Bankruptcy Prediction using Multivariate Discriminant Analysis - Empirical Evidence from Cases Referred to NCLT

Rajalakshmi Vel, Priyanka Zala

Abstract: ***The study is about bankruptcy prediction using multivariate model of analysis for the case of twelve large accounts which were referred to National Company Law Tribunal for insolvency proceedings. Corporate failures affect all stakeholders. It's also a fact that companies are never shielded from bankruptcy. With the mounting of India's non-performing assets, the pronouncement of Insolvency and Bankruptcy Code is a strong suit for maximising value of lenders as well as borrowers. The first part of the paper throws light on the code, the progress made and challenges faced. On the empirical literature side, the paper applies the famous Altman's Z-Score model on the first twelve companies on which insolvency proceedings are on. Suitability of the model is supported by literature review on the subject. Financial data gathered from Annual reports are analysed to arrive at Z-Score results. The strength of the results are statistically examined through hypotheses tested using regression and feasibility of the model is tested using ANOVA. The paper presents the limitation of the study, a discussion of the suitability of the model and further scope of research in the area.***

Keywords: Altman's Z-Score, Bankruptcy prediction, Financial ratios, Insolvency and Bankruptcy Code (IBC), National Company Law Tribunal (NCLT)

I. INTRODUCTION

Corporate failure prediction known as bankruptcy prediction is a vital area in financial research. The distinctive nature of bankruptcy is that it affects not only lenders but all stakeholders of a company. This is evident from the recent cases of bankruptcy filings with National Company Law Tribunal (NCLT). Bankruptcy is a concern for employees, shareholders, investors and regulators. It's also a fact that companies are never shielded from bankruptcy. The phases of business cycle impact companies and they are more likely to go bankrupt during recessionary conditions of the economy. Detecting deterioration in the financial health of companies is an important milestone in academic research.

II. SIGNIFICANCE OF THE STUDY:

Studies with strong empirical testing have evolved to predict the likelihood of bankruptcy. The models help in classifying a company as bankrupt or non-bankrupt. The area of bankruptcy prediction studies have progressed with time as enormous research has happened using various models. An observation at the pattern of these studies reveals that in Indian context there is scanty work on bankruptcy prediction models. Most studies have been done at global level in multinational companies. The aim of this research is to employ one of the time-tested models of bankruptcy by testing it on a sample of 12 companies that were referred to National Company Law Tribunal (NCLT) for insolvency proceedings and bring out the results. In doing so, the researchers reinforce the utility and suitability of this model for diverse nature of insolvent companies.

III. CORPORATE BANKRUPTCY – CURRENT SCENARIO:

The last three years have witnessed a spur in bankruptcy in India with 1484 cases of bankruptcy admitted for resolution. Out of the Rs.10 trillion non-performing assets in the banking system, about two-fifth of them have been referred to NCLT[15]. Bankruptcy which is an outcome of insolvency leads to economic failures of nations and India isn't exception to this syndrome. The history of insolvency dates back to the pre-financial crisis of 2005 when large corporations invested in capital-intensive projects as a part of India's infrastructure development. Owing to the Global Financial crisis of 2008, many projects slowed down thereby becoming unviable. Cash got trapped in unviable projects and as a result bank loans couldn't be repaid which triggered the NPA accounts of banks. Presently there are 11 Lakh active companies and 2511 companies have been referred to NCLT for insolvency as per the data released by SBI research as on 31st March 2018.[12] As per RBI directives, List I & II of large stressed assets were compiled by banks which are presented below.

Table: I
Sector-wise details of RBI 1st and 2nd list as on Dec. 2017

Sector	No of Companies	Amount (Rs. Cr.)	Share (%)
Metals	13	1,67,460	40.65
EPC	8	1,08,290	26.28
Electronics	1	47,550	11.54
Textile	2	25,220	6.12
Power	4	18,170	4.41

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Dr. Rajalakshmi Vel, School of Management, Vel Tech Rangarajan Dr.Sagunthala R & D Institute of Science and Technology, Chennai, India.
Dr. Priyanka Zala, Faculty of Business Administration, GLS University, Ahmedabad, India.

Auto Ancillary	1	14,080	3.42
Oil	1	8,000	1.94
Shipping	1	6,950	1.69
Consumer	1	5,330	1.29
Food Processing	1	4,000	0.97
Pharma	1	3,760	0.91
Telecom	1	3,210	0.78

(Source: SBI Research)

IV. INSOLVENCY AND BANKRUPTCY CODE:

To sort out the bad pile of loans in various sectors such as steel, cement, and housing, the NDA government pronounced the Insolvency and Bankruptcy code (IBC or the code) in 2016, one of the ambitious legislations. The new bankruptcy resolution rules were introduced with an aim to clean-up the bad loans of state owned banks and help them revive from the debt-stuck state thereby creating a robust market for restructured debt. The crux of the code is that it has a strict 180 + 90 days 'resolve or liquidate' plan, thereby emphasizing the concept of 'creditor in control'.[16] The code has received praise from the international community of World Bank and IMF. It gained impetus when twelve big ticket bad loans were referred for insolvency proceedings by RBI.

V. AN OVERVIEW OF IBC:

The fundamental tenets of IBC are listed below:

- To allow even small creditors to file bankruptcy petition against defaulting companies
- To draft resolution plans [where revival is possible] rather than directly liquidate which takes care of the interest of all stakeholders
- To turn around distressed assets by attracting investments in those assets from foreign investors

Three years have passed since the introduction of this law and nearly 586 cases have been resolved out of the 1484 cases admitted for resolution according to the details released by the Insolvency and Bankruptcy board of India.[6] That results in a strike rate of 40%. A peep into the journey so far reveals that progress is made by the legislation which act as a catalyst for improving companies conduct.

VI. MOTIVATION FOR THE STUDY:

The subject of bankruptcy which is of concern in a company's financial life is one area where theory can be applied to practice. A burgeoning topic in real-time, it concerns the government and business community. This is a good motivation for the researchers to cover an area of study, wherein the results can generate interesting classroom discussions. An additional motivation is to relate quantitative models per se for identifying pressing issues of companies.

VII. LITERATURE REVIEW:

Bankruptcy refers to insolvency of companies due to which the company is unable to service its borrowing (interest and principal amount). Assessment of bankruptcy risk of borrowers is of utmost importance to all stakeholders. Bankruptcy studies gained prominence due to the global financial crisis which spurred many companies to default on account of money locked in unviable projects. The univariate studies use financial ratios as a means of understanding the financial health of companies.

Some of the early studies in the area are:

- The study conducted by J.R.Ramster and L.O.Foster on 173 companies in 1931
- The study conducted by Raymond Smith and Arthur on 183 companies in 1935
- The study conducted by Charles Merwin on 900 companies in 1942

Financial ratios analysis were further popularized as a reliable tool for predicting company's performance through studies conducted by Beaver (1966) and Green (1978)[3]. Beaver's work served as a standard for investigating the phenomenon further by way of multivariate models. Therefore, by 1960s studies focusing on multivariate discriminant analysis started gaining prominence all over the world with Edward Altman proposing his first multivariate model of predicting bankruptcy in 1968[1]. His approach remains relevant for widely varying population of sample companies and applicable across nations. Considered as an accounting-model, it combines several accounting measures to arrive at a score which has the potential to predict the probability of default of companies. The field of bankruptcy is further advanced with studies by Martin (1977) and Ohlson (1980) who developed a logistic regression model known as logit analysis (LA)[9]. In west the field is so advanced today with development of neural networks and decision tree analysis supported by soft computing. Despite comprehensive literature on the subject, it is to be noted that studies covering Indian business firms are limited. A study on the suitability of bankruptcy model was carried out in 2013 by Narender et al. but the study covered only the Indian manufacturing sector[7]. Moreover, with the pronouncement of IBC, there is an immediate need for studies that span across all sectors where Indian banks have tremendous exposure.

VIII. OBJECTIVES OF THE STUDY:

The broad objective of the study is to

- To understand the arena of corporate bankruptcy in Indian context in the background of new legislation
- To apply the theoretical framework of bankruptcy prediction models to the first list of companies referred to NCLT
- To evaluate the empirical results using statistical tools
- To present the progress of new legislation by reporting challenges faced.

IX. METHODOLOGY:

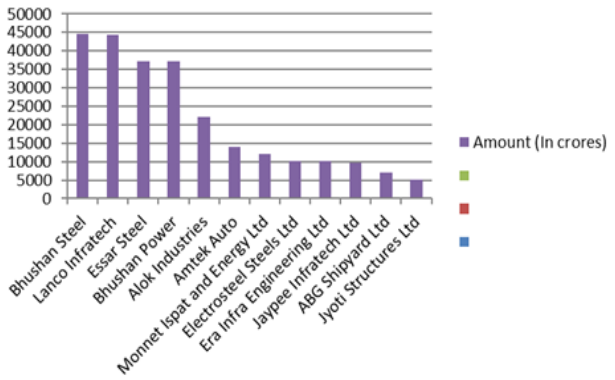
There are many methods that are used to predict financial distress in firms. The study employs the reputed credit risk model known as Altman's Z-score Model for the list of twelve companies that were referred to NCLT for insolvency proceedings. In order to evaluate the credit worthiness, five financial variables are calculated which are constituted as an equation to arrive at Z-score. For this purpose, the financial statements of sample companies are analysed for two years preceding the insolvency proceedings [i.e

2016-17 and 2015-16]. The financial data were extracted from Annual Reports of individual companies and stock price data were taken from nseindia.com. The resultant Z-scores are tested for their validity using regression analysis and ANOVA. The sample list of firms and their share of bad loans are given below:

Table: II
List of Companies referred for Insolvency

First List - These 12 companies account for 25% of total bad loans		
Sr. No.	**Companies**	**Amount (Rs. Cr.)**
1	Bhushan Steel	44,478
2	Lanco Infratech	44,364
3	Essar Steel	37,284
4	Bhushan Power	37,248
5	Alok Industries	22,075
6	Amtek Auto	14,074
7	Monnet Ispat and Energy Ltd	12,115
8	Electrosteel Steels Ltd	10,273
9	Era Infra Engineering Ltd	10,065
10	Jaypee Infratech Ltd	9635
11	ABG Shipyard Ltd	6953
12	Jyoti Structures Ltd	5165

Exhibit I:
Share of Bad loans of companies



X. ALTMAN Z-SCORE MODEL:

Edward Altman has the credit of proposing the first multivariate model on corporate bankruptcy prediction. The model combines five financial metrics fitted into an equation with weights to produce a Z-score. It's a proven model applicable to diverse industries for forecasting credit risk. The five variables analysed include liquidity, profitability, leverage, solvency and activity. Its calculated as:

$$\mathbf{Z = 0.012X_1\ 0.014\ X_2 + 0.033X_3 + 0.006X_4 + 0.999X_5}$$

X_1 = Working Capital /Total Assets
X_2 = Retained Earnings/Total Assets
X_3 = Earnings before interest and taxes/Total Assets
X_4 = Market Value of Equity/Book Value of total liabilities
X_5 = Sales/Total Assets.

Each of these metrices is multiplied with a predetermined weight and are added together to arrive at Z-score. The zones are defined as follows:

Z > 2.99 – SAFE ZONE
1.81 < Z < 2.99 – GREY ZONE
Z < 1.81 – DEFAULT ZONE

XI. HYPOTHESIS PROPOSED:

In order to validate the results, we formulate the following hypotheses for the study.

H_1- Z score model has a significant impact in measuring company failure or success

H_2- X_1 Working Capital /Total Assets has a significant impact in measuring company failure or success

H_3- X_2 = Retained Earnings/Total Assets has a significant impact in measuring company failure or success

H_4- X_3 = Earnings before interest and taxes/Total Assets has a significant impact in measuring company failure or success

H_5- X_4 = Market Value of Equity/Book Value of total liabilities has a significant impact in measuring company failure or success

H_6- X_5 = Sales/Total Assets has a significant impact in measuring company failure or success

XII. DATA ANALYSIS:

TABLE: III
Z-Score Results

Sr. No.	Company Name	Z Score Value as per Altman Model	
		2016-17	2015-16
1	Bhushan Steel	0.24	0.22
2	Lanco Infratech	0.09	0.14
3	Essar Steel	0.35	0.24
4	Bhushan Power	0.20	0.19
5	Alok Industries	0.25	0.36
6	Amtek Auto	0.12	0.09
7	Monnet Ispat and Energy Ltd	0.14	0.19
8	Electrosteel Steels Ltd	0.18	0.18
9	Era Infra Engineering Ltd	0.14	0.14
10	Jaypee Infratech Ltd	0.05	0.18
11	ABG Shipyard Ltd	0.13	0.41
12	Jyoti Structures Ltd	0.14	0.41

Table III shows the results of Z-Score for two years preceding the year when the companies were filed for bankruptcy. The Z-Score of all twelve companies are less than 1.81 which denotes a high degree of default. The scores tend to decrease for six companies as they approach closer to the year in which they filed for bankruptcy. The model clearly reckons a company's 'tendency' to bankruptcy. The model enables to determine with accuracy the companies that are in distress.

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XIII. FINDINGS OF THE STUDY:

TABLE: IV
Coefficient of Determinants Test

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	1.000[a]	1.000	.999	.0018342

a. Predictors: (Constant) X_1, X_2, X_3, X_4, X_5

Table IV shows that all the independent variables X_1, X_2, X_3, X_4 and X_5 have the ability to explain the variation of the dependent variable Z score of 0.999 or 99.99%. Model summary of Z-Score has an adjusted R square of 0.999 which is 99.99% (almost 100%), statistically representing that the model is a sound predictor of bankruptcy. Feasibility of the model and the percentage contribution shown by the coefficient of determination were tested using ANOVA and the results are tabulated below.

TABLE: V
ANOVA[b]

Model	Sum of Squares	Df	Mean Square	F	Sig.
Regression	.072	5	.014	4296.411	.000[a]
Residual	.000	6	.000		
Total	.072	11			

Table V shows that Z score model is significant (0.000) < 0.005. Therefore, we reject Ho and accept the alternative hypothesis that Z-Score model has a significant impact in measuring company failure or success

TABLE: VI
Multiple Regression Analysis of Independent Variables

Model	Unstandardized Coefficients		Standardized Coefficients	T	Sig.
	B	Std. Error	Beta		
Constant	.007	.003		2.567	.043
X_1 WC/TA	-.438	.436	-.013	-1.003	.354
X_2 RE/TA	1.164	.158	.057	7.379	.000
X_3 EBIT/TA	1.112	.237	.038	4.698	.003
X_4 MVE/TL	-1.420	.874	-.022	-1.623	.156
X_5 S/TA	.965	.014	.976	69.183	.000

XIV. EXPLANATION:

The tabulated results measure the individual impact of independent variables on company's success or failure. The regression coefficient of X_1 which is Working Capital to Total Assets is -.438 with a significance of 0.354. This leads to rejection of null hypothesis Ho stating that Working Capital to Total Assets have a significant impact in measuring company's failure or success. The regression coefficient of X_2 which is Retained Earnings to Total Assets is 1.164, with a significance of 0.000. This confirms the alternate hypothesis H_3 stating that Retained Earnings to Total Asset have a significant impact in measuring company's failure or success. Similarly, the regression coefficient of X_3, X_4 X_5 are 1.112 with a significance of 0.003, -1.420, with a significance of 0.156 and 0.965 with a significance of 0.000 leading to acceptance of alternate hypotheses H_4, H_5 and H_6 affirming EBIT/TA, MVE/TL and S/TA have significant impact in measuring company's failure or success. On the whole, its evident that all coefficients
X_1, X_2, X_3, X_4 and X_5 are helpful in measuring a company's success or failure.

XV. LIMITATIONS OF THE STUDY:

The study helps in classifying a company as bankrupt or non-bankrupt. However, it doesn't cover the reasons or circumstances under which a company goes bankrupt. Decoding the reasons would go a long way in making bankruptcy studies valuable. The second limitation concerns the model. The study uses a model which relies on accounting data which is readily available through published sources. The study does not identify the suitability of various models, given the advancement in models in the field.

XVI. DISCUSSION:

The study is carried out to understand if Altman's Z-Score is a good predictor of bankruptcy by arriving at the Z-Score of twelve large defaulting companies. The results of the study support that all twelve companies showed high degree of default in the two years preceding the bankruptcy proceedings. The study concludes that a logit model like Altman's Z-Score is a clear predictor of distress for Indian companies. It's an easy to apply, handy tool for financial institutions helping them to classify a company as 'good' or 'bad'.

XVII. SCOPE FOR FUTURE RESEARCH:

This is one of the few studies carried out on Indian companies. To augment further research in the area, the topic of bankruptcy can be applied to companies issuing debt instruments as they pose credit risk to bondholders.

As far as the models of bankruptcy are concerned, there is a great scope to study the suitability of other models or make a comparison of few models for extended research.

XVIII. CONCLUSION:

The enactment of IBC by Reserve Bank of India is to resolve the issue of non-performing assets. The IBC has gone through multiple revisions since its introduction. In its current form, it has brought a mindset change among borrowers who otherwise are unmindful of defaulting. The code has certainly succeeded in deterring corporate from defaulting. There is also considerable improvement in the time taken to resolve bad loans which is 1-1.5 years and recovery rate to 40-50% compared to an earlier time of 4 years and a recovery rate of 26%[14]. However, bankruptcy prediction studies are useful for lending institutions to gauge the deterioration in the health of companies. Models like the one employed in this paper have the potential to predict bankruptcy with accuracy. Further research with varying models need to be undertaken in Indian scenario to complement field of financial research.

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AUTHORS PROFILE

Educational Qualifications: M. Com, M.Phil, Ph.D. Dr. Rajalakshmi Vel is an Accounting & Finance Faculty with 14 years of teaching experience at the post graduate level for management programs. Her areas of interest include capital markets, corporate finance and banking. She has presented papers in International Conferences with the recent one on Payment Banks at IIM-Raipur. She has published papers in national and international refereed journals. Currently she observes developments in public policy and start up financing as her research interest.

Educational Qualifications: M.Com., M.Phil. (Acc. & Fin), Ph.D. Dr. Priyanka Zala specialization is in the area of accountancy and finance. Her areas of interest are accountancy, financial management, merger and acquisition, risk-return relationship, investment analysis, financial markets and financial services. Her research work has been in national and international refereed journal. She has presented and published 9 research papers in reputed national and international conferences and journals.

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