
Project Summary

Batch details	DSE November 2020 - Online
Team members	Yash Vahi , Apoorva Garg , Vishal Pandey , Pranavi Krishnamsetty , Shalini V.
Domain of Project	BFSI
Proposed project title	Bankruptcy Prediction
Group Number	3
Team Leader	Yash Vahi
Mentor Name	Mr. Animesh Tiwari

Date: 6th may 2021

Signature of the Mentor

Signature of the Team Leader

Table of Contents

SI NO	Topic	Page No
1	Overview	3
2	Business problem goals	3
3	Topic survey in depth	4
4	Critical assessment of topic survey	5
5	Methodology to be followed	6
6	References	6

OVERVIEW

A company goes Bankrupt when the assets and shares taken by the company cross the liability. In most cases, bankruptcy models are based on financial indicators that describe the current condition or a certain area of financial health, such as profitability, indebtedness and so on. This research shall analyse the financial statements and market data of these companies and then try to apply several models to determine the bankruptcy. The goal is to find out how far back these models are able to predict that the companies would get into financial distress and which information about the financial ratios would enhance the prediction accuracy of the bankruptcy prediction model.

Business problem statement

- The accurate financial failure predicting can provide time for corporate managers to take actions and save the business from financial insolvency. Bankruptcy prediction is a technique of forecasting and projecting on company financial distress of both public and firms.
- The purpose of predicting bankruptcy is fundamental in assessing the financial condition of a company and prospects in its operations. Corporate bankruptcy prediction is a very crucial phenomenon in economics. The financial soundness of a company is of great importance to the various factors and participants of the business cycle. The participants and interested parties include the policymakers, investors, banks, internal management, and the general public referred to as consumers. Accurate prediction of the financial performance of companies is also of great importance to various stakeholders in making important and significant decisions concerning their relationship and engagement with companies.
- Different approaches companies can take to reduce their risk of bankruptcy include 1. Analysing various factors like income by assets, net worth , shares, expenditure/revenue ratio, cash flow rate and making sure it's greater with a noticeable difference from liability and it's interests. 2. Making sure the payment of interest and taxes are upto date and there is a positive income from assets.3. Maintaining a positive cash-flow rate. 4.Making sure that expenditure to revenue ratio is small. 5. Having valuable assets which speeds up the company's revenue.
- Knowledge of an upcoming bankruptcy is a crucial aspect of the decision-making process of the imperilled company itself, as well as of other institutions interacting with the company. Companies should evaluate their financial ratio's and keep an eye on their expenditure to revenue ratio before hand to analyse if there are any vulnerable to the factors which can result in bankruptcy. We can conclude that companies should

research on audited financial data to reduce their risk associated with making investment decisions.

- The dataset used for this project has about 6k rows and 96 columns, it consists of columns with different financial ratios for all the companies and a column titled bankruptcy consisting of binary values(0,1), 1 denoting the companies that went bankrupt.

TOPIC SURVEY IN BRIEF

There is a lot of literature on Bankruptcy prediction models with initial research dating back to the 1930's playing with the adolescent albeit "rich with potential" concept of using ratios to predict bankruptcy. In searching for past approaches to predict bankruptcy, the most interesting and prevalent even in modern times was the Altman Z-score approach. While first developed in 1968, Altman himself and a few after him have made regular modifications(1968,1983,1993) to his formula using various financial ratios to guide his approach. Financial ratios are a key indicator of financial soundness of a business. Financial ratios are a tool to determine the operational & financial efficiency of business undertakings. One example of a financial ratio that Altman stuck with throughout his modifications is working capital/total assets ratio which is a measure of liquid assets in relation to the firm's size. The difference between current assets and current liabilities represents working capital^[1]. Altman in his research found that this financial ratio was more robust than other liquidity ratios like current ratio or the quick ratio. With the help of the Z-score model, Altman could predict financial efficiency/ bankruptcy up to 2-3 years in advance. Altmans' Z-score approach is said to be relevant and could still be applied to the modern economy to predict distress and bankruptcy one, two & three years in advance.

The latest formula for the Altman Z-score, last modified in 1993^[1], is

$$Z = 6.56(X_1) + 3.26 (X_2) + 6.72 (X_3) + 1.05 (X_4)$$

Where,

X_1 = Working capital/total assets

X_2 = Retained earnings/total assets

X_3 = EBIT(earnings before interest and taxes)/total assets

X_4 = N.W. (book value)/total liabilities

Where, if a score < 1.10 would indicate Bankrupt firms, > 2.60 would indicate non bankrupt firms and firms with scores between 1.10 and 2.60 are said to fall in the grey area or zone of ignorance^[1]. Results of Altman's newest revised Z-score model exhibit a 90.9% success rate in predicting bankruptcy one year prior to firm's demise and a 97% accuracy rate for identifying non bankrupt firms with continuing economic solvency^[1].

From 1968-present, the most prolific and significant bankruptcy models used Univariate Analysis or Multiple Discriminant Analysis. There are 3 other significant types of bankruptcy prediction models, Logit & Probit Analysis, Recursive Partitioning Algorithm and Neural Networks. Most bankruptcy prediction models have been constructed using datasets of only large publicly held business because the financial information is more readily available. Altman concluded that his model predicted well for one year (94%) and somewhat for two years (72%). Edmister (1972) added that small companies predicted almost as well at 93%. Lau (1987) using

Logit analysis had better predictability for three years. The three years are 96%, 92%, and 90%, respectively. McKee et al. (2000) using recursive partitioning algorithm had a predictive accuracy of up to 97%. All of the neural networks had lower predictive accuracy than the model already mentioned. Analysis of accuracy of the models suggests that multivariate discriminant analysis and neural networks are the most promising methods for bankruptcy prediction models. The findings also suggest that higher model accuracy is not guaranteed with a greater number of factors. Some models with two factors are just as capable of accurate prediction as models with 21 factors^[1].

CRITICAL ASSESSMENT OF TOPIC SURVEY

One common theme throughout has been that a consensus has not been forthcoming as to which variables are most effective in predicting bankruptcy and the time period prior to failure. We noticed that the models lacked versatility as all the data collected was from medium to large manufacturing or retail firms, Altmans' model does not always have the same accuracy across businesses^[2]. As pointed out by him, the model has limitations in its applicability to different business entities with the same prediction accuracy. In addition, his model is unable to accurately forecast financial difficulties for non-manufacturing firms and non-publicly operated firms. As the market value of equity is based on stock prices, the fourth ratio is difficult to establish in non-public firms. Almost all of the bankruptcy prediction models between 1930-2001 use a paired - sample technique, one sample group contains (the measure of study) the companies that will have failed while the other sample contains healthy companies and both samples use the same variable. Different ratios, statistical modelling approaches, and sampling techniques make comparing the various models very difficult. The models also contain an element of ambiguity. There is always a risk of the ratios being misleading, especially in a univariate approach. Even though Altman's bankruptcy prediction model is the most popular

analytical tool utilised by investors, auditors, and stakeholders, he advises not to use his formula to the exclusion of other analytical techniques.

Some of the approaches to solving key gaps could be:-

- Coming up with a general solution which applies to all types of firms regardless of their listing and manufacturing status.
- Looking for relationships that might not seem apparent at first but there could be a relation upon applying machine learning models and further statistical analysis.
- Coming up with a solution with consistent accuracy across different business entities.
- Trying to understand how different financial ratios work with respect to the health of a firm and trying to identify a distinct solution or a highly deterministic ratio/feature from our dataset.
- Making inferences about companies that would fall in Altmans' grey area or area of ignorance/uncertainty or try to minimise it.

Methodology

1. Identify the data required
2. Data pre-processing/cleaning
3. EDA - Descriptive analysis, Visualisation
4. Train-Test split
5. Modelling - Selecting appropriate model
6. Hypothesis Tests
7. Evaluate with test data

References

1. Anjum, Sanobar, Business Bankruptcy Prediction Models: A Significant Study of the Altman's Z-Score Model (August 13, 2012). SSRN, <https://ssrn.com/abstract=2128475> or <http://dx.doi.org/10.2139/ssrn.2128475>
2. Bellovary, Jodi L., et al. "A Review of Bankruptcy Prediction Studies: 1930 to Present." *Journal of Financial Education*, vol. 33, 2007, pp. 1–42. *JSTOR*, www.jstor.org/stable/41948574. Accessed 3 May 2021.
3. Narender, Gokhul, Manu, Srivastawan, Analysis of bankruptcy prediction models and their effectiveness : An Indian perspective, <https://www.greatlakes.edu.in/pdf/ANALYSIS%20OF%20BANKRUPTCY.pdf>

Notes For Project Team

Sample Reference for Datasets (to be filled by team and mentor)

Original owner of data	Taiwan Economic Journal
Data set information	The data was collected from the Taiwan Economic Journal for the years 1999 to 2009. Company bankruptcy was defined based on the business regulations of the Taiwan Stock Exchange.
Any past relevant articles using the dataset	-
Reference	Kaggle
Link to web page	https://www.kaggle.com/fedesoriano/company-bankruptcy-prediction
