay (2007) developed a hybrid logistic model taking inputs from BSM equity based option model. The findings of this study suggested for further enhancements in
the BSM model taking into consideration the accounting information from financial statements and to develop hybrid models. The results obtained in this paper indicates that a mix of asset volatility, market value of asset and firm’s leverage structure along with other financial and non financial factors could give us a more accurate prediction of corporate default than the ratio-based reduced form model.

Altman et al. (2007) developed a model for identifying potentially distressed firms in China. The variables used in the model were asset liability, working capital, return on total assets and retained earnings ratios. It was very similar to the EMS model of 1995. The findings of the study revealed that the model was robust with very high accuracy and was able to forecast up to three years with 80 percent accuracy for those firms categorized as Special Treatment (ST) which indicated that they were problematic firms.

Mishra et al. (2008) modelled the default probabilities and credit spreads for select Indian firms in the Black-Scholes-Merton framework. They showed that the objective (or ‘real’) probability estimates were higher than the risk-neutral estimates over the sample period. However, the probability measure was found to be robust to the ‘default trigger point’. The model output also compared favourably with the default rate reported by CRISIL’s Average 1-year rating transitions as well as the Altman Z-score measure. However it failed to generate spreads as high as those observed in the corporate bond market.

Miller (2009) evaluated the Distance to Default and Z-Score models for their ordinal and cardinal bankruptcy prediction abilities, rating durability over time, and rating stability. Distance to Default outperformed the Z-Score and our univariate TLTA model in both
ordinal and cardinal bankruptcy prediction. Curiously, the Z-Score’s ordinal ability is nearly equal to the other two models when ranking relatively safe companies, but performs worse in situations where the probability of bankruptcy is high. It was found that all three models produced actionable scores so far as rating durability was concerned. However, Distance to Default generated more durable ratings as its Ordinal Score was higher over all bankruptcy time-horizons and decayed at a slower pace than either of the other two models. However, Distance to Default had more volatile ratings than both the Z-Score and the TLTA model as it relies the most on market-based inputs, and market based inputs are usually more volatile than accounting-based inputs. Miller recommended the use of the Distance to Default model over the Z-Score model when trying to predict corporate bankruptcies subject to availability of data for each model and his results did not in any way condone the conclusion that all structural models outperformed all empirical ratio-based models.

Angur (2009) examined the aspects of corporate governance system and suggested ways to foresee a corporate fraud in the offing. Five key early warning signs in terms of high earning expectation, fraudulent accounting, dormant or non-existence of corporate governance committee, assessing the true nature of ethical and altruistic practices of the company and lookout for the Big Lie Theory were highlighted for assessment of corporate governance system. The findings of this paper suggested that corporate failures can be averted if the five key signs were closely monitored.

Appiah and Abor (2009) used MDA to develop the Z score to support the notion that Z score is an innovation to overcome the numerous difficulties associated with using single ratios to measure companies’ health or risk of failure. The sample consisted of private medium-sized 31 failed and 31 non-failed manufacturing firms in the UK, during the period
1994-2004. Ten ratios were taken representing turnover, net PBIT, interest expense, current assets, quick assets, current liabilities, long-term liability, capital employed, shareholders’ fund, working capital and gross profit. The initial model predicted bankruptcy with 79% accuracy whereas the modified model predicted bankruptcy with 97.3% accuracy which was done with a change in one of the variables i.e. net profit margin was included instead of gross profit margin and the sample was also changed to 17 failed and 20 non-failed firms. The findings of the study advanced the notion that net profit margin was superior to gross profit margin in discriminating between failed and non-failed UK manufacturing companies in terms of its significant contribution to Z score.

The majority of the works described above have used the Multiple Discriminant Analysis (MDA) technique to predict the corporate distress and or bankruptcy. Various other methodologies have been attempted as an improvement over MDA; however, the popularity of Discriminant analysis still dominates due to its simplicity and expediency in application.

2.3 Evaluation of Firm Performance using Efficiency as a Parameter

The financial factors in the credit risk assessment have been dealt in the first empirical chapter. Much of the earlier work has focused on the importance of traditional financial measures in prediction of distress with varying degrees of success, but the non-financial information remain largely uncharted. So, chapter 4 would look into the role of non-financial factors in the credit risk evaluation process. Here in this chapter the productive efficiency of a firm is calculated using the Data Envelopment Analysis (DEA) technique and then it is regressed upon the firm’s ratings given from a public source (CARE/ICRA). Subsequently, it
shows how a non-financial factor like efficiency can be an indicator of a firms’ financial health.

This section of the review covers the efficiency aspect and the DEA technique used by various researchers.

DEA was introduced by Charnes et al. (1978); they extended Farrell’s (1957) idea of estimating technical efficiency with respect to a production frontier. The resulting CCR model, named after the three authors, allowed for the calculation of the relative technical efficiency of similar Decision Making Units (DMU) in the analysis on constant returns to scale basis. This was achieved by constructing the ratio of a weighted sum of outputs to a weighted sum of inputs, where the weights for both the inputs and outputs were selected in a way that the relative efficiencies of the DMUs was maximised with the constraint that no DMU had a relative efficiency score greater than one.

There have been numerous books and articles published involving DEA since 1978 with several extensions and applications. One of the most significant developments since the CCR model was the introduction of the BCC model by Banker, Charnes, and Cooper in 1984. The BCC model relaxed the convexity constraint imposed in the CCR model which allowed for the efficiency measurement of DMUs on a variable returns to scale basis. The BCC model resulted in an aggregate measure of technical and scale efficiency, whereas CCR model was only capable of measuring technical efficiency. So, this allowed for the separation of the two efficiency measures.
Smith (1990) applied DEA to financial statements of companies in pharmaceutical industry. The model included average equity and average debt as inputs and earnings available for shareholders, interest payments and tax payments as the three outputs. The inputs and outputs were selected with the shareholders view of the firm. The study questioned the selection procedure of the variables, since there is no device to guide the analyst aside from his/her experience and some comprehensive sensitivity analysis. The author also cited the problem posed by outliers and emphasised on careful selection of the efficient DMUs. The study concluded that DEA potentially offers rich new insights into the performance of firms, and identified financial distress prediction and takeover activity as areas of possible future work.

Fernandez and Smith (1994) referred to the DEA model used in their paper as a solution intermediate between crude ratio analysis and complex regression technique. The study examined 27 datasets, each having a bankrupt firm and their healthy counterparts. The model included six financial ratios reflecting cash position (Cash/Total Assets), liquidity (Current Assets/Current Liabilities), working capital position (Working Capital/Total Assets), leverage (Net Income/Total Assets), profitability (Net Income/Total Assets) and turnover (Sales/Total Assets). All the six of these variables were taken as outputs to the DEA model and no inputs were specified. Based on the findings of the study, the authors concluded that DEA is likely to be useful for predicting bankruptcy only if it is employed in conjunction with other methods.

Thore et al. (1994) employed DEA to estimate the intertemporal productive efficiency of US computer manufacturers, using financial data brought from earnings statements and balance sheets. The results indicated that a few of the successful corporations were able to
stay at the productivity efficiency frontier throughout the time period investigated. Other successful companies however, received inefficient ratings which seemed to indicate that sub efficiency or disequilibrium sometimes actually goes together with very rapid growth. A new Malmquist type productivity index was calculated for each corporation which measured shifts of the estimated intertemporal efficiency frontier.

Athanassopoulos and Ballantine (1995) viewed the use of DEA as complementary to ratio analysis. DEA was used in addressing a series of issues concerning the measurement of corporate performance including an assessment of sales efficiency, the effects of economies of scale, benchmarking a firm’s performance and association between industry groups and performance. The sample comprised of 23 grocery firms in the UK. Various other methods like cluster analysis, ANOVA and Kruskal-Wallis test were also used. Five input variables such as capital employed, fixed assets, number of employees, number of outlets and sales area were used reflecting activity levels and resource commitments of individual grocers. Total sales figure was used as the single output variable. The findings of the study argued the use of DEA to provide useful insights into the assessment of corporate performance and also that the complementary use of both DEA and ratio analysis would greatly enhance the means of assessing corporate performance.

Majumdar (1996) examined the productivity trends in Indian industry for the period 1950-1951 to 1992-1993 using Data Envelopment Analysis. There were four inputs and one output used in the study. The inputs were rupee values of fixed and working capital, actual number of workers and actual number of administrative and support staff employed. The output variable taken was gross production expressed in crores of rupees. The data was collected from the Annual Survey of Industries (ASI) and Census of Manufacturing
Industries (CMS). The results showed that Indian industry reached its highest efficiency potential throughout the 1990s which could be attributed to the reforms of 1990s.

Retzlaff-Roberts (1997) developed one of the hybrid methods, which can be described as an efficiency approach to Discriminant Analysis (DA). Various formulation options were considered with respect to their effects on solution quality and stability. The data transformation issue was studied both for the hybrid method and also for DEA. The hybrid method was applied to an insurance data set, where some firms were solvent and others in financial distress, to further evaluate the method and its possible formulations. DA methods are applied to the same data set to provide a basis for comparison. The findings of the study showed the hybrid method to outperform the general discriminant models.

Feroz et al. (2003) argued that DEA can complement traditional ratio analysis if the goal is to provide information regarding the operating and technical efficiency of the firm. DEA was applied to the oil and gas industry and the inputs for the study were total assets, common equity and sales costs and the total revenue was taken as output. The empirical results showed the relationship between the deviations from the optimum DEA efficiency scores and the deviations from the optimum financial ratios i.e. the DEA deviations and the ratio deviations are somewhat correlated but not in a systematic way. Moreover, the DEA efficiency scores had incremental information contents over and above the information generated by ratios.

Saranga and Phani (2004) used the DEA on a sample of 44 pharmaceutical companies for the period 1992-2002, in order to find out the best practices in the Indian pharmaceutical industry. The inputs used for applying the DEA were cost of production and selling, cost of
material and cost of manpower. The outputs were profit margin, net sales and exports. CCR and BCC models both were used to find out scale efficiency and technical efficiencies of these firms. The findings of the study revealed that size of a company does not dictate the internal efficiency ratings. The results of DEA which had been analysed along with the Compounded Annual Growth Rate (CAGR) showed that there is a direct relationship between internal efficiencies and higher growth rates in the Indian pharmaceutical industry, except for a few where companies in the mode of expansion may not have achieved full efficiencies. Regression analysis was also performed to see the correlations between various inputs/outputs and the growth rates. CCR, BCC and AR models were used to substantiate the results obtained.

Paradi et al. (2004) introduced the concept of worst practice DEA aimed at identifying worst performers by placing them on the frontier. A list of public companies in the manufacturing sector that filed for bankruptcy between 1996 and 1997 was taken and the sample of non-bankrupt companies were the healthy companies that did not go bankrupt before 1998. A series of variables were used for the study like total assets, working capital, EBITDA, retained earnings, shareholder’s equity, total current liabilities, interest expense, cash flow from operations, stability of earnings and total liabilities. A layering technique with risk attitudes and risk-based pricing was used instead of traditional cut-off approach. It is shown in this paper how the use of a combination of normal and worst practice DEA models enabled detection of self-identifiers. The empirical results showed 100% bankruptcy and 78% non-bankruptcy prediction accuracy in the calibration sample and also 100% and 67% out-of sample classification accuracies with the best combination of layered normal and worst practice DEA models.
Sahoo et al. (2007) used DEA to examine the productivity performance trends of the Indian commercial banks for the period 1997-98 to 2004-05. The increasing average annual trends in technical efficiency for all ownership groups indicated the positive effect brought by the reform process on the performance of the Indian banking sector.

Anna Ferus (2008) used DEA method to forecast credit risk of Polish companies. The sample comprised of 100 construction companies during the period 2001-2003. Six financial indicators were chosen out of 22 on basis of the weak correlation with each other. The daily return indicator and the total liabilities indicator were taken as inputs whereas net profit indicator, asset return indicator, equity capital return indicator and liquidity ratio were taken as outputs. CCR model was used to calculate the technical efficiency indicator value of the firms. The findings of the study showed the efficacy of the DEA method in forecasting financial problems better than other approaches.

Chang and Kuo (2008) proposed a novel procedure based on a benchmarking model of DEA to solve the two group classification problem. A pair of nonlinear discriminant functions were constructed by the identifying the benchmarks of the two groups without pre specifying the classification functional form as in parametric discriminant approaches. This study compared the performance of the proposed approach with the Fisher’s Linear Discriminant Function (FLDF) and Minimising the Sum of Individual Deviations (MSD). A layering technique was used to establish the discriminant functions. The findings of the study revealed that benchmark-DA had better classification accuracy for smaller group than other approaches.
Xu and Wang (2009) proposed a corporate financial failure prediction model using efficiency as a predictor variable. Data Envelopment Analysis was employed to evaluate the input/output efficiency of the corporations. The sample comprised of the corporations listed in the Shanghai stock exchange (SSE) and the data set contained 120 externally audited firms with 60 financially distressed and 60 non-bankrupt firms from 1999 to 2005. The CCR model was used with total assets, total liability and costs of sales as inputs and the income of sales as the output variable. To verify the efficacy of efficiency as a predictor, the accuracy of the same prediction method with and without the variable was compared. The empirical results of the multiple discriminant analysis, logistic regression and support vector machines all suggested that efficiency is a useful predictor variable.

Premachandra et al. (2009) proposed DEA as a quick and easy tool for assessing corporate bankruptcy. DEA is compared with logistic regression (LR) by taking a sample of large corporate failures in the US. The inputs taken were cash flow to total assets ratio, net income to total assets ratio, working capital to total assets ratio, current assets to total assets ratio, EBIT to total assets ratio, EBIT to interest expense ratio and market value of equity to book value of common equity ratio. The total debt to total assets ratio and current liabilities to total assets ratio were taken as outputs. The additive model was used. The findings of the study showed DEA outperforming LR in evaluating bankruptcy when there is no estimation sample.

Sueyoshi and Goto (2009) described a practical use of DEA-DA for bankruptcy based performance assessment. DEA-DA is used for classifying non-default and default firms based upon their financial performance. However, there are three problems when this method is used; sample imbalance problem as number of default firms is often limited, computational
problem dealing with large data set and data alignment problem wherein the location of default firm may exist within that of non-default firms. This study discussed the simultaneous occurrence of these three problems from the perspective of Japanese industrial policy on construction business. To deal with the three problems, the study combined DEA-DA with principal component analysis to reduce the computational burden and then altered DEA-DA weights to address both the sample imbalance problem and location problem. A combined use of DEA-DA and Rank sum tests to examine statistically hypotheses related to bankruptcy assessment is also discussed in this paper The Japanese construction companies were taken from Nikkei Needs Corporate Financial Database of 2006. Profitability, leverage, growth, size and risk ratios were taken. The findings of the study revealed that the Japanese construction firms gradually deteriorated over the sample period (1998-2005).

Chong et al. (2009) analysed the survival ability of a sample of Malaysian public listed companies (PLCs) by analysing the impact of financing decision of the sample firms. DEA was used to identify the survivors among the PLCs based on their financing decisions. The PLCs were registered in the states of Selangor and Kuala Lumpur and were mainly manufacturing firms. The inputs taken were long-term debt, short-term debt and debt payables. Sales and equity were taken as outputs. BCC model in ratio form with VRS was used. The findings showed that the financing decisions help in evaluating the survival-ability of the PLCs. It was also found that the mixture of financing leverage and operating leverage that the PLCs used, determine the survival-ability of PLCs.

Ehmcke and Zloczysti (2009) analysed research efficiency at the industry level in manufacturing for 13 European member and four non-member countries during 2000 and 2004. Patent applications were used as output and human capital and R&D effort were taken
as inputs. The results showed Germany, US and Denmark having highest efficiency scores on average in total manufacturing. The main industries at the technology frontier were electrical and optical equipment and machinery.

Tyagi et al. (2009) evaluated the performance efficiencies of 19 academic departments of IIT Roorkee, India through data envelopment analysis technique using different combinations of input and output variables. The three inputs taken for this study were Academic staff, Non-academic staff and Departmental operating cost. The outputs were Total enrolled students, Progress and Research Index. Output-oriented model was used for analysis and CRS and VRS both were used for overall performance assessment model. Four assessments namely, overall performance assessment, research performance assessment, teaching performance assessment and assessment for engineering departments was done using 10 models. Sensitivity analysis was also done in these 10 models by changing inputs and outputs. The findings of the study revealed that overall performance assessment was good for all science departments. The 4 streams comprising of Biotechnology, Chemistry, Civil Engineering and Hydrology departments were efficient in every area of research and all other departments need to pay attention for their research works.

Tripathy et al. (2009) examined the efficiency of pharmaceutical firms in India using firm-level data. A two stage DEA was used. In the first stage, technical efficiency analysis of 90 sample firms for the period 2001-02 to 2007-08 was undertaken using Sales of the sample firms as single output and Raw material cost, Cost of salaries and wages and Cost of advertising and marketing as the three input variables. In the second stage, the efficiency scores obtained from the first stage are regressed on external environmental factors like the age of the firms, export of goods, import of capital goods, profit rate, R&D intensity,
ownership, patent regime and foreign direct investment using Tobit model. The results showed that during the study period the performance of a large number of sample firms was sub-optimal, ranging between 68% and 78%. The R&D intensive firms were more efficient than non-R&D firms. The Malmquist Productivity Index indicated that the total factor productivity of the sample firms has remained at the same level during the study period. The new patent regime, export of goods, presence of foreign direct investment, the profitability of firms and R&D intensity were found to be the important determinants of efficiency of the pharmaceutical firm’s.

Meenakumari et al. (2009) evaluated the relative operational efficiency of state owned electric utilities (SOEU) in India using DEA. Both CCR and BCC models were applied to study the overall efficiency and technical efficiency. 29 SOEUs in India were considered for the analysis and the relative operational efficiency scores were calculated. The results indicated that the performance of several SOEUs are sub-optimal, thereby suggesting a potential for significant improvements in the operation so as to improve the overall efficiency. Also sensitivity analysis was carried out to investigate the effect of changes in the solutions of the model.

Psillaki et al. (2010) investigated that technical efficiency as an important ex-ante predictor of business failure. The study outlined a flexible procedure for assessing firm performance and the likelihood for borrower default by banks. DEA is applied to estimate the directional distance function. The effect of efficiency on the likelihood of default in terms of franchise value hypothesis (which states that more efficient firms will be less likely to fail) was tested. Two French manufacturing industries for the period 2000 to 2004 were considered. DEA model used value added as output and capital stock and labour as inputs.
The DEA efficiency scores obtained along with financial performance indicators (profitability, growth, asset structure, and intangibility) and firm characteristics (size) were used as predictor variables in Probit and Logit models to determine the probability of firm’s survival or failure. While estimating these models, efficiency is found to have significant explanatory power in predicting the likelihood of default over and above the effect of standard financial indicators.

Nikoomaram et al. (2010) used DEA and the financial variables such as Return On Investment (ROI), Residual Income (RI), Return On Sale (ROS), Earnings Per Share (EPS), Price to Earnings ratio (P/E), Return On Assets (ROA) and Operating Cash Flows to Owners’ Equity (OCF) to measure the performance and efficiency of companies belonging to the metal industries and accepted in Tehran Stock Exchange Corporation. Six year data (2003-2008) on 24 companies was collected and used for the analysis. Multivariate regression was employed to study the relationship between the financial variables and DEA. The findings showed that ROS, EPS and OCF and the efficiency results of DEA are significantly related and hence can contribute towards performance and efficiency measurement of enterprises.

Data Envelopment Analysis (DEA), a mathematical programming technique has been used to evaluate the efficiency parameter of corporate performance. The power of this technique lies in its ability to handle multiple inputs and outputs and it does not require any specific functional form and also it gives a single measure of performance which takes into account the numerous dimensions of corporate activity.
2.4 Effects of Macroeconomic Factors on Financial Health of Corporations

The individual corporations and the financial institutions of a nation are very much linked to the macroeconomic conditions prevailing in that country. So, fluctuations in the macroeconomic conditions definitely have an impact over the financial health of any firm functioning inside the country. The literature contains studies focusing on explaining the relationship between business failures and fluctuations in aggregate measures of economic activities. The recent literature has emphasised on the time series analysis of business failures and macroeconomic factors and the correlations among them. Chapter 5 deals with examining the effects of macroeconomic factors on the financial health of Indian manufacturing corporations and vice versa. Here, the long run relationships are identified using panel unit root test, panel cointegration analysis and panel long run causality. This part of the review explores the various studies done earlier in this regard and methodologies followed thereof.

Tirapat and Nittayagasetwat (1999) attempted to incorporate the macroeconomic factors in the investigation of financially distressed firms in Thailand. The sample consisted of listed firms in the Stock Exchange of Thailand (SET) that experienced financial distress in 1997. The overall sample comprised of 341 non-financially distressed firms and 55 financially distressed firms. A logit regression analysis was used to develop a macro-related micro-crisis investigation model. The significance of this model was its ability to bridge a firm’s sensitivity to macroeconomic conditions and its financial characteristics in order to explore a firm’s financial distress. The macroeconomic variables used were growth of industrial production, inflation, changes in interest rates and changes in money supply. The
financial variables used were book value of stockholder’s equity to total assets, retained earnings to total assets, operating income to net sales and net working capital to total assets. The findings of this study indicated that macroeconomic conditions are critical indicators of potential financial crisis for a firm. It also showed the higher a firm’s sensitivity to inflation, the higher the firm’s exposure to financial distress.

Vlieghe (2001) investigated the corporate failures in the United Kingdom using aggregate time series data using Auto Regressive Distributed Lag (ARDL) approach. The developed model suggested that corporate failure rate could be determined by profits, by the level of indebtedness and if the firms face borrowing constraints, by the level of inflation. The debt-to-GDP ratio, the real interest rate, deviations of GDP from trend and real wages were found to be long-run determinants of the liquidation rate. The birth rate of new companies, an index of property prices and nominal interest rates had significant short-term effects. It was also found that the rapidly increasing level of indebtedness in the late 1980s was the main determinant of the subsequent increase in the liquidation rate. The decrease in the liquidation rate after 1992 was primarily due to lower real interest rates, lower real wages and the cyclical recovery of GDP.

Hutchison (2002) examined whether European banking systems were vulnerable to systemic risk during 1999. Episodes of banking sector distress were linked to economic developments using cross-country panel data sets taking a sample of 90 countries over the period 1975-97. Multivariate probit models were estimated linking the likelihood of banking sector distress to a set of macroeconomic variables and institutional characteristics. The institutional characteristics included aspects of bank supervision and regulation, restrictions on bank portfolios and development of the banking system. Real GDP, inflation, exchange
rate turbulence and financial liberalisation were the macroeconomic variables. Both institutional and macroeconomic variables pointed to relatively low risk of banking sector distress in EMU countries.

Liu and Wilson (2002) used quarterly data (1961.1 – 1998.2) on failure rates and potential macroeconomic determinants to test for the impact of changes to the insolvency legislation as enacted in the Insolvency Act 1986. The enactment of the 1986 Insolvency Act was incorporated into the time-series model determining failure rates along side macroeconomic variables such as the clearing bank base rate, lending to corporate sector, gross corporate profits, the retail price index, and the company birth rate. The econometric results confirmed that the Insolvency Act of 1986 had a preventive effect on business failures. It was also found that the business failure rates were responsive to the changes in the nominal interest rates, price level, costs of credit, company profits, and the population of companies over the period of 1966.1-1998.2.

Sharabany (2004) examined the effect of macroeconomic parameters on the financial stability of traded manufacturing companies. He analysed the characteristics of businesses in Israel that went into liquidation. The macroeconomic variables used were nominal and real interest rates, unexpected inflation, net debt of business sector to GDP ratio (log), the output gap, difference between the (log) change in real wage and the (log) change in labour productivity and the birth rate of new companies (log). Quarterly data (from 1990: I to 2002: I) on the compulsory company liquidation rate and potential macroeconomic determinants were used to build a time series econometric model that tested exclusively for the impact of macroeconomic variables on the number of company liquidations in Israel. The results showed that the liquidation rate rose with unexpected inflation and with positive changes in
the real and nominal interest rates. The output gap negatively affected the liquidation rate. It was also found that those businesses which had fewer employees than the average, local market-oriented and were mainly in manufacturing and in particular in traditional industries were the ones that went into liquidation.

Liou and Smith (2007) took macroeconomic variables along with financial ratios to model financial distress. An investigation was made as regards to those variables which would be most useful to reduce Type II error. The macroeconomic variables used were GDP, Industrial Production Index (IPI), Base Rate (BR), Producer Price Index (PPI), Retail Price Index (RPI) and FTSE All Share Index (FTSEALL). The financial ratios used were PBT to Average current liabilities, Current assets to total liabilities, Current liabilities to total assets and No Credit Interval on days (NCI). A sample of 340 manufacturing companies were identified for the study traded on the London Stock Exchange over a twenty year period (1981-2001). A linear discriminant analysis was adopted in this study. The result indicated that adding a macroeconomic variable as a ‘second stage’ to a linear discriminant model of financial distress prediction could suggest a means of reducing the element of Type II error, however, overall such models were of poor classificatory ability.

Carling et al. (2007) estimated a duration model to explain the survival time to default for borrowers in the business loan portfolio of a major Swedish bank over the period 1994-2000. The model took both firm-specific characteristics, such as accounting ratios and payment behaviour, loan related information and the prevailing macroeconomic conditions into account. The findings of the study showed that the output gap, the yield curve and the consumers’ expectations of future economic development have significant explanatory power for the default risk of firms. The model developed here was able to account for the absolute
level of risk. The other results showed firms default risk increasing monotonically over the survival of their loans and the risk of default being higher for short-term loans than for long-term credit.

Ahmad et al. (2008) investigated the long run dynamic linkages between the corporate failures in Malaysia and selected macroeconomic variables by employing the Autoregressive Distributed Lag (ARDL) bound test, which is a recently used robust time series technique and is applicable irrespective of the regressors being I(0) or I(1). Quarterly data from 1991:1 to 2005:4 was taken. The various macroeconomic variables used were log of Domestic credit aggregate, GDP, CPI, Average lending rate and corporate birth rate. A Dummy variable to decipher the corporate failure rates during the Asian financial crisis was also included. The findings of the study confirmed the existence of a long run relationship between macroeconomic variables and corporate failures in Malaysia. The results also revealed that corporate failure rates in Malaysia were significantly and positively associated with the average lending rate, inflation rate and the GDP in the long-run. The Asian financial crisis was also seen to be a significant contributor to the corporate failure rates in Malaysia.

Oxelheim and Wihlborg (2008) considered the impact of macro economy on corporate value and performance in evaluating corporate credit risk. They decomposed the Altman’s Z scores as predictor of default into macroeconomic and intrinsic components. The decomposition proposed here relied upon market price variables on the macro-, industry- and firm levels to obtain coefficients for the sensitivity of the default indicator to changes in the different price variables. The price variables used were exchange rates, interest rates and inflation rates. The Z scores for GM and Ford were calculated and the quarterly changes during the period 1997-2005 were decomposed into macroeconomic and intrinsic
components. Both GM’s and Ford’s Z scores fell during the period with substantial variation from quarter to quarter. The decomposition indicated that the decline in GM-score was explained by intrinsic factors while the decline in Ford’s Z-score was explained mainly by macroeconomic factors. The findings suggested Ford to either consider its leverage or its approach to macroeconomic risk management.

Liu and Pang (2009) tried to investigate whether macroeconomic factors accounted for the observed fluctuations in the UK business failures during the period of 1966-2003, using vector error correction model. The variables used were business failure rates, real commercial banks’ base rate, real credit, real profits, the inflation rate and the business birth rates. The major finding was that macroeconomic variables, i.e. credit, profits, inflation and company births, appeared to be the important factors influencing business failures. It was suggested that the interest rate, could be used as a feasible policy instrument to reduce the incidence of failures. It was also found that corporate failures played a significant role in macroeconomic fluctuations. An additional finding indicated that the deregulation policy adopted by the Thatcher government altered the relationships between failure rates and macroeconomic activities over the sample period.

Salman et al. (2009) in their paper attempted to shed some light on the influence of macroeconomic variables on the failure of small and medium sized Swedish businesses during the period 1986-2006 using quarterly data. Cointegration analysis and error correction model (ECM) was applied to study the short term and long term relationship between bankruptcies and macroeconomic variables. The findings of the study revealed that in the long run a firm’s failure was negatively related to the level of industrial activity, money supply, GNP and economic openness rate and positively related to the real wage. The time
series error correction model (ECM) estimates suggested that macroeconomic risk factors impinge on firm failures in the same direction in both the short run and the long run and the adjustment mechanism for stabilising the relationship was quite slow.

Santoro and Gaffeo (2009) used panel data on 20 Italian regions over the period 1985-2002 to test two competing theories of long run productivity dynamics: the opportunity-cost model, according to which productivity-enhancing activities have a comparative advantage during recessions; and the risk-aversion model, which predicts a negative relationship between transitory disturbances and productivity growth. The results suggested the existence of long-run relationship between business failures, trend output, a vertical interest spread and a measure of surprise inflation. The findings supported the risk-aversion theory of productivity growth and showed that bankruptcy risks played a significant role in the propagation of macroeconomic shocks.

Bhattacharjee and Han (2010) studied the impact of microeconomic factors and macroeconomic conditions as well as institutional influences on financial distress of Chinese listed companies over the period 1995-2006. Hazard regression analysis was used. Business cycles, real interest rates and exchange rates were the macroeconomic variables taken in this study. The findings revealed substantial effect of firm level covariates (age, size, cash flow and gearing) on financial distress. Also macroeconomic instability and institutional factors have a significant impact on the hazard rate of financial distress. The results were robust to unobserved heterogeneity at the firm level, as well as those shared by firms in similar macroeconomic founding conditions.
Chen and Mahajan (2010) investigated the effects of macroeconomic conditions on corporate liquidity (cash holdings) in 34 countries from 1994 to 2005. The macroeconomic variables used were GDP growth, inflation, short-term interest rate, government budget deficit, credit spread, private credit and corporate tax rate. Corporate liquidity was defined as ratio of cash to net assets wherein cash referred to cash plus its equivalents plus marketable securities. Panel data model i.e. fixed effect model was conducted. The results showed that all macroeconomic variables had a direct impact on corporate cash holdings. In addition to this, it revealed that macro variables have an indirect impact on corporate cash holdings because the effects of firm-specific variables on corporate liquidity can be influenced by macroeconomic conditions.

Any institution in general faces two types of threat which determines its longevity. One is the internal threat from its own management and the other is the external threat from the economy as a whole. The above literature showed that the macro economic variables do have significance in the functioning of a firm and hence are worth consideration while exploring their financial position.