

Predicting Bankruptcy and Financial Distress Using Altman Z Score, Grover G Score, Springate S Score and Zmijewski X Score-A Study on Select Companies.

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ABSTRACT

Financial distress is often a harbinger of bankruptcy and can cause a lasting damage to one's credit worthiness. In order to remedy the situation, a company or an individual may consider options such as restructuring debts or paying back the portion of assets as a debts and obligations. This study aims to detect the bankruptcy and financial distress of select companies which are listed on stock exchanges. The main purpose of the study was to predict the bankruptcy and financial distress of select companies for a period of three years i.e., from 2018-2019 to 2020-2021 by using the accounting tools such as Ratio applications, Altman z score, Grover G score, Springate S score and Zmijewski X score. For the study, data has been categorized into two variables such as dependent variables which includes bankruptcy and financial distress and independent variables such as accounting tools. At the end of the study, it came to known that all the accounting techniques used in the study can predict absolutely.

Keywords: Bankruptcy, Financial Distress, Ratio analysis, Altman Z score, Grovers G score, Springate S score, Zmijewski X score.

INTRODUCTION:

Managers, shareholders, lenders and employees are concerned about the financial health of their company. The job security of the managers and employees is not guaranteed when their companies experience financial difficulties. The capital resources of the stakeholders and the claims of the lenders are not guaranteed either. The government, as a regulator in a competitive market, is concerned about the consequences of financial distress of the companies and controls the capital adequacy through regulatory capital requirements. This shared concern of managers, employees, investors and government leads to frequent questions and recurring attempts to answer an incessant question of how to predict financial distress or what reveals corporate credit risk.

Financial distress is a likelihood that a company will not be able to meet its financial obligations when they fall due. A company in financial distress usually finds itself in tight situation where it is difficult to pay amounts due. If the situation lasts longer, it can lead to insolvent and bankruptcy or forced liquidation. It is compounded by the banking and other financial institutions refuse to lend to people in serious distress. When a company experiences difficulties, the situation often drastically reduces its market value, suppliers of goods or products and services usually insist on cash delivery items, and large customers may cancel their orders in anticipation of untimely deliveries.

Definition of Bankrupt: Bankruptcy is a legal proceeding initiated when an individual or a company fails to pay its outstanding debts and obligations.

Bankruptcy proceedings begin with a petition filed by the debtor, which is more common or on behalf of a creditor, which is a less common. All the assets of a debtors are measured and evaluated, and these assets are used to repay its portion of an outstanding debts.

Definition of Financial distress: "it is a term in corporate finance used to indicate a condition when promises to creditors of a company are broken or honored with difficulties".

If financial distress cannot be relieved, it can lead to bankruptcy. Financial distress is usually associated with some costs to the firm; these are known as costs of financial distress.

According to Altman, an emphasis on ratio analysis in a company's financial health, MDA multiple discriminant analysis is deemed as an appropriate statistical tool. Although not as popular as multivariate analysis, MDA has been utilized during a style of disciplines since its first application within the 1930's. In recent times, this system has become increasingly popular within the practical business world similarly as in academia.

The MDA technique has the advantage of considering a complete profile of characteristics common to the relevant firms, as well because the interaction of those

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properties. A univariate study, on the opposite hand, can only consider the measurements used for group assignments one at a time. Another advantage of MDA is that the reduction of the analyst's space dimensionally. The analysis is transformed into its simplest form: one dimension. The discriminant function, of the shape $Z = V_1X_1 + V_2X_2 + \dots + V_nX_n$ transforms the individual variable values to one discriminant score, or Z value, which is then used to classify the thing where $V_1, V_2 \dots V_n$ are discriminant coefficients, and $X_1, X_2 \dots X_n$ are independent variables (Altman, 2000). The model proposed by Altman (1968) combines various accounting ratios. He derived the Altman Z-score model, an MDA model, to discriminate between characteristics of a financially distressed firm and a non-financially distressed one combining traditional ratio analysis with statistical techniques. The Altman Z-score model analyses the whole variable profile of the item simultaneously instead of sequentially examining individual characteristics. Combinations of ratios are analyzed together in order to get rid of possible ambiguities and misclassifications. He suggested that this model can predict ultimate of distress the maximum amount as three reporting periods before the event.

Methods for predicting bankruptcy and financial distress:

Altman Z Score: Edward I Altman published the equation for the Z score to predict corporate bankruptcy for the first time in the United States in 1968. He used it to predict the likelihood of companies declaring bankruptcy within a two-year window. Z score model was originally proposed by Altman in 1968, who argued that a business with low profitability are substantial likelihood of bankruptcy. The method to predict Altman Z score variable is as follows:

$$Z = 1.2Z_1 + 1.4Z_2 + 3.3Z_3 + 0.6Z_4 + 0.999Z_5$$

where Working capital divided by Total assets is Z_1 , Retained earnings divided by Total assets is Z_2 , Earnings before interest and tax divided by Total assets is Z_3 , Market capitalization divided by Book value of liabilities is Z_4 , and Sales divided by Total assets is Z_5 . **Grover Score:** The Grover method is a method of predicting bankruptcy and financial distress created by designing and re-evaluating the Altman z score method. Jeffrey S Grover samples accordingly to Altman's 1968 Z score by adding 13 new financial ratios. The samples used are 70 companies out of which 35 were bankrupt between 1982 and 1996 and another 35 were not bankrupt. The method to predict Grover score is as follows:

$$G = 1.650X_1 + 3.404X_2 - 0.016X_3 + 0.057$$

where Working capital divided by Total assets is X_1 , Net profit before interest and tax divided by Total assets is X_2 , Net income divided by total assets (ROA) is X_3 . **Springate score:** The Springate score method of predicting bankruptcy and financial distress was developed by Gorgon L V Springate in 1978. It is a ratio application model using MDA (Multiple Discriminate Analysis) to choose 4 out of 19 financial ratios which

are best to differentiate bankrupt and non-bankrupt sound businesses. The method to predict to Springate score is as follows:

$$S = 1.03A + 3.07B + 0.66C + 0.4D$$

where Working capital divided by Total assets is A, Net profit before interest and tax divided by Total assets is B, Net profit before taxes divided by Current liabilities is C and Sales divided by Total assets is D.

Zmijewski Score: Zmijewski (1983) conducted an extension study on bankruptcy prediction and financial distress and added the validity of the financial ratio as a tool to detect financial failures of firms. The method to predict bankruptcy and financial distress through Zmijewski score is as follows:

$$X = -4.3 - 4.5X_1 + 5.7X_2 - 0.004X_3$$

Criteria for predicting Bankruptcy and Financial distress of a company:

According to Altman Z score: If the value of Z is less than 1.8, it is a Bankruptcy company or in a financial distress, If the value of Z is between 1.81 and 2.99, it is included in grey area (in a crisis). If the value of Z is greater than 2.99, then the company is said to be a healthy company.

According to Grover G score: If the G value is less than or equals to -0.02, then the company is said to be in a financial distress or bankruptcy company. If the G value is greater than 0.01, the company is said to be a healthy company or it is not in bankruptcy. If the G value is between the -0.02 and 0.01 then the company is said to be in grey area (in financial crisis).

According to Springate S score: If the value of S is less than 0.862, the company is said to be in financial distress or categorized as Bankruptcy, whereas the value of S is greater than 0.862 then it is said to be a healthy company or the company is not categorized as bankruptcy.

According to Zmijewski X score: Zmijewski claimed that companies are said to be in financial distress if the probability score or value of X is more than 0. Therefore, cut-off value which applies in this model is 0. However, the value of X is less than 0, then it is said to be a healthy company.

REVIEW OF LITERATURE:

Apergis (2019): The study advances financial distress and analyses the relationship between financial distress, performance, employment and Research and Development, investments in MNC's. To estimate financial distress conditions logit and hazard model is used and for consistency and efficient estimation conditional mixed process model is used.

Agarwal and chatterjee (2019): This paper studies the inter connection between the financial distress and earnings management of 150 samples which are financially distressed. Discretionary Accruals (DA) as a

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substitute for earnings management and multiple regression analysis have been used. Altman Z score and distant-to-default have been applied for different financial distress. Results shows that slightly distressed firms have large earnings management. Cash Flow coverage is having a significant negative relationship with earnings management and a company with large cash flow coverages.

Abadi (2018): His study concludes that the calculation result of financial ratio calculated using Springate S score between research period between 2013-2014, the result showed that there were 19 real-estate companies indicated bankruptcy potential out of 75 companies.

Altman et.al,(2017): studied the quality of Z score model finding bankruptcy various types of distress which firm is facing to verify model importance. Model efficiency is analyzed for firms from European and Non-European countries. The investigation uses the real Z score model by Altman for public and private manufacturing and non-manufacturing firms. Finally Z score model performed well in predicting the bankruptcy and financial distress with an accuracy of 75%.

Husein (2017): his research study reveals that, Altman, Grover, Springate, Zmijewski models can be used to predict financial distress. However, Zmijewski model is the best method to predict bankruptcy and financial distress of a company when compared to other three methods.

Kakauhe and pontoh (2017): They conducted research ion the Z score methods accuracy in predicting the bankruptcy of manufacturing companies in the consumer goods sector, where the companies are generally considered to be in good health as a result of having increased sales, that results in increased revenue. For firms that have been identified as potentially bankrupt, insolvent, or in the process of becoming bankrupt due to declines in sales, corporate assets, retained earnings, earnings before taxes, negative interest rates, and company losses.

Gunawan, et.al,(2017): By his research paper, the Grover model can foresee financial distress. This study demonstrates how the Grover model's financial ratios might be utilized to depict a company's financial difficulty using three financial ratios viz Working capital/Total assets, Net profit before interest and taxes/Total assets and Net income/Total assets.

Meiliawati (2016): By this study, it is found that using the Springate and Altman scores to predict the likelihood of financial hardship in cometic companies listed on stock exchanges which made a substantial effect. In this study various ratios are used to determine the level of financial distress.

Safitra(2013): her research found that she had two companies in good heathy. For companies indicated as vulnerable, they need to have an increase in revenue,

sales, operation expenses as optimized as possible and pay attention to the equity market value.

Research Gap:

It is found from the review of literature that, few studies have been done on financial distress and bankruptcy prediction models on manufacturing companies, non-manufacturing companies, private companies and public companies. To fill the research gap the present study has been undertaken.

Objectives of the Study:

The present study is on “Bankruptcy and Financial Distress Prediction using Altman Z score, Grover G score, Springate S score and Zmijewski X score- A study on select companies”.

- ❖ To present an overview of bankruptcy and financial distress prediction methods.
- ❖ To predict the bankruptcy and financial distress of select companies using Altman Z score.
- ❖ To predict the bankruptcy and financial distress of select companies using Grovers G score.
- ❖ To predict the bankruptcy and financial distress of select companies using Springate S score.
- ❖ To predict the bankruptcy and financial distress of select companies using Zmijewski X score.

Hypothesis of the Study:

- ❖ H0: Altman Z score has no significant effect in predicting bankruptcy and financial distress.
- ❖ H1: Altman Z score has a significant impact in predicting bankruptcy and financial distress.
- ❖ H0: Grover G score has no significant effect in predicting bankruptcy and financial distress.
- ❖ H1: Grover G score has a significant effect in predicting bankruptcy and financial distress.
- ❖ H0: Springate S score has no significant effect in predicting bankruptcy and financial distress.
- ❖ H1: Springate S score has a significant effect in predicting bankruptcy and financial distress.
- ❖ H0: Zmijewski X score has no significant effect in predicting bankruptcy and financial distress.
- ❖ H1: Zmijewski X score has a significant effect in predicting bankruptcy and financial distress.

RESEARCH METHODOLOGY:

- ❖ Data: there are two variables in this research study.
- ❖ Dependent variable: Dependent variable in the study is bankruptcy and financial distress.
- ❖ Independent variable: Independent variables in the study are Altman Z score, Grover G score, Springate S score, Zmijewski X score.
- ❖ Type of the study: Quantitative research has been taken up to predict the bankruptcy and financial distress of selected companies/

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- ❖ Sample type: The study has made use of Convenience sampling to collect data through secondary source.
- ❖ Source of the study: This type of research uses quantitative data obtained from secondary sources. The data has been collected from Annual reports of the selected companies and money control.
- ❖ Scope of the study: The present study is confined to study the selected companies to predict the bankruptcy and financial distress.

- ❖ Period of the study: The period of the present study is three years i.e., from 2021-2022 to 2023-2024.

Tools used for the study: various accounting tools like Ratio analysis, Altman Z score, Grover G score, Springate S score and Zmijewski X score have been used for the study.

RESULTS AND DISCUSSIONS:

Table 1: Calculation and Analysis Results of Altman Score Z method for Year 2021-2022.

Company Name	1.2 Z1	1.4Z2	3.3Z3	0.6Z4	0.999Z5	Z score	Prediction
Future Enterprises	0.126	0.04	0.184	-0.00001	0.457	0.806982	Bankrupt
Simplex infrastructure limited	0.16	0.108	0.224	0.036	0.637	1.165	Bankrupt
Kwality limited	-6.07	6.89	-21.93	0.212	4.685	-16.213	Bankrupt

The above table no.1 calculation and analysis results of Altman Z score method for the year 2021-2022 reveals that all the companies are in bankrupt as the calculated Z score is less than the standard score as per the Altman Z score i.e.,1.81.

Table 2: Calculation and Analysis Results of Altman Z score method for year 2022-2023.

company name	1.2 Z1	1.4Z2	3.3Z3	0.6Z4	0.999Z5	Z score	Prediction
Future Enterprises	-0.101	0.026	0.062	0.00000344	0.342	0.329003	Bankrupt
Simplex infrastructure limited	0.112	0.0627	0.012	0.037	0.432	0.6557	Bankrupt
Kwality limited	-8.57	10.634	-1.353	0.639	0.48	1.83	Bankrupt

The above table no 2 calculation and analysis results of Altman Z score method for the year 202-2023 reveals that all the companies are in bankrupt as the calculated Z score is less than the standard score as per the Altman Z score (1.89).

Table 3: Calculation and Analysis Results of Altman Z score method for year 2023-2024

Company Name	1.2Z1	1.4Z2	3.3Z3	0.6Z4	0.999Z5	Z score	Prediction
Future Enterprises	0.05	-0.098	-0.123	0.00000404	0.12	-0.051	Bankrupt
Simplex infrastructure limited	0.01	0.0626	0.0177	0.062	0.235	0.3519	Bankrupt
Kwality limited	32.24	-2.4	-5.37	0	0.894	-39.116	Bankrupt

The above table no 3 calculation and analysis results of Altman Z score method for the year 2023-2024 reveals that all the companies are in bankrupt as the calculated Z score is less than the standard score as per the Altman Z score (1.89).

Table 4: Calculation and Analysis results of Grover Score method on Variable X1

Company Name	2022	2023	2024	G score	Prediction
Future Enterprises	0.173	-0.138	0.069	0.104	Not Bankrupt
Simplex infrastructure limited	0.219	0.154	0.014	0.387	Not Bankrupt
Kwality limited	-8.035	-11.783	-44.34	-64.158	Bankrupt

The above table no 4 calculation and analysis results of Grover score method on variable X1 which is Working Capital divided by Total Assets, can be seen that the kwality company is facing bankruptcy or financial distress as the calculated G score is less than -0.02. In contrast, the two company's simplex infrastructure limited and future enterprises which are not experiencing financial distress and bankruptcy.

Table 5: Calculation and Analysis results of Grover Score method on Variable X2

Company Name	2022	2023	2024	G score	Prediction
Future Enterprises	0.19	0.064	-0.12	0.134	Not Bankrupt
Simplex infrastructure limited	0.231	0.012	-0.018	0.225	Not Bankrupt
Kwality limited	-2.262	-1.397	-7.112	-10.771	Bankrupt

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The above table no-5, calculation and analysis results of Grover score method on variable X2 which is Net Profit before Interests and Taxes divided by Total Assets, can be seen that future enterprises and simplex infrastructure limited are not experiencing bankruptcy and financial distress as the calculated G score is more than 0.01 and in case of kwality limited, it is experiencing bankruptcy and financial distress as the calculated G score is less than -0.02.

Table 6: Calculation and Analysis results of Grover Score method on Variable X3.

Company Name	2022	2023	2024	G score	Prediction
Future Enterprises	0.000188	0.0003912	-0.001678	-0.00109846	Bankrupt
Simplex infrastructure limited	0.000202	-0.00055	-0.00079	-0.0011384	Bankrupt
Kwality limited	-0.11334	-0.007385	-0.167164	-0.2878892	Bankrupt

The above table no-6, calculation and analysis results of Grover score method on variable X3 which is Net income/Total Assets, can be seen that all the three companies are in bankruptcy or financial distress as the calculated G score is less than -0.02.

Table 7: Calculation and Analysis Results of Springate S score method on variable A.

Company Name	2022	2023	2024	S score	Prediction
Future Enterprises	0.1081	-0.258	0.0432	-0.1067	Bankrupt
Simplex infrastructure limited	0.137	0.0967	0.00895	0.24265	Bankrupt
Kwality limited	-5.215	-7.35525	-23.52	-36.09025	Bankrupt

The above table no-7, calculation and analysis results of Springate S score method on variable A, which is Working Capital divided by Total Assets, can be seen that all the three companies are in bankruptcy and financial distress as the calculated S score is less than the standard value of Springate S score, that is 0.862.

Table 8: Calculation and Analysis Results of Springate S score method on variable B.

Company Name	2022	2023	2024	S score	Prediction
Future Enterprises	0.171	0.058	-0.11497	0.114	Bankrupt
Simplex infrastructure limited	0.208	0.011	-0.016	0.203	Bankrupt
Kwality limited	-2.04	-1.259	-6.414	-9.713	Bankrupt

The above table no-8, calculation and analysis results of Springate S score method on variable B, which Net profit before Interest and Taxes divided by Total Assets, can be seen that all the three companies are in bankruptcy and financial distress as the calculated S score is less than the standard value of Springate S score, that is 0.862.

Table 9: Calculation and Analysis Results of Springate S score method on variable C.

Company Name	2022	2023	2024	S score	Prediction
Future Enterprises	0.0586	-0.046	-0.1784	-0.1658	Bankrupt
Simplex infrastructure limited	0.0168	-0.0436	-0.0575	-0.0843	Bankrupt
Kwality limited	-0.891	-0.0421	-0.2224	-1.1555	Bankrupt

The above table no-9, calculation and analysis results of Springate S score method on variable C, which Net profit before Taxes divided by Current Liabilities, can be seen that all the three companies are in bankruptcy and financial distress as the calculated S score is less than the standard value of Springate S score, that is 0.862.

Table 10: Calculation and Analysis Results of Springate S score method on variable D.

Company Name	2022	2023	2024	S score	Prediction
Future Enterprises	0.183	0.137	0.048	0.368	Bankrupt
Simplex infrastructure limited	0.255	0.173	0.094	0.522	Bankrupt
Kwality limited	18.695	0.192	0.358	19.245	Not Bankrupt

The above table no-10, calculation and analysis results of Springate S score method on variable D, which is Sales divided by Total Assets, can be seen that the two companies viz future enterprises and simplex infrastructure limited are in bankruptcy and financial distress as the calculated S score is less than the standard value of Springate S score, that is 0.862. In contrast, the Kwality limited is not in bankrupt or financial distress as the company sales are very high at the moment.

Table 11: Calculation and Analysis Results of Zmijewski X score method on variable X1.

Company Name	2022	2023	2024	X score	Prediction
Future Enterprises	0.0529	0.11	-0.472	-0.3091	Not Bankrupt
Simplex infrastructure limited	0.918	-0.154	-0.222	0.542	Bankrupt
Kwality limited	-31.87	-2.076	-47.015	-80.961	Not Bankrupt

The above table no-11, calculation and analysis results of Zmijewski X score method on variable X1 which is Net Income divided by Total Assets. The table reveals that, the future enterprises and kwality limited are not experiencing bankrupt or financial distress as the calculated X value is less than the standard value (0) according to Zmijewski method whereas the simplex infrastructure limited is going to experience the financial distress as the calculated X value is greater than the standard X value which is 0.

Table 12: Calculation and Analysis Results of Zmijewski X score method on variable X2.

Company Name	2022	2023	2024	G score	Prediction
Future Enterprises	8.655	10.252	7.61	26.517	Bankrupt
Simplex infrastructure limited	9.168	8.764	6.726	24.658	Bankrupt
Kwality limited	1.185	0.86	0.363	2.408	Bankrupt

The above table no-12, calculation and analysis results of Zmijewski X score method on variable X2 which is Total Liabilities divided by Total Assets. The table reveals that, all the three companies viz, the future enterprises, Simplex infrastructure limited and kwality limited are experiencing bankruptcy or financial distress as the calculated X value is more than the standard value (0) according to Zmijewski method.

Table 13: Calculation and Analysis Results of Zmijewski X score method on variable X3.

Company Name	2022	2023	2024	G score	Prediction
Future Enterprises	0.0067	0.00312	0.00442	0.01424	Bankrupt
Simplex infrastructure limited	0.0469	0.00447	0.00404	0.05541	Bankrupt
Kwality limited	0.00014	0.0000478	0.0000209	0.0002087	Bankrupt

The above table no-13, calculation and analysis results of Zmijewski X score method on variable X3 which is Current Assets divided by Current Liabilities. The table reveals that, all the three companies viz, the future enterprises, Simplex infrastructure limited and kwality limited are experiencing bankruptcy or financial distress as the calculated X value is more than the standard value (0) according to Zmijewski method.

CONCLUSION:

Based on the data analysis results, the present study can be concluded that, all the four methods namely, Altman Z score method, Grover G score method, Springate S score method and Zmijewski X score methods best suits for predicting bankruptcy and financial Distress. However, for better research results, more number of samples should be taken and more methods of predicting bankruptcy and financial distress should be used in the study.

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