Financial Distress Analysis Using The Altman Z Score Model, The Springate Model, And The Grainger Model In The Indian Cement Industry

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Abstract:

The paper's main objective is financial distress analysis in the cement industry in India, to fulfill the objective of this paper to collect the data from 2019 to 2023 and select 14 cement companies that were listed in NSE. Selected Springate Model, Z Score Model, and Grover Model to achieve the objective of this paper. The result states that Shree Cement Company, ACC, and Star Cement Company have Grey Zone and the remaining selected cement companies are bankrupt as per Altman Z Score, according to Grover score all selected cement companies have not bankrupt and the Spring Model implies Dalmia Cement Company have non-bankrupt and rest of the cement companies have bankrupt. The percentage of accuracy of the Z score is (21.43), the Grover score is (100) and the Spring score is (7.14) and the error percentage of the Z score is 78.57, the Grover score is 0.00 and the Spring score is 92.86.

Key Words: Altman Z Score, Grover Score, Spring Score, and Normality Test.

Introduction

Cement is the most important raw material in the field of construction, it plays an important role in the improvement of the country's infrastructure. China produces the most percentage of cement in the world, it occupies the first position in the world.India was the world's second-largest producer of cement. In February 2023 it increased cement production by 7.3% compared to February 2022.

Any business's main motive is to get maximum profit with minimum cost, the organization must have secure financial stability and utilize all financial, physical, and human resources properly. With the help of financial statements, the company's financial strength condition, and performance. The depth of financial study may provide insight into the company's prospects for success or failure. The different parts of financial statement evaluation mainly serveto enable the accomplishment of the company's goals.

There are many techniques to assess an organization's financial strength, such as the Altman Z Score, Grover Score, and Spring. These models aim to predict the probability that manufacturing companies might file for bankruptcy.

Literature Review

(Mustofa & Fahad Noor, 2020)This focused on solvency and financial distress prediction of Non – Banking Financial Institutions (NBFIs), by using the Fulmer H Score and Springate Z score model. The sample size is 20 Non-Banking Financial Institutions from the Dhaka Stock Exchange. According to the Springate Model, all samples of NBFIs were in financial distress, and as per the Fulmer H Score Model, a few sample NBFIs were in risky zones. It suggested that the Fulmer H Score model is more appropriate than the Springate Z Score model for predicting solvency. The limitation of the study was information not available for all listed NBFI at the Dhaka Stock Exchange.

(Nurasik et al., 2023)The topic is Financial Distress Prediction Models: Altman Z-Score Approach" In this topic they concentrated on the prediction of financial distress by applying the Altman Z Score model in Plastic and Packaging Companies. They selected nine manufacturing companies from the listed Indonesia Stock Exchange in packaging and plastic. Based on the result of this study, demonstrated that while some of the selected companies had consistently

endured the financial crisis in the plastics industry, not all of them were in good health.

(Dwi Wahyuni, 2021)In this study, return on assets showed a positive and significant effect on financial distress, the other variables like institutional ownership variables, independent commissioners, board of directors, and leverage had an influence but not significantly on financial distress. Selected a sample of real estate and property sector companies in 2018-19. The researcher selected independent variables (institutional ownership, independent commissioners, number of board of directors) and the dependent variable financial distress for testing the hypothesis in this research.

(Arora & Jiyani, 2022)their study selected Grover's model and Springate's model to guess financial distress and compare between two models which are accurate. All selected sample NBFCs were financially distressed based on the result of the Springate model and inconsistent results given by Grover's model. In between the two models Springate model is more efficient for forecasting financial health.

(Dalvadi & Pandit, 2018)They selected eight public sector enterprises to analyze the financial distress with the help of the Springate model. Four selected public sector companies were in financially worst condition and the rest of the public sector companies were financially healthy.

(Seto, 2022)in his study researcher selected prediction models namely Altman, Springate, Grover, Ohlson, and Zmijweski to study PT. Garuda Indonesia's financial difficulties. The study showed PT. Garuda Indonesia Tbk is in a condition of financial distress or declares bankruptcy between 2018 and 2021.

(Fedorova et al., 2016)in their study they suggested based on the study selected Altman, Fulmer, Springate, TafflerZmijewski, Saifullin, ISEA, and Zaitseva models for current financial analysis, forecasting financial distress and adoption of efficiency management decisions.

(Dwiningsih et al., 2023)in their study applied the Altman, Springate, and Zmijewski model to predict the financial distress of Bhutan Telecom Limited. The study confirms that Bhutan Telecom Limited was financially healthy during the study period.

(Muzanni & Yuliana, 2021)in this study, researchers selected Descriptive Statistical Analysis, Paired Sample T-Test, Normality Test, Accuracy Test of methods, and Springate and Altman Models to predict the financial distress of PT Eagle MahkotaTbk. In their investigation, the researchers discovered that the Altman model has an error type of 0% and an accuracy rate of 100%, whereas the Springate model has a type error of 33% and an accuracy rate of 67%.

(Sudjiman & Sudjiman, 2019)This study's primary goal is to determine the bankruptcy status of cement businesses listed in Bangladesh. The bankruptcy position was analyzed using the Altman Z score methodology. Out of the selected 8 cement companies, 2 companies were secure regions, 3 companies were grey regions and 3 companies were bankruptcy regions, and positive correlation between 5 independent variables and the dependent variable.

(Yendrawati & Adiwafi, 2020)in their study, the main aim is the accuracy level of financial distress in Altman, Sprinagte, and Zmijewski in the property, building construction, and real estate sectors. The highest accuracy is Altman followed by Zmijewski and Springate models in predicting financial distress of building construction, property, and real estate sectors.

(Ispanggara, 2020)in this study, 152 debtors were analyzed in the category of small and medium enterprises to determine business trends from before the COVID-19 pandemic and during the COVID-19 pandemic by using Altman, Sprigate, Zmijewski, and Grover models. The result indicates down downward trend in business conditions during the COVID-19 pandemic and indicates financial distress condition.

Research Gap

Once critically analyzed the above review of literature, it is said that not much study has been done to predict financial trouble for cement companies in India using the Altman, Springate, Zmijewski, and Grover model. Hence, the researcher attempts to analyze the financial distress by using Grover, Altman, Zmijewski, and Springate model for registered cement companies in India during the period of 2016-17 to 2021-22.

Objective of the study

The primary goal of the research is to use prediction models to analyze the financial difficulties of a subset of Indian cement companies.

Hypothesis

H01: There is no significant difference between sample data of Z Score and normally distributed data

H02: There is no significant difference between the sample data of Grover Score and normal distribution data.

H03:

There is no significant difference between the sample data of Spring Score and normal distribution data.

Research Methodology

The secondary data used in this research study was collected from the annual reports of the selected cement businesses. The researcher has selected fourteen listed top cement companies out of 37 listed cement companies from the National Stock Exchange (NSE). Out of these selected top listed cement companies from NSE.

1. Ultra Tech Cement
2. Ambuja Cements
3. Shree cements
4. Dalmia Cement
5. ACC
6. J. K. Cement
7. Ramco Cement
8. JK Lakshmi Cem
9. India Cement
10. Star Cement
11. Heidelberg Cem
12. Orient Cement
13. Sagar Cement
14. Sanghi Cement

Altman Z-Score Model:

In 1968, Altman became the first researcher to apply the Multiple Discriminant Analysis method. Altman provides the resultant technique well-known as the Altman Z-Score. This method classified the possibility of distress, grey areas, and health for the company.

The Z score formula is as follows:

$Z = 1.2A + 1.4B + 3.3C + 0.6D + 0.99E$

Where:
A = Working Capital / Total Assets
B = Retained Earnings / Total Assets
C = EBIT / Total Assets
D = Market Value of Equity / Total Liabilities
E = Sales / Total Assets
Altman Z Score below 1.81 specifies a distress zone – a high likelihood of bankruptcy, between 1.81 and 2.99 signals a grey zone-moderate risk of bankruptcy and more than 2.99 implies a safe zone-low likelihood of bankruptcy.

Grover Score Model:
It is a model formed by redesigning the model of the Altman Z Score. It took A and C of the Altman model and added Profitability Ratio which is ROA.
G = 1.650A + 3.404B – 0.016C + 0.057
Where:
A + Working Capital / Total Assets
B = EBIT / Total Assets
C = Net Income / Total Assets (ROA)
G Score is less than or equal to -0.02 indicates bankrupt and greater than 0.01 signs not bankrupt.

Springate Model:
It is a type of multiple discriminant analysis that was created in 1978 at Simon Fraser University by Gordon L V. Springate. It uses 19 financial ratios to predict the soundness of a corporation with an accuracy rate of 92.5 percent.
S = 1.03A + 3.07B + 0.66C + 0.4D
Where:
A = Working Capital / Total Assets
B = Net Profit before Interest and Taxes / Total Assets
C = Net Profit before Taxes / Current Liabilities
D = Sales / Total Assets
A Springate Score is less than 0.862 indicates bankrupt and more than 0.862 signs not bankrupt.

Table No 1 Model of Altman Z Score

Co Name	2019	2020	2021	2022	2023	Average	Result
Ultra	0.9970	1.2256	1.3166	1.4360	1.4128	1.2776	Bankrupt
Ambuja	1.3342	1.3180	1.4472	1.4576	1.5619	1.4238	Bankrupt

Shree	1.6058	2.6547	1.8521	2.1346	2.0456	2.0586	Grey Zone
Dalmia	1.2481	0.8185	0.6755	0.7374	1.5147	0.9988	Bankrupt
ACC	1.5911	1.9899	1.8043	1.9103	1.8925	1.8376	Grey Zone
JK	1.3201	1.3401	1.5291	1.4593	1.4515	1.4200	Bankrupt
Ramco	1.2343	1.0673	1.0762	0.9511	0.8757	1.0409	Bankrupt
JKL	1.0687	1.3700	1.6594	1.9345	1.9832	1.6032	Bankrupt
India	0.7741	0.6149	0.7369	0.6667	-0.3997	0.4785	Bankrupt
Star	2.7323	2.5041	1.9860	2.1848	2.2468	2.3308	Grey Zone
Heildel	1.5565	1.6926	1.6845	1.7827	1.4989	1.6430	Bankrupt
Orient	1.1528	1.2558	2.5534	1.8950	1.5679	1.6850	Bankrupt
Sagar	1.0183	0.9259	1.5711	0.7753	1.2211	1.1023	Bankrupt
Sanghi	0.8295	0.6055	0.6955	0.5725	0.0366	0.5480	Bankrupt

Compiled from Annual Reports of Selected Cement Companies in India

Table No. 1 implies the Altman Z Score model of elected cement companies in India during the study period from 2019 to 2023. Shree Cement Company (2.0586), ACC (1.8376), and Star Cement Company (2.3308) have more than 1.81 and less than 2.99 so, these companies have grey zone area and the remaining selected cement companies' average Z Score is less than 1.81 Hence, they have bankrupt during the study period.

Table No 2 Grover Score Model

Co Name	2019	2020	2021	2022	2023	Average	Results
Ultra	0.1837	0.3139	0.4600	0.4018	0.3324	0.3384	Non Bankrupt
Amb	0.44	0.37	0.47	0.55	0.56	0.484	Non

uja	85	09	49	95	67	1	Bankrupt
Shree	0.5086	0.6465	0.8021	0.7023	0.3523	0.6024	Non Bankrupt
Dalmia	0.2542	0.2778	0.1523	0.1647	0.1723	0.2043	Non Bankrupt
ACC	0.2805	0.7249	0.6932	0.7915	0.4915	0.5963	Non Bankrupt
JK	0.3969	0.4428	0.6493	0.4524	0.3883	0.4660	Non Bankrupt
Ramco	0.2194	0.1928	0.2572	0.1293	0.0293	0.1656	Non Bankrupt
JKL	-0.0012	0.2360	0.4193	0.5800	0.5391	0.3546	Non Bankrupt
India	0.0413	-0.0582	0.0228	0.0295	-0.0044	0.0062	Non Bankrupt
Star	1.2356	1.0052	0.7729	0.6722	0.5639	0.8500	Non Bankrupt
Heildel	0.4711	0.5966	0.5685	0.6622	0.3924	0.5382	Non Bankrupt
Orient	0.1142	0.2185	0.4602	0.4252	0.2063	0.2849	Non Bankrupt
Sagar	0.1018	0.0844	0.5255	0.2155	0.1477	0.2096	Non Bankrupt
Sanghi	0.1507	0.0605	0.1251	0.0098	0.3089	0.1310	Non Bankrupt

Compiled from Annual Reports of Selected Cement Companies in India

Table No 2 implies the Grover Score Model of selected companies of cement during the period of study. All selected

cement companies' average Grover Score is more than 0.01. Therefore, all companies non-bankrupt in the study period**.**

Table No 3 Spring Score Model

Co Name	2019	2020	2021	2022	2023	Average	Results
Ultra	0.6297	0.5940	0.7134	1.0291	0.6562	0.7245	Bankrupt
Ambuja	0.4380	0.5313	0.5321	0.3773	0.5000	0.4757	Bankrupt
Shree	0.6340	0.5146	0.8607	0.6429	0.2363	0.5777	Bankrupt
Dalmia	1.5063	4.2500	0.1405	7.7586	6.6129	4.0537	Non Bankrupt
ACC	0.3182	0.4336	0.3890	0.4261	0.2387	0.3612	Bankrupt
JK	0.3296	0.5125	0.6719	0.4697	0.3538	0.4675	Bankrupt
Ramco	0.3444	0.3331	0.4714	0.2883	0.1536	0.3182	Bankrupt
JKL	0.1429	0.3309	0.4194	0.4675	0.3631	0.3448	Bankrupt
India	0.0385	0.0111	0.1272	0.0201	0.2116	0.0817	Bankrupt
Star	1.1483	1.0217	0.5483	0.4506	0.5455	0.7429	Bankrupt
Heildel	0.3740	0.4284	0.4261	0.4005	0.1597	0.3577	Bankrupt
Orient	0.1473	0.2845	0.6892	0.6005	0.2388	0.3409	Bankrupt
Sagar	0.1005	0.1196	0.5632	0.2571	0.1112	0.2303	Bankrupt
Sanghi	0.0958	0.0914	0.1767	0.0719	0.4956	0.1863	Bankrupt

Compiled from Annual Reports of Selected Cement Companies in India

Table No. 3 depicts the spring model of selected Indian cement companies during the study period. Dalmia Cement Company's average Spring Score is more than 0.862. So, the company was not bankrupt in the period of study. The rest of

the selected cement companies are bankrupt because the average Spring Score is less than 0.862.

Table No 4 Descriptive Statistics

Values	Models		
	Z-Score	Grover-Score	Springate-Score
Mean	1.3892	0.3737	0.6617
Median	1.4219	0.3465	0.3595
Variance	0.280	0.052	0.988
Std. Deviation	0.52923	0.22852	0.99414
Minimum	0.48	0.01	0.08
Maximum	2.33	0.85	4.05
Range	1.85	0.84	3.97
Std. Error	0.14144	0.06107	0.26570

Source: Computed Value

Table No 4 depicts descriptive statistics of prediction financial distress models viz., Z-Score, Grover-Score, and Springate-Score Models. Z Score of mean and median is more than the mean and median of Grover and Springate. The variance and standard deviation of Springate are more than that of the Z Score and Grover Score. The minimum Z Score is the highest value compared to Grover and Springate, and the maximum value of Springate is the highest compared to other models. The range and Standard Error value of Springate are more than the Z Score and Grover Score values.

Table No 5 Normality Test

Model	Kolmogorov-Smirnov[a]			Shapiro - Wilk		
	Statistic	df	Sig.	Statistic	df	Sig
Z Score	0.095	14	0.200*	0.978	14	0.962
Grove Score	0.121	14	0.200*	0.974	14	0.925
SpringateScore	0.396	14	0.000	0.473	14	0.000

- This is a lower bound of the true significance.

a. Lilliefors Significant Correction

Table No 5 implies the normality test of Z score, Grover score, and Spring score significant value of Kolmogorov and Shapiro.

The null hypotheses H01 and H02 were accepted due to the significant value of the Grover score and Z score being more than 0.05%. The null hypothesis H03 is rejected as the Spring score significant value is less than 0.05%.

Table No 6 Results of Potential Bankruptcy of Fear Level Prediction

Prediction	Methods		
	Z - Score	Grover – Score	Springate - Score
Bankrupt	11	0	13
Grey	3	0	0
Non Bankrupt	0	14	1
Total Samples	14	14	14
% Accuracy	21.43	100	7.14
% Error Type	78.57	0	92.86

Source: Processing of Data Outcome

The Altman Z-Score model implies that 11 businesses have the potential to file for bankruptcy, 3 have a gray area, and no business has ever filed for bankruptcy. The model of Altman Z-Score has an accuracy rate of 21.43% with an error type of 78.57%. Grover Score forecasts 14 firms that have no bankruptcy, with an accuracy rate of 100%. As per Springate Score, 13 companies were bankrupt and one company was nonbankrupt. The accuracy rate of 7.14% and the error type of 92.86%.

Conclusion

Based on the study of financial distress analysis by using a model of Altman Z score, Grover score, and Spring score model from 2019 to 2023. Z Score model predicts 3 companies as grey zone and 11 companies as bankrupt companies, with an accuracy rate of 21.43% with a 78.57% error type, as per the Grover score model 14 companies are nonbankrupt, rate of accuracy of 100% with an error type of 0% and Spring score model states one company nonbankrupt and 13 companies were bankrupt precision rate of 7.14% and type of error 92.86%. Based on the conclusion this study can imply that investors are owners of the capital can know the signals of company failure or not, creditors are lenders of the company can know the health condition of the company and management can take necessary steps to overcome the risk of bankruptcy.

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