

# Measuring Financial Distress of selected Public Sector Enterprises of India

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## ABSTRACT

In this research paper, Researchers have attempted to compare the results of financial distress models (Zmijewski X score, Springate S score, Grover G score) of six loss making manufacturing Public Sector Enterprises which were listed in Bombay Stock Exchange of India by using secondary data collected from their Annual Reports for the study period of 5 years from 2011-12 to 2015-16. The result revealed that as per X score, S score and G score, two companies, four companies and one company is financial distressed respectively. While doing comparison of all three models, it was revealed that only one company named HOCL was financially distressed. Hence, by maintaining proper working capital & increasing profit and sales, companies can be saved from bankruptcy.

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## 1. Introduction

Financial Distress is an alarming situation for those companies that incur losses and henceforth unable to pay off their debts on time. Prediction of financial distress may guide such companies to take corrective steps and avoid bankruptcy. Initially, only financial ratios were used for predicting financial distress, later on combination of financial ratios were used along with various models developed by various researchers. Hence, in this research paper, Researchers have attempted to compare the results of financial distress models of selected six Public Sector Enterprises.

## 2. Literature Review

1. (M.noor salim and sudiono, 2017): The main purpose of this research was to determine the bankruptcy possibility of 19 coal mining companies out of 22 such companies listed in Indonesia Stock Exchange using altman z model, springate s score model & zmijewski x score model for the period 2011-2014. It was found that zmijewski x model is the most accurate predictive model as compared to altman z score and springate s score models.
2. (Niken Savitri Primasari, 2017): This study predicted financial distress of 29 companies which belonged to Consumer Goods Industry and listed in Indonesia Stock Exchange Market for the study period from 2012 to 2015 and also compared Altman model, Springate model and Zmijewski model. In this study, hypotheses were tested by using t- test and feasibility of the model by observing the F-test results and test the coefficient of determination (R<sup>2</sup>), R<sup>2</sup> value used to examine differences among Altman, Grover, Springate and Zmijewski models in predicting financial distress, besides this one way ANOVA was used for analysis of data. The results showed that all the prediction models used in this study can be used to predict Financial Distress. Besides this, five companies out of 29 companies found in distress zone. Altman Z score is most accurate model and Grover model is less accurate model to predict financial distress.
3. (Abolfazl Aminian, Hedayat Mousazade, Omid Imani Khoshkho, 2016): This study predicted bankruptcy by using Altman, Springate, Zmijewski and Grover models and compared results of all four models during the period from 2008 to 2013 for the 35 companies from textile, ceramic and tile industries. These companies were listed on the Tehran Stock Exchange. In this study, eight hypotheses were tested by using regression analysis. The result showed that all the models respectively Grover, Altman, Springate and Zmijewski have the better ability to predict financial crises during 2008-2013.
4. (sinarti and tia maria sembiring, 2015): Researchers have analysed bankruptcy of listed 11 manufacturing companies by using altman z score, springate score and zmijewski models to find out significance between all three models. Linear regression and t-test were used to prove the hypothesis. The results showed that there was no significant difference in the prediction of altman z score and springate score models but there was a significant difference among all the three models.
5. (M. Fakhri Husein & Galuh Tri Pambekti, 2014): In this quantitative study, the accuracy of Altman model, Springate model, Zmijewski model, and Grover model in predicting financial distress was analyzed for the sample of 132 companies which were listed on Daftar Efek Syariah (DES) in 2009-2012. Data was analyzed by using Binary Logistic Regression. The results showed that all models can predict financial distress but Zmijewski model was the most appropriate model for predicting financial distress.

## 3. Research Gap

After critically evaluating literature review, it was clear that very few research works have been undertaken for the comparison of financial distress by using Springate S score, Zmijewski X score & Grover G score models, especially in India. Hence, in this

research paper, researchers have made attempts to analyze financial distress of the selected public Sector Enterprises in India by using above stated models.

**4. Objective of the study**

The objective of this research paper is to compare the result of financial distress models for the selected Public Sector Enterprises.

**5. Research Methodology**

The study has been carried out on the basis of secondary data collected from the websites of selected PSEs. In this analytical research, six Public Sector Enterprises have been selected by using non-probability purposive sampling techniques. The criteria for selection of samples were as under:

- PSEs which were listed on the recognized stock exchange i.e.BSE
- Loss making PSEs as per the Loksabha’s starred question NO.\*27 for reply on loss making CPSEs on 19.07.2016
- Belonging to the manufacturing cognate group out of five cognate group of Public Sector Enterprises

Following companies were selected on the basis of above mentioned criteria:

1. Bharat Earths Movers Limited (BEML)
2. Chennai Petroleum Corporation Limited (CPCL)
3. Hindustan Organic Chemicals Limited (HOCL)
4. Mangalore Refinery and Petrochemicals Limited (MRPL)
5. Scooters India Limited (SIL)
6. National Fertilizers Limited (NFL)

**6. Data Analysis & Findings**

**1. ZMIJEWSKI X Score Model**

This is one of the probit models adopted by Zmijewski in 1984 by using 40 bankrupt and 800 non-bankrupt industrial firms’ data for the period 1972-1978.

**Equation: Zmijewski X – score = -4.336-4.513(X<sub>1</sub>) +5.679(X<sub>2</sub>) +0.004(X<sub>3</sub>)**

**Where, X<sub>1</sub> =  $\frac{\text{Net Income}^1}{\text{Total Assets}^2}$**   
**X<sub>2</sub> =  $\frac{\text{Total Liabilities}^3}{\text{Total Assets}}$**   
**X<sub>3</sub> =  $\frac{\text{Current Assets}}{\text{Current Liabilities}}$**

If x score ≥0.5 = bankrupt or financially distressed Company and if x score <0.5 = Solvent company. (M.noor salim and sudiono, 2017)

**Sample calculation of Zmijewski X score of BEML for the study period from 2011-12 to 2015-16**

**Table No. 1: Zmijewski X- score of BEML for the study period from 2011-12 to 2015-16**

YEARS	CALCULATION					INTERPRETATION <sup>4</sup>
	-4.336	-4.513 (X <sub>1</sub> )	5.679(X <sub>2</sub> )	0.004 (X <sub>3</sub> )	Results <sup>5</sup> X score	
2015-16	-4.336	-0.0559	2.90797	0.01007	-1.4739	-1.4739<0.5 =Solvent
2014-15	-4.336	-0.0063	3.11	0.0089	-1.2235	-1.2235<0.5=Solvent
2013-14	-4.336	-0.2277	3.1980	0.0087	-1.1521	-1.1521<0.5= Solvent
2012-13	-4.336	+0.071	3.4085	0.00797	2.5596	2.5596>0.5=Financially distressed
2011-12	-4.336	-0.0508	3.17950	0.0082	-1.1911	-1.1911<0.5= Solvent

<sup>1</sup> For the calculation of Zmijewski X score Net Income = Profit/Loss after Tax and Before Extraordinary Items.

<sup>2</sup> Total assets = Sum of all current and noncurrent assets

<sup>3</sup> Total liabilities = Sum of all short term and long term liabilities

<sup>4</sup> Interpretation for the company If x score ≥0.5 = bankrupt or financially distressed Company and if x score <0.5 = Solvent Company.

<sup>5</sup> Results= Zmijewski X – score = -4.336-4.513(X<sub>1</sub>) +5.679(X<sub>2</sub>) +0.004(X<sub>3</sub>)

Where, X<sub>1</sub> =  $\frac{\text{Net Income}}{\text{Total Assets}}$

X<sub>2</sub> =  $\frac{\text{Total Liabilities}}{\text{Total Assets}}$

X<sub>3</sub> =  $\frac{\text{current Assets}}{\text{Current Liabilities}}$

From the above table, it can be observed that x score of BEML is less than 0.5 for all the years except 2012-13. It means company was financially healthy during 4 years except the year 2012-13. Company was financially distressed for one year because of negative profit and high liabilities than the assets.

**2. Springate Score Model**

Springate Score Model is one of the Multiple Discriminant Analysis model developed by Gordon L.V. Springate in 1978 at Simon Fraser University by using 19 financial ratios to predict soundness of business, with 92.5% accuracy rate. The Springate model takes the following form:

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

Where,

- A = Working Capital/Total Assets
- B = Net Profit before Interest and Taxes (NPBIT)/Total Assets
- C = Net Profit before Taxes (NPBT)/Current Liabilities
- D = Sales/Total Assets

If  $Z < 0.862$ , then the firm is classified as "failed/distressed"

**Sample calculation of Springate S Score of BEML for the study period from 2011-12 to 2016-17**

**Table No. 2: Springate S Score of BEML for the Study Period 2011-12 to 2015-16.**

YEARS	CALCULATION					INTERPRETATION <sup>6</sup>
	I	II	III	IV	I+II+III+IV	
	1.03 (A)	3.07 (B)	0.66 (C)	0.4 (D)	<sup>7</sup> RESULTS	
2015-16	0.4798	0.08	0.031982	0.27357	0.8658	0.8658>0.862= Solvent
2014-15	0.4419	0.052	0.002817	0.2419	0.73834	0.73834<0.862=Financially Distressed
2013-14	0.4293	0.077	0.003524	0.2419	0.7518	0.7518<0.862=Financially Distressed
2012-13	0.408	0.0101	0.03878	0.2126	0.5932	0.5932<0.862=Financially Distressed
2011-12	0.4282	0.0964	0.022185	0.21827	0.7649	0.7649<0.862=Financially Distressed

(Source: Computed from Annual Reports of BEML)

Above table shows Springate S Score of BEML for the Study Period from 2011-12 to 2015-16. It was observed that s score of BEML is less than 0.862 from 2011-12 to 2014-15 which indicates that the company is financially distressed for these four years. The reason behind this was negative Net Profit before Interest and Taxes (NPBIT) and Net Profit before Taxes (NPBT) and reduction in sales. So it is mandatory to take precautionary steps to avoid bankruptcy.

**3. Grover G Score Model**

Grover model was developed by Jeffrey S. Grover by designing and reassessment of Altman Z score model. Results revealed that out of 70 samples of the companies, 35 companies found bankrupt and 35 found Non-bankrupt from the years 1982-1996.

**Equation:**

$$G \text{ Score} = 1.650X_1 + 3.404X_3 - 0.016ROA + 0.057$$

Where,

$$X_1 = \frac{\text{Working Capital}^8}{\text{Total Assets}}$$

$$X_3 = \frac{\text{Earning Before Interest and Tax}^9}{\text{Total Assets}}$$

$$ROA = \frac{\text{Net Income}^{10}}{\text{Total Assets}^{11}}$$

<sup>6</sup> Interpretation: If S score < 0.862; then the firm is classified as "failed/financially distressed"

<sup>7</sup> Results = S score = 1.03A + 3.07B + 0.66C + 0.4D

Where,

- A = Working Capital/Total Assets
- B = Net Profit before Interest and Taxes (NPBIT)/Total Assets
- C = Net Profit before Taxes (NPBT)/Current Liabilities
- D = Sales/Total Assets

<sup>8</sup> For the calculation of G score working capital =current assets less current liabilities

<sup>9</sup> Earnings Before Interest and tax=Earnings Before Depreciation Interest and Tax Less depreciation

<sup>10</sup> Net Income=Profit/Loss after Tax and Before Extraordinary Items

<sup>11</sup> Total assets=Sum of all current and Noncurrent assets

<sup>12</sup> Interpretation: If G score less than or equal to -0.02 (G Score ≤ -0.02)=Bankrupt company or Financially Distressed company while if G score is greater than or equal to 0.01(G Score ≥0.01) =Solvent or Non Bankrupt Company.

<sup>13</sup> G Score=1.650X1+3.404X3-0.016ROA+0.057

If G score is less than or equal to -0.02 (G Score  $\leq$  -0.02) = Bankrupt company or Financially Distressed company while if G score is greater than or equal to 0.01 (G Score  $\geq$  0.01) = Solvent or Non-Bankrupt Company. (Anissa Agustina Rahmadini\*)

**Table No.3: Calculation of Grover G score of BEML for the Study Period from 2011-12 to 2015-16.**

YEARS	CALCULATION					INTERPRETATION <sup>12</sup>
	1.650 (X <sub>1</sub> )	3.404 (X <sub>3</sub> )	0.016 ROA	0.057	RESULTS <sup>13</sup> G SCORE	
2015-16	0.773	0.0999	0.000236	0.057	0.9297	0.9297>0.01=Solvent
2014-15	0.7294	0.057	0.00002	0.057	0.8436	0.8436>0.01=Solvent
2013-14	0.6877	0.0854	0.00001	0.057	0.8301	0.8301>0.01=Solvent
2012-13	0.6541	0.0121	0.0002	0.057	0.7234	0.7234>0.01=Solvent
2011-12	0.6869	0.1068	0.0002	0.057	0.8505	0.8505>0.01=Solvent

Above table shows the calculation of Grover G score of BEML for the Study Period from 2011-12 to 2015-16. From the above table, we can observe that BEML is solvent for all the five years as G is greater than 0.01.

Similar calculation has been carried out for the rest of five CPSEs and calculated X score, S score & G score are as follows:

**Table No. 4: Calculation of Zmijewski X score, Springate S score and Grover G score of the selected public sector enterprises for the study period from 2011-12 to 2015-16.**

Calculated Zmijewski X score, Springate S score & Grover G score							
Name of the selected CPSEs	Year	X score	Prediction	S Score	Prediction	G Score	Prediction
BEML	2015-16	-1.4739	Solvent	0.8658	Solvent	0.9297	Solvent
	2014-15	-1.2235	Solvent	0.73834	Financially Distressed	0.8436	Solvent
	2013-14	-1.1521	Solvent	0.7518	Financially Distressed	0.8301	Solvent
	2012-13	2.5596	Financially Distressed	0.5932	Financially Distressed	0.7234	Solvent
	2011-12	-1.1911	Solvent	0.7649	Financially Distressed	0.8505	Solvent
CPCL	2015-16	-0.8085	Solvent	1.1757	Solvent	0.5854	Solvent
	2014-15	0.50393	Financially Distressed	1.2402	Solvent	0.26997	Solvent
	2013-14	0.7436	Financially Distressed	1.6488	Solvent	0.51099	Solvent
	2012-13	1.0960	Financially Distressed	0.6679	Financially Distressed	0.21528	Solvent
	2011-12	-0.1107	Solvent	1.3407	Solvent	0.4463	Solvent
HOCL	2015-16	21.2982	Financially Distressed	3.9724	Solvent	-4.8031	Financially Distressed
	2014-15	14.17	Financially Distressed	-2.9742	Financially Distressed	-3.2218	Financially Distressed
	2013-14	8.5319	Financially Distressed	-2.0496	Financially Distressed	-2.6648	Financially Distressed
	2012-13	4.334	Financially Distressed	-1.0476	Financially Distressed	-1.8741	Financially Distressed
	2011-12	1.9401	Financially Distressed	-0.2282	Financially Distressed	-0.8403	Financially Distressed
MRPL	2015-16	0.2403	Solvent	0.6821	Financially Distressed	0.0344	Solvent
	2014-15	0.6938	Financially Distressed	0.2788	Financially Distressed	-0.3199	Financially Distressed
	2013-14	0.2627	Solvent	1.0429	Solvent	0.17569	Solvent

$$X_1 = \frac{\text{Working Capital}}{\text{Total Assets}}$$

$$X_3 = \frac{\text{Earnings before interest and Tax}}{\text{Total Assets}}$$

$$ROA = \frac{\text{Net Income}}{\text{Total Assets}}$$

	2012-13	0.0990	Solvent	0.8669	Solvent	-0.0164	Solvent
	2011-12	-0.3795	Solvent	1.0247	Solvent	0.235	Solvent
SIL	2015-16	-1.9332	Solvent	1.0946	Solvent	1.17689	Solvent
	2014-15	-1.849	Solvent	1.258	Solvent	1.2452	Solvent
	2013-14	6.49106	Financially Distressed	1.5726	Solvent	1.3647	Solvent
	2012-13	-0.6065	Solvent	0.777	Financially Distressed	0.3084	Solvent
	2011-12	6.0758	Financially Distressed	0.225	Financially Distressed	-0.7888	Solvent
NFL	2015-16	-0.9837	Solvent	0.254	Financially Distressed	0.4028	Solvent
	2014-15	-0.7101	Solvent	0.57217	Financially Distressed	0.31044	Solvent
	2013-14	-0.700	Solvent	0.0648	Financially Distressed	0.51190	Solvent
	2012-13	-0.6703	Solvent	0.0292	Financially Distressed	0.4512	Solvent
	2011-12	-0.2962	Solvent	0.6641	Financially Distressed	0.6310	Solvent

(Source: Computed from the annual reports of all public sector enterprises)

Above table presents calculated Zmijewski X score, Springate S score & Grover G score for the study period from 2011-12 to 2015-16. Above CPSEs become financially distressed, if X score is greater than or equal to 0.5, Springate score is less than 0.862 and G score is less than or equal to -0.02 ( $G \text{ Score} \leq -0.02$ ) while if X score is less than 0.5, Springate score is greater than 0.862 and G score is greater than or equal to 0.01 ( $G \text{ Score} \geq 0.01$ ), then company is considered as Solvent or Non-Bankrupt Company. According to X Score model, BEML is in Solvent position except the year 2012-13 & BEML is financially distressed for all the years except the year 2015-16 and lastly BEML was fully solvent company as per G score model. While comparing it with X score and S score, company was found financially distressed only in the year 2012-13.

CPCL was financially distressed from 2012-13 to 2014-15 as per X score, fully solvent except in the year 2012-13 as per S score model and was in solvent position for all the years as per G score model. While comparing X score and S score, CPCL was financially distressed for the year 2012-13.

HOCL was financially distressed CPSEs for all the 5 years as per all the three models except in the year 2015-16 as per S score model. According to all three models, MRPL was in solvent position for the initial three years i.e. 2011-12 to 2013-14 but later becomes financially distressed in the year 2014-15. Later, it was able to recover its position and became solvent as per X score and G score except for the year 2015-16 as per S score model.

SIL was fully solvent company as per G score model but found in financial distress in 2011-12 as per X score and S score models & later also company became financially distressed in 2013-14 as per X score and in 2012-13 as per S score model.

NFL was fully solvent company for all the five years as per X score and G score models and financially distressed as per S score model.

**Table No.5: Average of Zmijewski X score, Springate S score, Grover G score for the study period from 2011-12 to 2015-16.**

Name of the CPSEs	Average X score	Prediction	Average S Score	Prediction	Average G Score	Prediction
BEML	-0.50	Solvent	0.74	Financially distressed	0.85	Solvent
CPCL	0.28	Solvent	1.16	Solvent	0.48	Solvent
HOCL	10.05	Financially distressed	-0.47	Financially distressed	-3.42	Financially Distressed
MRPL	0.18	Solvent	0.78	Financially distressed	0.14	Solvent
SIL	1.64	Financially distressed	0.99	Solvent	0.69	Solvent
NFL	-0.67	Solvent	0.32	Financially distressed	0.46	Solvent

(Source: Computed from the annual reports of selected public sector enterprises)

Above table shows Average Zmijewski X score, Springate S score & Grover G score for the study period from 2011-12 to 2015-16. According to average X score, SIL and HOCL are financially distressed CPSEs. As per average S score, BEML, HOCL,

MRPL and NFL are the most financially distressed companies while HOCL is the only financially distressed company as per average G score model. While comparing Average X score and average S score, HOCL was found in the worst situation. HOCL was found the most financially distressed CPSE as per all the three models.

## 7. Limitations of the study

In this study, purposive sampling method is used for sample selection and this study is based on secondary data collected from the Annual Reports so trustworthiness and results depend upon the correctness of data published in said reports. Besides this, the study considers only six loss incurring manufacturing CPSEs which were listed in BSE for five years only beginning from 2011-12 to 2015-16. The researchers have used only three models namely Zmijewski X score model, Springate S score model and Grover G score model for predicting financial distress.

## 8. Conclusion

Financial distress models use combination of four to five ratios which show their better predictive ability of financial distress. In this research paper, researchers have selected three models namely Zmijewski X score, Springate S score and Grover G score model and compared the results of financial distress of selected six loss making manufacturing and listed (in BSE) Public Sector Enterprises for the study period from 2011-12 to 2015-16. The result revealed that as per X score, S score and G score respectively two companies, four companies and one company is financially distressed. While the comparison of all the three models revealed that only one company namely HOCL is financially distressed. Hence, proper maintenance of working capital, increase in profit and sales may save this company from bankruptcy.

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