Journal of Banking,
Information Technology and Management
Volume 7 No. 2
July-December 2010

Use of Altman 'Z' Score Analysis for Evaluation of Financial Health of Hindustan Copper Ltd: A Case Study

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Abstract

The prediction and prevention of financial distress is one of the major factors which will help to avoid bankruptcy. One of the most commonly used statistical ratio models for predicting business collapse is Altman's Z Score. This model has proven to be a reliable tool for bankruptcy forecasting in a wide variety of contexts and markets. In this paper, an attempt has been made to use Edward Altman's Z Score analysis to have an insight into the examination of financial health of Hindustan Copper Limited and consistency of financial performance for eight financial years from 2001-02 to 2008-09. The research findings revealed that the company's overall financial health had improved during the study period.

Key words: *Altman's Z Score, bankruptcy prediction, credit risk analysis, financial health, risk assessment and viability.*

In the present scenario every corporate body is striving hard to survive in this growing era of core competence. In order to survive and continue to be in business it is essential that a corporate body successfully manages its finance which requires more attention and care. The important factor causing business failure is ineffective financial management. The prediction and prevention of financial distress is one of the major factors which will help to avoid bankruptcy. A company's chances of survival can be predicted with the use of financial-statement analysis. One of the most commonly used statistical ratio models for predicting business collapse is Altman's Z Score. This model has proved to be a reliable tool for bankruptcy forecasting in a wide variety of contexts and markets. The model is both popular and widely used in the fields of credit risk analysis, distressed investing, M&A target analysis, and turnaround management. It incorporates five weighted financial ratios into the calculation of the Z-Score. However, it should be noted that the Z score does not apply to every situation. It can only be used for forecasting if the company being analyzed can be compared to the database.

In this paper, an attempt has been made to use Edward Altman's Z Score to have an insight into the examination of financial health of Hindustan Copper Limited and consistency of financial performance for eight financial years from 2001-02 to 2008-09.

Objectives of the Study

The objectives of the study are as follows:

1. To examine the overall financial performance of the company.
2. To know the efficiency in financial operations.
3. To predict the financial health and viability of the company.

Hypotheses of the Study

In the present study the following hypotheses were framed and tested:

1. Correlation between working capital and total assets of this company is not significant.
2. Correlation between retained earnings and total assets of this company is not significant.
3. Correlation between EBIT and total assets of this company is not significant.
4. Correlation between market value of equity and book value of total debt of this company is not significant.
5. Correlation between sales and total assets of this company is not significant.

Methodology of the Study

The study has been confined only to one public sector company viz. Hindustan Copper Ltd. It confines itself to issues relating to the financial performance only. A moderately lengthy period was deemed necessary to arrive at meaningful and purposeful inferences. An eight year period beginning from 2001-02 and ending with 2008-09 was chosen for the present study. The data has been collected from the secondary sources which comprise published annual reports, various journals and information from the related websites. The collected data was classified, tabulated and analyzed in a systematic manner. The data was analyzed with the help of ratio analysis. The Edward Altman's 'Z" Score analysis has been adopted to monitor the financial health of the company to predict as well as to avoid business failure and subsequent bankruptcy. In addition to that, the study used statistical tools like mean, standard deviation, correlation and't' test.

Limitations of the Study

This study had the following limitations:

(a) The study was limited to eight years only i.e. from the year 2001-02 to 2008-09.

(b) The study was limited to one company.

(c) The study used the secondary data for analysis and interpretations collected from the published annual reports of the company.

(d) Apart from few statistical analyses, the study has been carried out mainly by employing 'Z' Score analysis technique.

Profile of the Company

Hindustan Copper Limited (HCL), a public sector undertaking under the administrative control of the Ministry of Mines, was incorporated on 9th November 1967. Its registered office is situated at Tamra Bhavan, 1, Ashutosh Chowdhury

Avenue, Kolkata, India. It has share capital base of Rs.462.61 crores with 92.52 crores equity shares of Rs.5.00 each fully paid. The number of employees as on March 31, 2009 was 5440. It has the distinction of being the nation's only vertically integrated copper producing company as it manufactures copper right from the stage of mining to beneficiation, smelting, refining and casting of refined copper metal into downstream saleable products. The Company markets copper cathodes, copper wire bars, continuous cast copper rods and by-products, such as anode slime (containing gold, silver, etc.), copper sulphate and sulphuric acid. More than 90% of the sales revenue is from cathode and continuous cast copper rods. The Company has earned a net profit of Rs 5.48 crore against a sales turnover of Rs 1349.10 crore during the financial year 2008-09. HCL's mines and plants are spread across four operating Units, one each in the States of Rajasthan, Madhya Pradesh, Jharkhand and Maharashtra named: as Khetri Copper Complex (KCC) at Khetri Nagar, Rajasthan, Indian Copper Complex (ICC) at Ghatsila, Jharkhand, Malanjkhand Copper Project (MCP) at Malanjkhand, Madhya Pradesh, and Taloja Copper Project (TCP) at Taloja, Maharashtra.

Review of Literature

There are various models such as Uni variate, Multiple Discriminate Analysis (MDA), Logit model, etc. that are widely used to predict bankruptcy or financial distress. In the past, researchers have compared different bankruptcy models and have concluded that despite certain practical and theoretical limitations, the Altman method is superior due to its simplicity, practicality, and accuracy (Collins, 1980; Mossman et al, 1998). Over the period many research works have been conducted by applying the multiple discriminate analysis to predict the corporate failure. W. H. Beaver (1966) was the first researcher to study the prediction of the bankruptcy using financial data. His analysis was based on ratios which have discriminating power to predict the bankruptcy of the companies using 79 failed and non-failed manufacturing companies in each of two matched pair groups. Altman I. Edward (1968) used the classical Multiple Discriminate Analysis technique with five financial ratios for predicting the risk of failure. He developed a model built out of the five weighted financial ratios to find a bankruptcy prediction based on a sample composed of 66 manufacturing companies with 33 companies in each of two matched pair groups. Altman selected 33 publicly traded manufacturing bankrupt companies between 1946 and 1965 and matched them to 33 firms on a random basis for a stratified sample.

Jonah Aiyabei (2002) discussed the theoretical aspect of a financially distressed firm based on a cyclical concept and examined the financial performance of small business firms based in Kenya using Z score model. Ben McClure (2004) had confirmed the 'Z' score model through his research study and concluded that to keep an eye on their investments, investors should consider checking their companies' Z score on a regular basis. A deteriorating Z- score can signal trouble ahead and provide a simpler conclusion than the mass of ratios. The predictive ability of Altman model is in line with findings by other researchers in Greece and in the United States. Christopoulos et al (2007) find that Altman is useful in predicting Greek telecom company failures, while Altman (2002) finds supportive

evidence in the US market. Vergos et al (2008) and Christopoulos et al (2008) also show that analysts' predictions and company announcements may considerably affect market prices upto 18 months before the announcement of negative financial results, something that leads to incorporation of probability of failure in company prices, and respective company Altman z-score that are affected by market price of shares, well before the company declares bankruptcy. Panayotis Alexakis (2008) in his empirical analysis concentrated on the construction companies listed in Athens Exchange, for the period 1995-2006 and has derived that a particular Altman model performs well in predicting failures for a period up to five years earlier. Similar are the findings of Gerantonis et al (2009), who also investigated whether Z-score models can predict bankruptcies for a period up to three years earlier and show that Altman model performs well in predicting failures.

In Indian context, L. C. Gupta (1999) attempted a refinement of Beaver's method for predicting business failure. Mansur A. Mulla (2002) made a study of a textile mill with the help of Z score model for evaluating the financial ratios with five weighted financial ratios and was followed by Selvam M et al (2004) who revealed the financial health of cement industry especially India Cements Limited. Rao Surya et al (2004) made a study with the help of Z score model for predicting the corporate failure of sugar mills under private, cooperative and public sectors in Tamil Nadu. Krishna Chaitanya (2005) used Z score model to measure the financial distress of IDBI and concluded that IDBI is likely to become insolvent in the year to come. To ascertain the financial health of Wendt (India) Limited Kannadhasan (2007) made a study using Z score model and revealed that the company has been maintaining good financial performance throughout the study period. Dheenadhayalan (2008) used Z score approach to predict the corporate failure of Steel Authority of India Limited. Venkat Janardhan Rao and Durga Prasad (2009) have analysed the possibility of a firm's failure with reasonable accuracy by using Z score concentrating on the heavy commercial vehicle industry companies such as Mahindra & Mahindra Company Ltd and Eicher Motors Ltd.

Altman 'Z'-Score

The Z-score formula for predicting bankruptcy was published in 1968 by Edward I. Altman, Professor of Finance at New York University, School of Business. This model has proved to be a reliable tool for bankruptcy forecasting in a wide variety of contexts and markets. Z-scores are used to predict corporate defaults and an easy-to-calculate control measure for the financial distress status of companies in academic studies. The Z-score uses multiple corporate income and balance sheet values to measure the financial health of a company. The model incorporates five weighted financial ratios into the calculations of the Z-Score. Professor Altman continues to update the model's coefficients to reflect changing ways of conducting business. Prof. Altman has defined 5 variables that comprise the Z-score for public and private companies.

Altman 'Z' Score Bankruptcy Model:

$Z = 1.2T_1 + 1.4T_2 + 3.3T_3 + .6T_4 + .999T_5$

Where:

T_1 = Working Capital / Total Assets

T_2 = Retained Earnings / Total Assets

T_3 = Earnings before Interest and Taxes / Total Assets

T_4 = Market Value of Equity / Total Liabilities

T_5 = Sales / Total Assets

(1) **T_1 (Working Capital / Total Assets):** The ratio of Working Capital to Total Assets is the Z-Score component which is considered to be a reasonable predictor of deepening trouble for a company. A company which experiences repeated operating losses will generally suffer a reduction in working capital relative to its total assets.

(2) **T_2 (Retained Earnings/Total Assets):** The ratio of Retained Earnings to Total Assets is a Z-Score component which provides information on the extent to which a company has been able to reinvest its earnings in itself. An older company will have had more time to accumulate earnings so this measurement tends to create a positive bias towards older companies.

(3) **T_3 (Earnings Before Interest and Taxes /Total Assets):** This ratio adjusts a company's earnings for varying income tax factors and makes adjustments for leveraging due to borrowings. These adjustments allow more effective measurements of the company's utilization of its assets.

(4) **T_4 (Market Value of Equity/Total Liabilities):** This ratio gives an indication of how much a company's assets can decline in value before debts exceed assets. Equity consists of the market value of all outstanding common and preferred stock. For a private company the book value of equity is used for this ratio. This depends on the assumption that a private company records its assets at market value.

(5) **T_5 (Net Sales/Total Assets):** This ratio measures the ability of the company's assets to generate sales. This ratio is not included in the Z-Score of a private company.

Zones of Discrimination:

The resulting Z-score puts a company in one of the three zones

$Z > 2.99$ -"Safe" Zone

$1.8 < Z < 2.99$ -"Grey" Zone

$Z < 1.80$ -"Distress" Zone

Table-I: Altman Guidelines

Situation	*'Z' Scores*	*Zones*	*Remarks*
I	Below 1.8	Bankruptcy (Distress Zone)	Its failure is certain and extremely likely and would occur probably within a period of two years.
II	Between 1.8 and 2.99	Healthy (Grey Zone)	Financial viability is considered to be healthy. The failure in this situation is uncertain to predict.
III	3.0 and above	Too Healthy (Safe Zone)	Its financial health is viable and not to fall.

Accuracy and Effectiveness

In its initial test, the Altman Z-Score was found to be 72% accurate in predicting bankruptcy two years prior to the event, with a Type II error (false positives) of 6% (Altman, 1968). In a series of subsequent tests covering three different time periods over the next 31 years (up until 1999), the model was found to be approximately 80-90% accurate in predicting bankruptcy one year prior to the event, with a Type II error (classifying the firm as bankrupt when it does not go bankrupt) of approximately 15-20% (Altman, 2000).

From about 1985 onwards, the model is both popular and widely used in the fields of credit risk analysis, distressed investing; M&A target analysis, and turnaround management. The formula's approach has been used in a variety of contexts and countries, although it was designed originally for publicly held manufacturing companies with assets of more than $1 million. Later variations by Altman were designed to be applicable to privately held companies and non-manufacturing companies.

Results and Discussion

The ratios used in Z score analysis, its ingredients and value of Z score of Hindustan Copper Ltd is given in table II and III respectively.

Table-II: Ratios Used in the 'Z' Score Analysis

Year	*Working Capital/Total Assets* (T_1)	*Retained Earnings/Total Assets* (T_2)	*EBIT/Total Assets* (T_3)	*Market Value of Equity/ Book Value of Total Liabilities* (T_4)	*Sales/Total Assets* (T_5)
2001-02	0.0081	-0.6838	-0.1260	1.6246	0.5694
2002-03	-0.0287	-0.8548	-0.0974	1.4190	0.4803
2003-04	-0.0013	-1.0781	0.0045	2.3149	0.5857
2004-05	0.0424	-0.9632	0.1186	8.3199	0.6025
2005-06	0.0511	-0.4775	0.1129	9.1147	0.7443
2006-07	0.2159	-0.1943	0.2409	8.0131	1.0235
2007-08	0.2915	0.3054	0.1958	26.7373	0.9281
2008-09	0.2266	0.3170	0.0077	15.4462	0.7467
Mean	0.1007	-0.4536	0.0571	9.1237	0.7101
Correlation	0.9472	0.9058	0.6798	-0.3239	0.9602

Source: Computed from the Annual Reports of Hindustan Copper Ltd from 2001-02 to 2008-09.

Table-III: 'Z' Score Ingredients and their Value

Year	*Working Capital/Total Assets*	*Retained Earnings/ Total Assets*	*EBIT/Total Assets*	*MV of Equity/ BV of Total Liabilities*	*Sales/Total Assets*	*'Z' Score*
	($1.2\ T_1$)	($1.4\ T_2$)	($3.3\ T_3$)	($0.6\ T_4$)	($0.999\ T_5$)	
2001-02	0.0097	-0.9573	-0.4158	0.9748	0.5688	0.1802
2002-03	-0.0344	-1.1967	-0.3214	0.8514	0.4798	-0.2214
2003-04	-0.0016	-1.5093	0.0149	1.3889	0.5851	0.4780
2004-05	0.0509	-1.3485	0.3914	4.9919	0.6019	4.6876
2005-06	0.0613	-0.6685	0.3726	5.4688	0.7436	5.9778
2006-07	0.2591	-0.2720	0.7950	4.8079	1.0225	6.6124
2007-08	0.3498	0.4276	0.6461	16.0424	0.9272	18.3931
2008-09	0.2719	0.4438	0.0254	9.2677	0.7460	10.7548
Mean	0.1208	-0.6350	0.1884	5.4742	0.7094	5.0937

Source: Computed from the Annual Reports of Hindustan Copper Ltd from 2001-02 to 2008-09.

The results of the Z score ingredients of Hindustan Copper Ltd were as under:

(1) Working Capital / Total Assets: It may be seen from the table II that the eight years average percentage of working capital to total assets works out at 10.07

percent. The percentage of working capital to total assets was insignificant or negative in the beginning of the study period from 2001-02 to 2003-04 but after that it showed an increasing trend and increased to 29.15 per cent of the total assets in 2007-08. It was 22.66 percent in 2008-09. It indicates that the efficiency of the company in the management of working capital helps it to improve its financial health. The correlation coefficient between working capital and total assets during the study period was 0.9472, indicating a high degree of positive correlation between the two variables. The significance of correlation coefficient was tested by using Student's 't' test and the result has confirmed the linear relationship between working capital and total assets.

(2) **Retained Earnings/Total Assets:** The ratio of retained earnings to total assets indicates the extent of assets, which have been paid by the company profits. Table II shows that the ratio of retained earnings to total assets was negative during the period 2001-02 to 2006-07 indicating that the company was not financed through reinvesting profits. However, the ratio shows improvement throughout the period of study and was positive in the last two years of the study period. The correlation coefficient between retained earnings and total assets was positive which was tested through the hypothesis and the result is indicated in table IV.

(3) **Earnings before Interest and Taxes /Total Assets:** The operational performance and earning power could be assessed through EBIT to total assets, which lead to business success or failure. The earnings before interest and taxes to total Assets ratio ranged between (-) 12.06 % and 24.09 % during the period of study. The EBIT of the company showed an increasing trend during the study period. If the EBIT and total assets move in the same direction, they will adversely affect the financial health of the company. The correlation coefficient between EBIT and total assets during the study period was 0.6798, indicating a high degree of positive correlation between the two variables. The significance of correlation coefficient was tested by using Student's 't' test and the result has confirmed the linear relationship between retained earnings and total assets.

(4) **Market Value of Equity/Total Liabilities:** Table II shows that the ratio of market value of equity to total liabilities showed an increasing trend throughout the period of study having some fluctuations. It was 1.62 times in 2001-02 which increased to 26.74 times in 2007-08. In the year 2008-09 the market value of equity was 15.446 times of the total liabilities. The correlation coefficient between market value of equity and book value of total liabilities was negative, which was tested through the hypothesis and the result is indicated in table IV.

(5) **Net Sales/Total Assets:** It is observed from the table that the net sales to total assets ratio showed an increasing trend during the period of study having some fluctuations. The ratio fluctuated between 0.48 times in 2002-03 and 1.02 times in 2006-07. The eight years average of the net sales to total assets ratio works out at 0.71 times. The correlation coefficient between net sales and total assets during the study period was 0.96, indicating high degree of positive correlation between the two variables. The significance of correlation coefficient was tested by using

Student's't' test and the result has confirmed the linear relationship between retained earnings and total assets.

(6) 'Z' Score Value: Table III shows the 'Z' Score Ingredients and their Value during the study period. It indicated that as per the Altman's guidelines, the financial position of the company was in distress zone during the first three years from 2001-02 to 2003-04 but thereafter the company improved its financial performance and came into the safe zone as its Z score was always more than 3 during the period from 2004-05 to 2008-09.

Table-IV: Summary of T Distribution Inferences

Relationship	*Correlation*	*Calculated Value of 't'*	*Degree of Freedom*	*Table Value @ 5 % confidence*	*Remarks*
Correlation between Working Capital and Total Assets	0.9472	7.237	6	1.94	Significant
Correlation between Retained Earnings and Total Assets	0.9058	5.237	6	1.94	Significant
Correlation between EBIT and Total Assets	0.6798	2.27	6	1.94	Significant
Correlation between Market Value of Equity and Book Value of Total Liabilities	-0.3239	0.839	6	1.94	Not Significant
Correlation between Sales and Total Assets	0.9602	8.421	6	1.94	Significant

Source: Computed from the Annual Reports of Hindustan Copper Ltd from 2001-02 to 2008-09

Major Findings

Major findings of the study are as under:

- It is clear that the financial health of Hindustan Copper Ltd is not good in the beginning of the study period but the Company has improved its financial health during the remaining period of the study.
- The Company has incurred financial losses during 2001-02 to 2003-04 and 2008-09 and has negative retained earnings from 2001-02 to 2006-07 of the study period; hence it was financed through debts, instead of reinvesting profits.
- The under-recovery of the cost of production, over the years, has severely affected the cash flow and working capital management of the Company.
- The total assets show an increasing trend during the study period, which was unfavourable for the Company.
- The turnover of the Company showed an increasing trend during the study period but it was stable during the last three years and the Company had failed

to increase its sales to the desired level.

- The market value of equity fluctuated throughout the study period.
- The correlation coefficients of the financial ratios are positive except correlation between market value of equity and book value of total liabilities.

Suggestions

Though the overall financial health of the Hindustan Copper Ltd has been improving during the period of study, the following suggestions are made to sustain this growth:

- The working capital management of the Company should be strengthened to help the Company maintain a good financial health.
- The growth of the Company should be financed through profits. It has to identify the level of debt and utilize it properly to maintain a sustainable growth.
- The total assets of the Company show an increasing trend, which adversely affects the financial health of the Company. Therefore the Company should reduce its fixed assets.
- The Company should increase its sales to the desired level, because the growth in sales is not consistent.

Conclusion

In this study an attempt has been made to have an insight into the financial health of Hindustan Copper Ltd. To examine the overall financial performance of the Company, this study uses Altman 'Z' Score model, which captures the predictive viability of a Company's financial health by using a combination of financial ratios that ultimately predict a score, which can be used to determine the financial health of a Company. The study concludes that the Company's overall financial health had improved during the study period.

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