

FINANCIAL DISTRESS PREDICTION – AN OVERVIEW OF RELATED LITERATURE

Jaya Justy* & Unny C J**

Abstract

Financial distress is a condition when a firm finds it difficult to meet its debt obligations to its creditors. A firm's inability to pay off its liabilities continuously may lead to a situation of financial distress. This may ultimately end up in the firm being insolvent. For a given level of operating risk, financial distress intensifies with higher debt. The probability of financial distress becomes higher with greater business risk and higher debt. The researcher has made an attempt to make a review of the existing financial prediction models developed using different variables which includes financial ratios as well as market variables and using different analytical tools.

Key words: *Financial Distress, Prediction models, financial ratios*

Introduction

Financial distress is a condition when a firm finds it difficult to meet its debt obligations to its creditors. The probability of financial distress becomes higher with greater business risk and higher debt. The degree of business risk depends on many factors like general economic conditions, demand and supply factors, intensity of competition, extent of diversification, and the age and maturity of the company along with the degree of operating leverage –that is the proportion of fixed costs. Since matured companies are relatively stable they have lesser operating risk. Similar is the case with well diversified companies with unrelated businesses. (Pandey, 2014).

* Assistant Professor, School of Management Studies, De Paul Institute of Science and Technology, Angamaly.

** Principal, De Paul Institute of Science and Technology, Angamaly.

Prediction of financial distress becomes very important in the context of different types of costs that is involved with financial distress- both direct costs and indirect costs. If left alone most of the firms in distress may move towards insolvency. A warning signal on time can help the firms to restructure and make a comeback. There are many companies which has come back after reaching situation of distress.

The fact is that we could bring down this number if we properly analyze the financial statements. Many of the financial ratios when combined together act as good predictors of financial distress. A condition of financial distress does not happen overnight. The firms will start showing its symptoms at least few years before. If the management is capable of identifying the symptoms on time then such an adverse situation could be reverted.

Financial distress is a condition that is a matter of concern for every firm irrespective of size, industry, country or nature of business. For this reason, numerous studies have been made in this topic by many researchers in the context of different countries. Many models were also developed by many researchers which could be used to predict financial distress well in advance. The main objective of these researchers was to develop models which could improve the accuracy of predictions.

Many studies have been undertaken by researchers regarding symptoms of financial distress, and prediction of future financial distress based on different variables. Many models to predict the corporate financial distress are also available. The prominent contributors are Beaver (1966), Altman (1968), Ohlson (1980), Springate (1978), Taffler (1983) and Shumway (2001). Attempts were made by many academicians to develop improved

models to predict financial distress. In this article a compilation of studies related to different aspects of corporate financial distress are given.

Whitaker (1999), in his study titled “The early stages of financial distress” has found that management actions play a significant role in improving the performance of firms which enter into a state of financial distress. It was also found that the management intervention was not very effective if the cause of distress was economic. But for the distress caused by poor management, performance could be improved significantly by management actions. In his study the researcher was trying to prove Jensen’s (1976) hypothesis that financial distress triggers corrective action which improves firm’s performance. In this paper, the early stages of financial distress has been defined as the first year in which cash flow is less than current maturities of long-term debt. Cash flow is defined as net income plus non-cash charges. Market value is used as a selection criteria in order to assure that all firms in the sample are distressed. The sample consisted of firms which entered financial distress during the years 1980-1992. The final sample consisted of 267 firms after all omissions based on the criteria which are made. The firms in the sample have been divided into two groups one who has entered financial distress due to economic reasons and other who has entered into state of financial distress through poor management. Changes in the firm’s performance and the factors which contributed to the recovery are studied for both the sample groups. The performance of firms are being evaluated on the basis of net operating income. A firm whose performance is low relative to the industry performance could be attributed to the sub optimal performance of the management. As per Jensen (1989) such a situation would trigger

management action which would improve the performance of the firm. Logit regression was applied to derive the results.

Accurate prediction of corporate financial distress help managers, creditors and investors to make correct evaluations and make decisions so that the loss could be reduced. Many empirical models have been developed employing quantitative methods for predicting corporate bankruptcy. But there was always a dilemma with regard to the selection of information, for building the models, which could maximize the predictive accuracy, from the plethora of information disclosed in the financial statements of the corporates. This research study, has included more than 20 models based on six features and ranking strategies and are tested on North American companies and Chinese listed companies. The experimental results are helpful to develop financial models by choosing the proper quantitative methods and features selection strategy. (Zhou, 2012)

Ong, Yap and Kong (2011), in a study attempted to develop a model that can predict financial distress amongst public listed companies in Malaysia using the logistic regression analysis. The sample for the study was selected from the listed companies in Bursa Malaysia. A sample of 105 companies coming within the purview of the definitions given by the researchers were selected. The dependent variables were financial ratios which were selected after an extensive review of literature and the time period chosen for the study was from 2001 to 2007. The dependent variables are dichotomous variables that is distressed and non-distressed companies listed in Bursa, Malaysia. Logistic regression is the statistical technique that can be ideally used when the dependent variable is a categorical (nominal or non-metric) variable and the independent variables are metric variables. Besides that, logistic regression is also a specialized

form of regression that is formulated to predict and explain a binary (two-group) categorical variable rather than a metric-dependent measurement. Logistic regression models, often referred to as LOGIT analysis, are a combination of multiple regression and discriminant analysis.

Alifiah (2014), in a study attempted to predict financial distress of companies in the trading and services sector in Malaysia. The researcher used financial distress as the dependent variable and macroeconomic variables and financial ratios as the independent variables. Since the financial ratios may not be necessarily normal in nature and since the dependent variables are binary in nature Logit Analysis was used as the analysis procedure. Also it could provide the probability of a company being financially distressed, in addition, to giving the sign of the independent variable(s). This study found that the independent variables that could be used as indicators to predict financial distress companies in the trading and services sector in Malaysia were debt ratio, total assets turnover ratio, working capital ratio, net income to total assets ratio and base lending rate.

Cohen and Rossi (2017), in their study analyzed whether and how the financial ratios can be used by the auditors of local self-governments to get an indication of financial distress. 44 distressed and 53 non-distressed companies have been identified and logistic regression technique was applied. The period of study was from 2003-2012. The study revealed that the percentage of personnel expenses over revenues, the turnover ratio of short-term liabilities over current revenues and the reliance on subsidies (calculated as subsidies per capita) were factors discriminating non-distressed LGs from the distressed ones.

A comprehensive guide to predicting and dealing with corporate bankruptcy: how to anticipate financial crisis, manage a financial turnaround, and handle the legal, accounting and investment implications of bankruptcy was given in this research paper. It discusses failure prediction and develops specific and aggregate business failure models for analyzing both private and publicly held firms. It provides complete documentation and analysis of failure prediction models in ten countries.(Altman E. I., 1984)

Altman, Laitinen and Suvas (2017) in their research paper evaluated the classification performance of the Z-Score model in predicting bankruptcy and other types of firm distress. The researcher's goal was to examine the model's usefulness for all types of firms, especially banks that operate internationally and need to assess the failure risk of firms. The researchers modified the original model and applied it to firms from 31 European and three non-European countries. It was the first attempt to do an international analysis of such wide coverage. The firms in the sample were primarily private which included non-financial companies across different sectors. Unites States and China was an exception to this. The researchers used the original Z"-Score model developed by Altman (1983), for private and public manufacturing and non-manufacturing firms. Even though there are few evidences that certain hazard based models which have outperformed Z-score model, the performance of Z-score has been found to be very good. Other models lack a comprehensive international comparison and so they cannot be generalized. But the results of this study proves that the general Z-Score model works reasonably well for most countries (the prediction accuracy is approximately 0.75) and classification accuracy can be

improved further (above 0.90) by using country-specific estimation that incorporates additional variables.

In another study the researchers used rough set (RS) model to empirically estimate the financial distress prediction for Chinese listed companies and assess its classification accuracy. The study was conducted using a sample of 212 financially distressed and 212 healthy firms for a period of 1998-2005. RS model was used to test the effect of financial ratios and some non-financial ratios on the probability of financial distress. Growth ratio of per share of equity, net return on assets, earnings per share, interest coverage, ownership concentration coefficient, net profit margin, pledge, retained-earnings ratio and total assets turnover were the ratios which have been used by the researchers for financial distress prediction of Chinese listed companies. The prediction model employed here considers not only accounting ratios, but also cash flow and corporate governance variables, thus improving the prediction accuracy. (Wang & Li, 2007)

Bae (2012), has made an earnest effort to develop a model which could predict financial distress of corporates with more accuracy. Information of such accuracy is very useful for the decision makers, investors and all the stakeholders concerned. This area had long been a matter of interest for both scholars and practitioners equally and so the researchers had tried to develop a new and better prediction model. To improve the accuracy of estimation the researchers analyzed the yearly data of 1888 manufacturing corporations collected by the Korea Credit Guarantee Fund. Then they developed a financial distress prediction model based on a radial basis function support vector machines. Then they compared the accuracy of predictions using this model and other models based on artificial intelligence. It was found that the RSVM model outperformed other

models in prediction accuracy. This enhancement in predictability of future financial distress could significantly contribute to the correct valuation of a company, and hence those people from investors to financial managers to any decision makers of a company can make use of RSVM for the better financing and investing decision making which can lead to higher profits and firm values eventually.

Beaver, Correia and McNichols (2010) used financial statement analysis to assess a company's likelihood of financial distress — the probability that it will not be able to repay its debts. Financial statement analysis was used by credit suppliers to assess the credit worthiness of its borrowers. Today, financial statement analysis is ubiquitous and involves a wide variety of ratios and a wide variety of users, including trade suppliers, banks, credit rating agencies, investors and management, among others. Financial distress refers to the inability of a company to pay its financial obligations as they mature. Empirically, academic research in accounting and finance has focused on either bond default or bankruptcy. The basic issue is whether the probability of distress varies in a significant manner conditional upon the magnitude of the financial statement ratios. This monograph discusses the evolution of three main streams within the financial distress prediction literature- the set of dependent and explanatory variables used, the statistical methods of estimation, and the modeling of financial distress.

Ho, Yang and Ye (2013), in a research study examined North American pulp and paper company bankruptcies that occurred between 1990 and 2009. The study found that the shareholders suffered substantial losses (37 %) during the month when bankruptcy occurs. It was also found that the financial ratios were useful in predicting firm failure and that failed firms

were less profitable, more liquidity constrained and higher in debt leverage. The researchers used a binary logit model. They predicted financial distress for pulp and paper firms 1 to 2 years ahead of the bankruptcy.

Gunathilaka (2014), in his paper examined the solvency positions of Sri Lankan Companies and whether the Z-score models of Altman and Springate appropriately predict financial distress in Sri Lanka. The study included a sample of 82 companies among different sectors listed on Colombo Stock Exchange. The study covered a period of five years from 2008 to 2012. The study analyzed company financials using independent sample t-tests and multivariate discriminant analysis. The study found that that the solvency test does not discriminate solvent and insolvent firms meaningfully. The Altman's and Springate's Z-score models yield similar predictive power. In particular, Altman's Z-model shows a higher degree of discriminant power in identifying financially distressed firms, at least one year prior to the distress. The market value and book value contribute similarly between Z-models. The study indicated the level of care required in solvency test-based decision making.

Calandro (2007), in his research study commented on the utility of Altman's Z-score as a strategic assessment and performance management tool. This paper analyzed the utility of Altman's Z-score as a strategic assessment and performance management tool based on published research, with suggestions for further research. The analysis supported Carton and Hofer's findings with respect to the utility of the Z -score as a strategic assessment and performance management tool. Z-score is both popular and widely used in the fields of credit risk analysis, distressed investing, M&A; target analysis, and turnaround management, but it has received relatively little

Appiah and Abor (2009), used relevant financial information of private medium-sized failed and non-failed manufacturing firms in the UK, during the period 1994-2004 to determine whether corporate failure could be predicted by developing a Z score model. The researcher used multiple discriminant analysis to develop the Z- score. The study revealed that the notion that the net profit margin is superior to the gross profit margin in discriminating between failed and non-failed UK manufacturing companies in terms of its significant contribution to the - score, though the latter exceeds the former slightly using the univariate analysis. A sample of 62 companies comprising of 31 failed and 31 non failed companies were studied by the researchers.

Bhandari (2014) made an attempt to compare the two models for predicting distress - the first model and latest model. Altman's model was the first model and Bhandari and Iyers was the latest model. The study found that Altman's model was industry specific whereas Bhandari's model was more generic in nature. The approach used by both models for selecting the companies were different. The study also found that the focus is narrow in Bhandari's model when compared with Altman's model. The study was an attempt to critically evaluate both the models. Even though hundreds of models have been developed these two were selected for being first and the latest model.

Wang and Campell (2010), conducted a study among the listed companies in China for a period of 8 years from September 2000- September 2008. The objective of the research was to test the accuracy of financial distress prediction models developed by different people prominent being the Altman's Z score model. Three different variants of Altman's Z score was used for prediction one being the original model, second a re- estimated

model in which coefficients were recalculated and a third one which was a revised model using different variables. The results showed that all the models had significant predictive capability but the Altman's model showed higher prediction accuracy for predicting non failed firms. The study concluded that the Altman's Z score was helpful in predicting failure of a publicly listed company in China.

Appiah, Abor and Joshua (2009), made an attempt to determine the significance of Altman's Z score model in predicting corporate failures among private medium sized manufacturing firms of UK. The study covered financial information pertaining to a sample of failed and non-failed manufacturing firms during the period 1994-2004. The researchers used multiple discriminant Analysis to develop the Z score. The results that emerged from the study supported the notion that net profit margin is superior to the gross profit margin in discriminating failed companies from non-failed companies.

Oz and Yelkenci(2017), in their study examined the theoretical base for the financial distress modeling. The study spanned around eight different countries covering a sample of 2500 publicly listed non-financial companies. The study used the data covering a period from 2000-2014. The prediction model derived through the model was examined for its potential to predict and whether it was generalizable over distinct industry and country samples. Two estimation methods were used and four sub samples were used to examine the validity of the results. The results proved that the prediction models had high level prediction accuracy and the use of large samples from different countries increased the validity of prediction results.

Demyanyk (2010), in his paper provided a summary of empirical results obtained in several economics and operations research papers that attempt to explain, predict, or suggest remedies for financial crises or banking defaults. The researchers also outline the methodologies used and also analyze financial and economic circumstances associated with the US subprime mortgage crisis and the global financial turmoil that has led to severe crises in many countries. The objective of this research was to promote future empirical research for preventing bank failures and financial crises.

Arshad, Iqbal and Omar (2015), attempted to find a tool which could be collectively used for financial distress prediction and fraudulent reporting. Another aim was to examine whether business failure is associated with fraudulent financial reporting. The collective prediction model was based on ratio analysis, Beneish – M score and Z score model. The study used data pertaining to 24 failed companies and matched it with 24 non failed companies listed on Bursa Malaysia. A total of 10 ratios, cash conversion cycle, Beneish – M score and Altman's Z score were used for checking and predicting financial distress, and predicting fraudulent financial reporting. The results showed that the model was accurate up to 96 percent in predicting financial distress and the accuracy of finding fraudulent reporting was 83.3 percent. It was concluded that this model could be used by regulators, banks, top management and external auditors for decision making and policy formulations.

Smith and Liou (2007), in their study tried to examine the differences that exists across manufacturing sector and to identify those sub sectors for which amalgamation is not advisable. The researcher has used a correlation of financial ratios with sector performance for a sample of 340 companies

in UK. Allmans Z score model was used to evaluate the solvency of 340 manufacturing companies for determining any classification errors. The findings of the study reveal that inclusion of certain sub sectors would make the models erroneous. So care should be taken while selecting the samples for using financial distress prediction models to avoid type II errors.

Aziz and Dar (2006), in an extensive literature review on the bankruptcy prediction models the authors have tried to have a broader and comprehensive analysis of the methodologies and the findings from these models across ten countries. They have evaluated the predictive capabilities of different models. The predictive accuracies of different models were generally comparable but the models based on artificial intelligent expert systems were marginally better than statistical and theoretical models. It was also found that the multi discriminant Analysis and logic methods were predominantly used by researchers.

Conclusion

Financial distress prediction is an area in which enormous amount of research studies have been undertaken. The past few decades have witnessed the development of so many financial prediction models using different variables. The predictive capability of these models vary and so many comparative studies were also conducted by many researchers. Models which exhibited good predictive capability under certain economic conditions were not found to give similar results in a different situation. So it can be concluded that the existing financial prediction models even though claim to have universal applicability the degree of effectiveness may be different when applied under different situations.

References

- Altman, E. I. (1984). Corporate financial distress: A complete guide to predicting, avoiding, and dealing with bankruptcy. *Journal of Business Strategy* (pre-1986), 5(1), 102 - 108. Retrieved 09 18, 2017, from <http://www.loc.gov/catdir/enhancements/fy0607/82016103.html>
- Altman, E. I., Iwanicz-Drozowska, M., Laitinen, E. K., & Suvas, A. (2017). Financial Distress Prediction in an international context: A review and empirical analysis of Altman's Z-Score model. *Journal of International Financial Management and Accounting*, 28(2), 131-171. doi:10.1111/jifm.12053
- Altman, Edward I; (2000). Predicting financial distress of companies: Revisiting the Z-Score and ZETA® models. *Handbook of Research Methods and Applications in Empirical Finance*, 53(July), 428-456. doi:10.4337/9780857936097.00027
- Appiah, K. O., & Abor, J. (2009). Predicting corporate failure: *Some empirical evidence from the UK. Benchmarking*, 10(3), 432-444. doi: <http://dx.doi.org/10.1108/14635770910961425>
- Arshad, R., Iqbal, S. M., & Omar, N. (2015). Prediction of business failure and fraudulent financial reporting: Evidence from Malaysia. *Indian Journal of Corporate Governance*, 8(1), 34-53. doi: <http://dx.doi.org/10.1177/0974686215574424>
- Aziz, M. A., & Dar, H. A. (2006). Predicting corporate bankruptcy: Where we stand. *Corporate Governance*, 6(1), 18-33. Retrieved on 9 16, 2017, from <https://search.proquest.com/docview/205184309?accountid=188340>
- Bae, J. K. (2012). Predicting financial distress of the South Korean manufacturing industries. *Expert Systems with Applications*, 39(10), 9317-9321. doi:10.1016/j.eswa.2012.02.058

- Beaver, W. H., Correia, M., & McNichols, M. F. (2010). Financial statement analysis and the prediction of financial distress. 5(2), 99-102. Retrieved 09 20, 2017
- Bhandari, S. B. (2014). Two discriminant analysis models of predicting business failure: A contrast of the most recent with the first model. *American Journal of Management*, 14(3), 11-19. Retrieved on 09 13, 2017, from <https://search.proquest.com/docview/1648606831?accountid=188340>
- Calandro, J. J. (2007). Considering the utility of Altman's Z-score as a strategic assessment and performance management tool. *Strategy & Leadership*, 35(5).
- Cohen, S., Costanzo, A., & Manes-Rossi, F. (2017). Auditors and early signals of financial distress in local governments. *Managerial Auditing Journal*, 32(3), 234-250. Retrieved 7 26, 2017, from <https://search.proquest.com/docview/1872763291accountid=18830>
- Demyanyk, Y. (2010). Financial crises and bank failures: A review of prediction methods. *Omega*,
- Gunathilaka, C. (2014). Financial distress prediction: A comparative study of solvency test and Z-Score models with reference to Sri Lanka. *IUP Journal of Financial Risk Management*; Hyderabad, 11(3). Retrieved 08 1, 2017, from <https://search.proquest.com/docview/1628368454?accountid=188340>
- Ho, C, Mccarthy, P., Yang, Y., & Ye, X. (2013). Bankruptcy in the pulp and paper industry: Market's reaction and prediction. 45(3). doi:<http://dx.doi.org/10.1007/s00181-012-0661-6>
- Kasilingam, R., & Ramasundaram, G. (2012). Predicting solvency of non-banking financial institutions in India using Fulmerand Springate models. *Journal of Services Research*, 12(1), 65-88. Retrieved 10 4, 2017, from <https://search.proquest.com/docview/1019285920?accountid=188340>
- Ohlson, J. A. (1980). Financial ratios and the probabilistic prediction of bankruptcy. *Journal of Accounting Research*, 18(1), 109. doi:10.2307/2490395

- Ong, S.-W., Yap, V. C., & Khong, R. W. (2011). Corporate failure prediction: A study of public listed companies in Malaysia. *Managerial Finance*, 37(6), 553-564. doi: <http://dx.doi.org/10.1108/03074351111134745>
- Pandey, I. M. (2014). *Financial Management*. New Delhi, Vikas Publishing House Pvt Ltd.
- Smith, M., & Liou, D.-K. (2007). Industrial sector and financial distress. *Managerial Auditing Journal*, 22(4), 376-391. doi:<http://dx.doi.org/10.1108/02686900710741937>
- Wang, Y., & Campbell, M. (2010). Business failure prediction for publicly listed companies in China. *Journal of Business and Management*, 16(1), 75-88. Retrieved 09 15, 2017, from <https://search.proquest.Com/docview/89233426?accountid=188340>
- Wang, Z., & Li, H. (2007). Financial distress prediction of Chinese listed companies: a rough set methodology. *Chinese Management Studies*, 1(2). doi:<http://dx.doi.org/10.1108/17506140710758008>
- Whitaker, R. B. (1999). The early stages of financial distress. *Journal of Economics and Finance*, 23(2), 123-132. Retrieved July 26, 2017, from <https://search.proquest.Com/docview/215567927?Accountid=188340>
- Zhou, L. (2012). Empirical models based on features ranking techniques for corporate financial distress prediction. *Computers and Mathematics with Application*, 64(8). doi:10.1016/j.camwa.2012.06.003