

GUJARAT TECHNOLOGICAL UNIVERSITY

**PhD Synopsis**

**A study of Financial Distress of Selected Indian Companies**

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**A. Title of the thesis and abstract:****Title: A study of Financial Distress of Selected Indian Companies**

**Abstract:** Financial Distress is the stage before bankruptcy; financial distress is the late stage of corporate decline where firm faces lack of liquidity. It is the stage where the firm finds difficulty in making payments to its creditors and other stake holders. If attention is not paid or such situation is not relieved, it will result in bankruptcy. The area of distress prediction is of high economic importance, as it affects huge section of society. Thus early recognition of it helps firm to get relaxation from its danger zone.

The prediction of financial distress and corporate insolvency has been the matter of talk among the academic literature and professional researcher throughout the world. A lot of publication has been issued and lots of results have been represented. New techniques and methodology are created constantly. But very few studies are conducted considering Indian context due to limitation of scare of information available. Raising rate of indebtedness of Indian Companies directing towards corporate leverage is one of the leading motivating factor for researcher. Therefore the basic purpose of the research is to come up with the model that can estimate the probability of failure or distress of Indian companies in next year by evaluating its occurrence of failure using multiple discriminant analysis. Researcher has reestimated the coefficient for developing the model.

The research focus on comparison of financial position of the selected companies through financial information obtained from respective companies financial statement by using Z score, O score and newly framed model. Initially researcher test the models with original established model and with the help of logistic regression, she tries to examine role of accounting ratio.

The outcome of the study is when the discriminant functions were used to predict from the five variables, 84% of the original grouped cases were correctly reclassified back into their original categories. Using Logistic regression at the first step, the bankrupt category is classified 67% and non bankrupt category by 91% correctly. The model increase correct classification as it increases the steps. At the forth step, the bankrupt category is 100% and not bankrupt category by 100% correctly classified. The overall correct classification of model is 100 %.

This will benefit management itself, creditors, investors and other stakeholders in formulating their plans and strategies.

**Keywords:** Financial Distress, Bankruptcy, Altman Z score, Ohlson O score, Discriminant Analysis, Indian Companies.

### **B. Brief Description on the state of the art of the research topic:**

Bankruptcy is a very actual subject in the financial world. The prediction of financial distress and corporate insolvency has been the matter of talk among the academic literature and professional researcher throughout the world. A lot of publication has been issued and lots of results have been represented. New techniques and methodology are created constantly. According to report prepared by Jung and Lindner (2014) in International Monetary Fund(IMF) regarding the financial status in Indian corporate, Indian firms are facing severe problems in repayment of Loans due to decline in profitability and high level of leverage. This result in failure of the firms which further affects the stakeholders namely employees in terms of losing the job and creditors losing their capital.

Varieties of the models have been introduced such as univariate discriminant analysis, multivariate discriminant analysis, binary logistic, logistic regression etc. Bankruptcy Prediction Literature has its roots in the 1930-es'. Various Researchers have compared the performance of different statistical and mathematical methods of bankruptcy prediction.

(Angelessai, 2005) The study examines the accuracy of financial ratios to predict bankruptcy in the high tech industry. The prediction model was based on a sample of 120 companies (60 bankrupt & 60 matching non-bankrupt companies) during the period 2000-2002 for which six financial ratios were employed. The ratios were calculated from financial statements one & two years prior to bankruptcy. The models predictability was tested by using 20 bankrupt and 20 matching non-bankrupt firms after 2002 and was found to accurately predict 85% of the bankruptcy & non-bankruptcy cases.

(Ray, 2011) This paper attempts to investigate the financial health of automobiles industry in India and test whether Altman's Z score model can foresee correctly the corporate financial distress of the automobile industry in Indian context for the study period 2003-04 to 2009-10. The study states Z score value is gradually declining since 2007-08 after global recession hits Indian Economy in general and automobile industry in particular. This indicate that overall financial performance of automobile sector in India is at present viable as Z score indicates

but may lead to Corporate bankruptcy in near future unless regulatory measures are taken immediately.

(Junare, 2012) The study basically aims to develop the model based on accounting information that predict the bankruptcy. Researcher tested 26 companies listed on NSE. India from 2007-10. The sample was composed of 13 bankrupt companies and 13 healthy companies matched on industry multiple discriminant analysis was used to test two group. i.e., bankrupt & non-bankrupt. In this study, the ratios found with high predictive power were 'Net Income/ Total assets', 'Net Income/ Book Value', 'Non current liabilities/ Total assets' and 'Retained earnings / book value'. These were considered as key factors to predict bankruptcy in the particular context or India in the horizon from 2007-2010. The set of models tested in the paper were direct model with base year and 2 year prior to failure. The 2 year prior model had a high predictive value than year of bankruptcy model. It was observed that the type-I error (bankrupt firm classify as non-bankrupt) is low in base year model and type-II error (non-bankrupt firm classify as bankrupt) is low in 2 year prior to failure.

(Avenhuis, November2013) In this study the author re-estimated the below bankruptcy prediction models using an estimation sample of 14:326 bankrupt and non bankrupt Dutch firms from the period 2011-2012. Author tested all the bankruptcy models with their original statistical technique. Also to examine the role of accounting ratio, author tested all the bankruptcy prediction models with the logit regression. When the original statistical techniques were used, the accuracy rates for the models of Altman, Ohlson and Zmijewski were respectively 80.6%, 93.8% and 95.3%. Although Zmijewski models looks to be having highest prediction power but it predict 0% of the bankrupt firms correctly and 99.4% of non-bankrupt correctly. The accuracy rates for the models of Altman, Ohlson, Zmijewski models are respectively 49.1%, 93.8% and 87.7% when the logit regression was used. Even Ohlson model having the highest predictive power, but the same applies for the model of Ohlson as for the results of the model of Zmijewski. The model of Ohlson is the most accurate when all the models use the same statistical technique. This implies that the explanatory variables of this model are the best predictors of the likelihood of bankruptcy. Author concluded that practitioners should use the bankruptcy prediction models of Altman, Ohlson and Zmijewski cautiously because the frequency of Type-1 errors is high in Ohlson and Zmijewski model or the accuracy rate is low in Altman.

**C. Definition of the problem:**

As these bankruptcies are matters of talk for majority of the stakeholders of the organization. The research is mandated by the current scenario of global financial difficulty which further create credit crunch. The possibility of financial distress can be predicted well in advanced before firm goes bankrupt. This will help stakeholders to respond before they suffer. The problem is that the prediction models, that are under study in this research, the precision, performance and structure of the models change over time periods due to change in population of firms, Business Condition etc . This thesis will evaluate mentioned model which have been popularly used in the prior literature to appraise firm health and will spring up with new method on the basis of gathered knowledge.

**D. Objective and scope of work****Objectives:**

1. To conduct secondary study for understanding sickness prediction models formulated by earlier researchers, number of parameters used by them, the mathematical treatment given in the model and the predicting accuracy of them.
2. To develop the model based on accounting information that predicts the financial distress.
3. To investigate financial ratio of selected companies and identify which ratios contribute to the downfall or bankruptcy.
4. To test with past data of selected companies various predictions models and validate the efficacy of the models in predicting the sickness.
5. To identify difference in five ratios among safe, distress and grey zone companies.

**Scope of the work:**

The study relying only on solvency prediction based on the Altman Z-score model as well as Ohlson O score model as means of analysis. So other financial measures of distress will have strengthened for further study.

The study has completely based on financial data used in Altman model, but certain non-financial aspect mainly corporate governance, consumer price index, market capitalisation are open field for future study.

More accounting data and parameters could produce better predictor models than the model which is used in this study.

### E. Original contribution by the thesis:

The original contribution made by the study is formulation of model for prediction of financial distress based on discriminant analysis and logistic regression. The model will supplement the creditors, investors, financial institutes, customers, employees to predict the likelihood of financial distress and if not recovered will result in bankruptcy. This will help stakeholders the outline to arrive at rational decision before selecting any companies for investing their funds and risk can be compensated against expected return.

### F. Methodology of Research, Findings

**Research Design:** Researcher will be using Descriptive Research with mathematical and financial models.

**Sample design:** Clustered sampling method

**Target population:** The universe of the study is all the listed companies on Bombay stock exchange and bankrupt companies in last decade.

**Target group:** Financially sound companies, financially distressed companies

**Data Collection:** The source of secondary data would be obtained from the financial report of the selected companies.

**Models used:** Altman's Z score, Ohlson's Oscore, Discriminant Analysis, Logistic Regression.

#### Findings:

##### 1. Descriptive Statistics

Descriptive Statistics					
	N	Minimum	Maximum	Mean	Std. Deviation
EBIT	50	-1959.29000	31835.00000	3388.514000	6561.278243
TA	50	27.1000000	397785.0000	30517.62000	68535.93422
Net sales	50	19.1100000	329076.0000	20199.79460	49001.75514

Market value of equity shares	50	.0000000	266551.5600	53667.83172	79723.71825
Total liabilities	50	27.1000000	397785.0000	30517.62000	68535.93422
Current assets	50	22.9800000	116152.0000	8992.305800	18764.13575
Current liabilities	50	19.3500000	91301.00000	7133.163200	14518.69668
Retained earning	50	-667.540000	212923.0000	15699.76340	37265.10158
Z score	50	-.241	12.09	3.17	2.88

**2. Discriminant Function:**

Discriminant Analysis (DA) is a technique for analyzing data when the criterion or dependent variable is categorical and the predictor or independent variables are interval in nature.

In the estimation part of research we firstly decided to use the DA procedure. Discriminant Analysis is used primarily to predict membership in two or more mutually exclusive groups.

Present study also used various ratios for financial analysis which has used in Edward Altman model. The model developed is like this:

$$D_i = -2.475 + 1.007X_1 + 1.885X_2 + 3.467X_3 + 0.212X_4 - 1.058X_5$$

Classification Results <sup>a,c</sup>						
		Status of company	Predicted Group Membership			Total
			Safe	Grey	Distress	
Original	Count	Safe	14	4	1	19
		Grey	0	10	1	11
		Distress	0	2	18	20
	%	Safe	73.7	21.1	5.3	100.0
		Grey	.0	90.9	9.1	100.0
		Distress	.0	10.0	90.0	100.0

Cross-validated <sup>b</sup>	Count	Safe	13	5	1	19
		Grey	0	10	1	11
		Distress	0	3	17	20
	%	Safe	68.4	26.3	5.3	100.0
		Grey	.0	90.9	9.1	100.0
		Distress	.0	15.0	85.0	100.0

- a. 84.0% of original grouped cases correctly classified.
- b. Cross validation is done only for those cases in the analysis. In cross validation, each case is classified by the functions derived from all cases other than that case.
- c. 80.0% of cross-validated grouped cases correctly classified.

This table is used to assess how well the discriminant function works. After estimation phase of research follows the classification. Here researcher has used cross-validated procedure of classification (i.e. jack knife classification), which is more honest than classical classification. The data from the table reveal that DA model accuracy is 68.4% for Safe firms, 26.3% Grey firms and 5.3% for Distress firms and 84% in total. According to the table above when the discriminant functions were used to “predict” from the five variables, 84% of the original grouped cases were correctly reclassified back into their original categories.

### 3. LOGISTIC REGRESSION (from Ohlson model)

The independent variables used in logistic regression are ratio type of scale. The variables are nominal type coded as dummy variable. The list of dummy variables and their coding is displayed in below table.

From the result of logistic regression, it seems that at the first step, the bankrupt category is classified 67% and not bankrupt category by 91% correctly. The model increase correct classification as it increases the steps. At the fourth step, the bankrupt category is 100% and not bankrupt category by 100% correctly classified. The overall correct classification of model is 100 %.

**4. Classification matrix for the bankruptcy models with original statistical technique**

Classification Table					
	Observed		Predicted		
			Decision O score		Percentage Correct
	bankrupt	not bankrupt			
Ohlson model	O score	bankrupt	18	0	100.0
		not bankrupt	0	32	100.0
		Overall Percentage			100.0

Classification Results						
		Status of company	Predicted Group Membership			Total
			Safe	Grey	Distress	
Altman	Count	Safe	13	5	1	19
		Grey	0	10	1	11
		Distress	0	3	17	20
	%	Safe	68.4	26.3	5.3	100.0
		Grey	.0	90.9	9.1	100.0
		Distress	.0	15.0	85.0	100.0

Accuracy Rate

Model	Accuracy
Altman	80%
Ohlson	100%

The model of Altman (1968) has an overall accuracy rate of 80%. The overall accuracy rate of this model is low as compared to the Ohlson. Furthermore, the model of Ohlson (1980) has an overall accuracy rate of 100 %.

**G. Achievements with respect to objectives:**

Objectives	Achievements	Significance
To conduct secondary study for understanding sickness prediction models formulated by earlier researchers, number of parameters used by them, the mathematical treatment given in the model and the predicting accuracy of them.	Descriptive statistics for the estimation sample	This will help researcher to have insight on the topic and different methodologies used across the world.
To develop the model based on accounting information that predict the Financial Distress	Altman Model, Discriminant Analysis	<p>It is used primarily to predict membership in two or more mutually exclusive groups.</p> <p>Model :</p> <p><b><math>D_i = 2.475 + 1.007X_1 + 1.885X_2 + 3.467X_3 + 0.212X_4 - 1.058X_5</math></b></p> <p>DA model accuracy is 68.4% for Safe firms, 26.3% Grey firms and 5.3% for Distress firms and 84% in total.</p> <p>84% of the original grouped cases were correctly reclassified back into their original categories.</p>
To investigate financial ratio of selected companies and identify which ratios contribute to the downfall or bankruptcy.	Ohlson model, Logistic Regression	At the first step, the bankrupt category is classified 67% and not bankrupt category by 91% correctly. The model increase correct classification as it increases the steps. At the fourth step, the bankrupt category is 100% and not bankrupt category by 100% correctly

		classified. The overall correct classification of model is 100 %.		
To test with past data of selected companies various prediction models and validate the efficacy of the models in predicting the sickness.	Accuracy Rate, Classification table		Model	Accuracy
			Altman	80%
			Ohlson	100%
To identify difference in five ratios among safe, distress and grey zone companies.	ANOVA Post Hoc	<ol style="list-style-type: none"> <li>1. Significant difference between the groups on working capital to total assets.</li> <li>2. significant difference between the groups on Retained Earnings to Total Assets</li> <li>3. Statistically significant difference between the groups on Market value of Equity Shares to Total Liabilities.</li> <li>4. Statistically significant difference between the groups on Net Sales to Total Assets</li> </ol>		

**H. Conclusion:**

All the objectives are addressed and a new model is framed by changing coefficient and adding a constant taking Altman model as base. As with change in business condition, country, time period the accuracy of the model changes, this model will help stakeholders to know the likelihood of financial distress of the companies.

**I. Copies of papers published and list of publications arising from the thesis:**

*Miss Jaya Kumari P Dakhwani, D. K. (2018). Predicting Financial Distress of S Kumar Nationwide Ltd- A comparison of Altman's Z score model and Ohlson's O score model. IJCESR , 5 (4), 57-61.*

**Miss Jayakumari P Dakhwani, D. K. (2017).** Financial Distress Analysis of Selected Indian Pharmaceutical Companies. *International Journal of Exclusive Management Research , 7 (10), 16-21.*

**Dakhwani, M. J.** (2015). *A Case Study on Crisis in Kingfisher Airlines. Interdisciplinary Studies in Management* , 227-233.

**J. Patent: Nil**

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