Validity of Altman's "Z" Score Model in Predicting Financial Distress of Pharmaceutical Companies

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Abstract

Prediction of financial distress has been a major concern for all companies since the financial crisis of 2008. Financial distress is detrimental to big and small organisations alike. It is costly because it creates a tendency for firms to do things that are harmful to debt holders and non-financial stakeholders, impairing access to credit and raising stakeholder relationships. Again financial distress can be costly if a firm's weakened condition induces an aggressive response by competitors seizing the opportunity to gain market share. The motivation for empirical research in corporate bankruptcy prediction is clear – the early detection of financial distress and the use of corrective measures (such as corporate governance) are preferable to protection under bankruptcy law. If it is possible to recognize failing companies in advance, then appropriate action can be taken to reverse the process before it is too late. This study uses Altman's 'Z' Score Model to test the financial distress of a few selected pharmaceutical companies. This model has been applied in several financial distress and bankruptcy studies with satisfactory results. The study covers a period of 5 years viz., 2012-2013 to 2016-2017. For the purpose of investigation, purely secondary data is used. The technique of Altman's "Z" score test has been applied to analyse the data. The result shows that the average Z-Score of the pharmaceutical industry is 5.90 during the period of study. It clearly indicates that the pharmaceutical industry has a healthy financial position because Z-Score is much above the cut-off scores i.e. 1.8.

Keywords: Financial Distress, Liquidity, Pharmaceutical Industry, ALTMAN'S Z Score Test.

Introduction

A firm's financial health plays a significant role in its successful functioning. Poor financial health threatens the very survival of the firm and leads to business failures. The financial crisis of 2008 and the ensuing economic downturn have had a significant impact on the corporate sector. Corporate profitability has eroded sharply while debt burden has increased. Corporate failures are a common problem of developing and developed economies.

Proactive efforts can save a company heading towards potential bankruptcy from facing painful consequences of a complete failure. With the global financial crisis of 2008 and the failure of many organisations in the US and Europe, it has become all the more necessary that the stakeholders study the financial health of their organisations. For companies, being able to meet their financial obligations is an integral part of maintaining operations and growing in the future. Liquidity is the ability to meet expected and unexpected demands for cash through ongoing cash flow or the sale of an asset at fair market value. Liquidity risk implies the possibility of a firm not having sufficient funds or liquid assets to meet its cash obligations.

Financial Distress

Financial distress is a situation where the liabilities exceed assets in a company and it generally happens due to under-capitalisation, not maintaining sufficient cash, resources not being utilised properly, inefficient management in all activities, sales decline and adverse market situation. Financial distress is a low cash flow state of a company in which it incurs deadweight losses without being insolvent. The issues of financial distress are so diverse and have been approached from various disciplines and perspectives including political theory, legal theory, management, economics, accounting and finance. Financial distress and failure is the result of chronic losses which cause a disproportionate increase in liabilities accompanied by shrinkage in the asset value. Financial distress occurs when the company does not have the capacity to fulfil its liabilities to third parties.

Review of Literature

A lot of research has gone into studying and analysing the financial health of companies by accountants and researchers all over the world. Accounting ratios have been widely used in development of models for the prediction of financial health and financial distress of companies. They have also tried to build up models that would help in predicting the financial health of companies. Financial distress is a situation where a company is unable to pay off its short-term and long-term liabilities. In a real sense, the company's assets are not enough to settle its financial obligations. Elijelly (2004) in the study on "Liquidity – profitability tradeoff: An empirical investigation in an emerging market" empirically examined the relationship between profitability and liquidity, as measured by current ratio and cash gap (cash conversion cycle) on a sample of joint stock companies in Saudi Arabia.

The study found a significant negative relation between the firm's profitability and its liquidity level, as measured by current ratio." Beneda (2006) investigated returns, bankruptcies and firm distress for new US public companies that issued IPOs from 1995 through 2002. Beneda found that the average first year returns for IPO companies underperformed the market and that Ohlson's model was effective in identifying companies that had a higher probability of bankruptcy and financial distress and earned lower than average returns. Dawkins et al., (2007) analysed the fluctuations in share price after a firm has filed for bankruptcy. They employed event study methodology and controlled firms' financial condition by using Altman's Z-score model.

It was observed that there was an increase in share price even when a firm filed for bankruptcy because of prevailing bull market conditions. Huge transactions were commanded by large traders post-bankruptcy filing as investors were abnormally optimistic. Fich et al; (2008) investigated the association between a firm's governance practices and capability to avoid bankruptcy. They predicted bankruptcy of firms using Altman's Z-score model along with interest coverage ratio. It was found that during a firm in a distress situation, bad governance will misrepresent accounting information and will not have the ability to handle the situation. This often occurs if they are independent boards than inside directors. Agarwal et al. (2008) compared the accuracy of predicting bankruptcy using market base model with accounting Z-score model. It was found that neither of the models had adequate information for predicting failure as they were unique.

However, it was concluded that accounting based models account for credit risk since accounting statements capture performance for several years. Gopinathan Thachappilly (2009) stated that even if a business has high profitability, it can face short-term financial problems and its funds are locked up in inventories and receivables not realizable for months. Any failure to meet the obligations can damage its reputation and creditworthiness and in extreme cases, even lead to bankruptcy. In addition, liquidity ratios are worked with cash and near-cash assets of a business on one side, and the immediate payment obligations (current liabilities) on the other side. The near-cash assets mainly include receivables from customers and inventories of finished goods and raw materials. Shen, et al. (2010) compare logit model with robust logit developed based on Altman's Z-score. They found robust logit model was superior even when the sample included statistical outliers (firms that are doing extremely good or bad). However, robust logit model was vigorously allocating firms as default.

Sherin (2010) in her article on "Liquidity v/s profitability - Striking the right balance" writes about the implications of liquidity and profitability in a pharmaceutical company. A firm is required to maintain a balance between liquidity and profitability while conducting its day-to-day operations. Investments in current assets are inevitable to ensure delivery of goods or services to the ultimate customers. A proper management of the same could result in the desired impact on either profitability or liquidity. Ray (2011) evaluates financial health of the automobile industry from 2003 to 2010 in India using Z-score model. The multiple discriminant framework has depicted a moderate picture. The Z-score lies within "Grey Zone" suggesting credit risk associated with the industry. The study indicates an alarming situation where Z score is declining after global recession hit the Indian economy (2007). Bhunia and Sarkar (2011) carried out a study on 64 private pharmaceutical companies for a period of 10 years since 1996 to 2005 and applied multiple discriminant analysis on selected financial ratios from different segments like liquidity, profitability, solvency and efficiency to develop a business failure prediction model. Chen et al., (2012) analysed the effect of pricing of corporate debt due to "unionized workers" in financially distressed and healthy firms. They employed five different indicators including Altman's Z-score model to identify if a firm is in distress.

Using all five alternative models of distress, it was found that "unionized workers" and Distress has a negative relation which is statistically significant. This is because labour unions try to shield creditors' wealth even though they support firm policy to reduce creditors' wealth during distress. Singhal et al. (2013) examine the relationship between bankruptcy and diversification strategy of firms. Altman Z-score is used to represent the likelihood of bankruptcy which is highly correlated with leverage. It was found that focused firms are more likely to go bankrupt than diversified firms. Li (2014) explores the application of

Altman's bankruptcy model in the construction industry. The original 5-set variable is expanded to 14-set variable. The conclusion drawn is that Altman's model stands both valid and effective in the context of bankruptcy prediction for the sample selected. Celli (2015) found that the Z-score degree of reliability is relatively high and still works quite adequately in predicting listed industrial company failure in Italy. It proved a precious tool in the detection of a company's operating and financial difficulties up to 3 years before the default. Altman et al. (2016) re-examined the original version of the Z-Score model using data of different countries. They re-estimated values using another statistical method and additional variables to assess the effect of classification performance when the data are heterogeneous. The evidence indicates that the original Z-Score model executes well at an international context till date. Panigrahi et al. (2018) have undertaken a research study on the liquidity and profitability of the top five Indian pharmaceutical companies.

The study's intent was to provide empirical evidence about the effects of working capital management on profitability for this sample of five listed pharmaceutical companies for the period 2011-12 to 2015-16. Although liquidity and profitability are inversely related in all cases, which coincide with the theory of finance, it was found that highly liquid companies were profitable. The assumption that all profitable companies suffered from lack of liquidity and all liquid companies suffered losses was not evident. In other words, a company need not forego liquidity to earn profit. The key aspect is to draw a balance in terms of the extent to which a company can forego liquidity to earn the desired profit, which is the ultimate trade-off between liquidity and profitability. While this is essential, there is no universally acceptable solution or rule to work out this trade-off. On the other hand, operating with negative working capital for the sake of greater profits is gaining popularity in today's corporate world; this is also a key parameter used to judge managerial efficiency. However, the author would caution finance managers to ensure that this method of functioning does not lead to financial bankruptcy of the organisation.

Research Problem

If financial distress is not detected in time and turnaround measures taken, then bankruptcy is likely. The costs of bankruptcy are enormous and affect all stakeholders of the company. The earlier the detection the greater is the time allowed to effect appropriate strategies. Although companies experience a positive change in net income, they do not seem to generate enough cash flows to satisfy their debt obligation and eventually may experience financial distress. It is argued that operating cash flow variables are the most significant in predicting corporate failure. This study therefore tries to judge the financial distress status of sample companies by using Altman's Model.

Research Objective

The study is aimed at examining the financial distress status or financial health of sample units by using Altman's Model.

Research Methodology

In this paper, we have studied the financial distress status for a sample of four Indian pharmaceutical companies for a period of five years. The paper mainly focuses on the probability of financial distress, measured by Edward Altman's Z-Score models, which have become a popular and widely accepted measure of financial distress. Also, the Z-Score models are used to predict corporate defaults. The financial crisis forms the basis for testing the robustness and applicability of the Z-Scores, as one in retrospective can compare the predictions of the models to actual events. This is an appealing approach, as it dwells on the intersection of theory and real life.

Sample Design

A sample of four companies engaged in the pharmaceutical sector was selected for the purpose of this study. This study is based on secondary data, which have been obtained from published sources i.e. Annual reports of the sample companies and from the website **www.moneycontrol.com**, for the period of five years (2012-13 to 2016-17).

Review of Altman's Z-score Model

The widely popular Z-score function used for analysing and predicting bankruptcies was first published in 1968 by Edward I. Altman (Altman, 1968). In Altman's study, the initial sample involved sixty-six corporations with thirty-three companies in each group in the time period of 1946 to 1965. The Z-score uses multiple inputs from corporate income statements and balance sheets to measure the financial status of a company. The inputs that Altman selected were from those financial reports that are one reporting period earlier than bankruptcies. The inputs that Altman used were twenty-two different financial ratios. Altman considered that these financial ratios were chosen to eliminate size effects. Those ratios were divided into five categories:

liquidity, profitability, leverage, solvency, and activity. The reason for dividing the input variables into 5 categories is ad-hoc. They are standard financial categories.

Z-Score Analysis

Altman used five ratios to calculate the Z-Score. These different ratios were combined into a single measure Z-Score Analysis. The formula used to evaluate the Z-Score analysis as established by Altman is as follows:

Z = 0.012X1 + 0.014X2 + 0.033X3 + 0.006X4 + 0.999X5

"Z" is the overall index and the variables X1 to X4 are computed as absolute percentage values while X5 is computed in number of times.

Ratios Used in Z-Score Analysis

The following accounting ratios are used as variables to combine them into a single measure (index), which is efficient in predicting bankruptcy.

X1 -The ratio of working capital to total assets (WC/TA*100). It is the measure of the net liquid assets of a concern to the total capitalisation.

X2 -The ratio of net operating profit to net sales (NOP/S*100). It indicates the efficiency of the management in manufacturing, sales, administration and other activities.

X3 -The ratio of earnings before interest and taxes to total assets (EBIT/ TA*100). It is a measure of productivity of assets employed in an enterprise. The ultimate existence of an enterprise is based on the earning power (profitability).

X4 -The ratio of market value of equity to book value of debt (MVE/ BVD *100). It is reciprocal of the familiar debt-equity ratio. Equity is measured by the combined market value of all shares, while debt includes both current and long term liabilities. This measures the extent to which assets of an enterprise can decline in value before the liabilities exceed the assets and the concern becomes insolvent.

X5 -The ratio of sales to total assets (S/TA). The capital turnover ratio is a standard financial measure for illustrating the sales generating capacity of the assets.

Analysis and Discussion

The financial health of the sample units has been judged through Altman's score. The details regarding Altman Model have been given at the end of the article in the form of end notes. The ratios used in calculating Z – Score in Altman model have been discussed in the following paragraph.

Table 1: Aurobindo Pharma

Year	Working Capital (WC)	Retained Earnings (RE)	EBIT	Market value of Equity	Total Liabilities	Sales	Total Assets (TA)
2012-2013	361.07	-71.72	129.76	1659.85	6233.78	4204.60	5991.21
2013-2014	862.73	452.31	813.18	2212.24	7272.85	5352.91	6824.57
2014-2015	1763.9	1084.68	1808.3	7455.11	9489.7	7049.57	8575.53
2015-2016	2421.89	1385.07	2072.49	17835.36	12909.73	8018.01	10225.88
2016-2017	2441.86	1473.53	2369.36	43591.54	15699.26	8922.38	11932.50

Source: www.moneycontrol.com

Table 2: Lupin Pharma

Year	Working Capital (WC)	Retained Earnings (RE)	EBIT	Market value of Equity	Total Liabilities	Sales	Total Assets (TA)
2012-2013	990.44	661.45	1033.39	47313.63	22357.15	5315.89	6158.71
2013-2014	1884.74	1544.8	1757.09	56498.71	130853.54	7010.49	7045.73
2014-2015	3582.38	2870.08	3160.08	83931.51	10135.22	8777.18	8798.96
2015-2016	4792.13	2875.07	3217.09	180433.79	8843.42	9611.54	11007.71
2016-2017	4941.78	3567.61	3920.33	134584.33	7935.44	10810.01	14216.90

Source: www.moneycontrol.com

Table 3: Dr. Reddy's Laboratories

Year	Working Capital (WC)	Retained Earnings (RE)	EBIT	Market value of Equity	Total Liabilities	Sales	Total Assets (TA)
2012-2013	1861.4	679.3	1322.8	149650.8	11305.10	6667.80	10340.60
2013-2014	2552.2	1010.7	1814.6	155018.91	13380.20	8244.70	11989.10
2014-2015	4793.6	1621.6	2532.7	218187.89	15905.50	9646.80	14508.10
2015-2016	5724.7	1338.6	2123.7	297241.5	18457.10	9927.50	16456.00
2016-2017	5296.2	1014	1643.8	258902.5	19951.20	10150.60	17557.60

Source: www.moneycontrol.com

Table 4: Sun Pharmaceutical Industries

Year	Working Capital (WC)	Retained Earnings (RE)	EBIT	Market value of Equity	Total Liabilities	Sales	Total Assets (TA)
2012-2013	2952.34	1257.37	1726.26	29512.52	16318.80	2398.17	9131.20
2013-2014	2732.19	-1.24	663.47	42078.49	20377.32	2243.40	9246.29
2014-2015	1465.97	3139.19	2782.71	119042.22	29095.15	2724.31	13837
2015-2016	-5601.8	2196.08	1007.72	212070.16	48723.19	7730.92	37445.55
2016-2017	-3495.08	1314.04	537.27	197341.2	54157.94	7132.03	34189.93

Source: www.moneycontrol.com

Table 5: ALTMAN'S "Z" Score Test for Solvency Analysis

Company / Ratios	Working Capital/ total Assets (A)	Retained Earnings/ Total Assets (B)	EBIT/ Total Assets (C)	Market value of equity/ Book value of total debt (D)	Sales/ Total Assets (E)
Aurobindo Pharma	0.16	0.28	0.14	1.09	0.76
Lupin Pharma	0.24	0.22	0.26	10.4	0.86
Dr. Reddy's Labs	0.27	0.07	0.13	13.51	0.63
Sun Pharma	-0.09	0.30	0.004	3.18	0.21
Mean	0.14	0.21	0.13	7.04	0.61
Std. Deviation	0.16	0.10	0.10	5.86	0.28

Computed from the data taken from the Source: www.moneycontrol.com

An analysis of the working capital shows that the industry's average working capital to total assets is 0.14. Aurobindo Pharma, Lupin, Dr. Reddy's Labs and Sun Pharma are below the industry average whereas all the other companies are well above the industry average. It indicates that the average working capital maintained by the Indian pharmaceutical companies is around 14% of their total assets. The lowest ratio is reported by Sun Pharma i.e., 0.09 while Dr. Reddy's Labs has the highest ratio of 0.27. It may be concluded that Sun Pharma utilised its assets more effectively as compared to other sample units in this study.

The retained earnings-to-total assets ratio indicates the proportion of retained earnings to the total assets. On an average, the industry retains an amount of 21% of its total assets. Companies like Lupin Pharma, Dr. Reddy's Labs and Aurobindo Pharma have retained less than the industry average. The retained earnings to total assets is maximum (0.30) in Sun Pharma while it is the lowest in Dr. Reddy's Labs (i.e. 0.07).

The industry ratio of earnings before interest and tax (EBIT) to total assets is 13%. The EBIT to total assets of Lupin Pharma is high (i.e. 0.26) compared to both the industry as well as other companies.

The market value of equity compared to book value of total debt of the industry is 7.04 times which indicates a comfortable position of the industry as a whole. Lupin Pharma is in the most comfortable position followed by Aurobindo Pharma, Sun Pharma and Dr. Reddy's Labs.

The average sales compared to total assets of the industry is 0.61. This low ratio indicates that the industry has idle capacity and there is scope for further improvement. Sun Pharma is below the industry average. All other companies are at or above the industry average indicating comfortable position. The highest ratio (0.86) has been reported by Lupin Pharma.

Measurement of Financial Health

Altman established the following guidelines to be used to classify firms as either financially sound or bankrupt.

Altman Guidelines for Healthy Zone

Situation	Z-Score	Zones	Results
I	Below 1.8	Bankruptcy Zone	Failure is certain
II	1.8 to 3	Healthy Zone	May or may not fail
III	Above 3	Too Healthy	Will not fail

1. A unit with Z-Score of below 1.8 is considered to be in bankruptcy zone. Its failure is certain and could occur probably within a period of two years.
2. If a unit has a Z-Score between 1.8, and 3, its financial viability is considered to be healthy. Failure in this situation is uncertain to predict.
3. Z-Score of above 3 implies that the unit is in the 'too healthy' zone. Its financial health is very viable and the company will not fail.

Table 6: ALTMAN'S "Z" Score Test

Company / Year	2012-2013	2013-2014	2014-2015	2015-2016	2016-2017	Mean	CV
Aurobindo Pharma	1.02	1.60	2.05	2.75	3.48	2.18	0.44
Lupin Pharma	4.76	5.04	8.09	14.96	12.61	9.002	0.4967
Dr. Reddy's Labs	9.31	8.51	10.02	11.22	9.11	9.63	0.1077
Sun Pharma	2.55	2.07	3.75	2.80	2.62	2.75	0.2236
Mean	4.41	4.30	5.97	7.93	6.95	5.90	
CV	0.8184	0.7410	0.6199	0.7750	0.6819		

Computed from the data taken from the Source: www.moneycontrol.com

The average Z-score of the pharmaceutical industry is 5.90 during the period of study. It clearly indicates that the pharmaceutical industry has a healthy financial position because Z-score is much above the cut off score i.e.1.8. Dr. Reddy's Labs reported the highest average ratio (9.63) followed by Lupin Pharma with 9.002. Sun Pharma at the third place has a Z-Score of 2.75.Aurobindo has a relatively lower Z-score of 2.18.

Z-score of Aurobindo Pharma in the years2012-13 and 2013-14 is below 1.8 which is in the Bankruptcy Zone. However, in 2014-15 and 2016-17, it came into the healthy zone, and in 2015-16, it came into the 'too healthy' zone. All other companies are well above the healthy zone with strong financial health.

Contributions of the Study

This paper makes several contributions in multiple fields. First, the paper addresses the impact of the financial crisis on selected pharmaceutical companies, which will definitely give insights to other companies in the pharmaceutical sector. This may give valuable insights into whether the pharmaceutical industry in India is more likely to be exposed to financial distress. Furthermore, the article examines the predictive ability of the Z-score models under the conditions of the financial crisis.

Limitations of the Study

Perhaps the most important weakness of the paper is that we are relying solely on the Z-score models as the only means of analysis. Including other measures of financial distress would have strengthened the results. It is also possible that the paper has a geographic limitation, in the sense that the findings are related to enterprises chosen from the Indian pharmaceutical sector for a period of five years; this may not be directly applicable to other sectors or periods. For instance, it may be that certain conditions in India and particularly the pharmaceutical industry have an impact on the findings. Testing the validity for some of the results on broader stock exchanges may help to clarify this potential restriction.

Managerial Implications and Scope for Further Study

The research will be useful to investors in making informed decisions by analysing the financial ratios of a company before deciding on which shares to buy and which ones to dispose off. By applying the Z-score model, investors will be able to predict the financial soundness of companies before investing. Managers will find the research useful in making timely responses to financial distress to avoid further losses and avert the situation. The regulators can apply the findings in designing and implementing appropriate policies to ensure an efficient market system. The government can use the findings in designing strategies to avoid tax losses which are brought about by financial distress. This research can form a basis for further research and scholars could find the information useful in its contribution to the pool of knowledge. It will also add to theory by confirming whether the Altman's Z-score model is relevant among the firms in the Indian context as well as other emerging economies.

The fashion of managing the show with negative working capital is gaining popularity in today's corporate world for the sake of earning more profit, which is regarded as managerial efficiency. But here is a word of caution to all finance managers - they need to ensure that 'managerial efficiency' must not lead to financial bankruptcy of the organisation. In India, negative working capital is as popular as it is with global companies such as McDonalds, Amazon.com, etc. Negative working capital indicates non-liquidity or less liquidity within the firm, which is unfavourable at each and every stage of business. Many companies operating in India are able to manage with negative working capital efficiently, creating shareholder value by way of higher EPS and higher market capitalisation. At the same time, companies with higher working capital have sufficient liquidity, are more successful because of liquidity and can expand business optimally. However, a company with higher working capital needs higher revenue to maintain a healthy operating ratio. A better credit management system will help these companies generate higher ROCE in the long run. However, in each and every situation, lower level of liquidity is not preferable; a proper trade-off between liquidity and working capital is needed in the long run.

Conclusion and Recommendations

The year 2015-2016 may be considered a successful year for the pharmaceutical industry because it reported the highest average ratio of Z-score i.e. 7.93. The Altman Z-score of the companies under study in the pharmaceutical sector reveal that the financial health of these companies was good. Aurobindo Pharma, Lupin Pharma, Dr. Reddy's Labs and Sun Pharma are financially very healthy and have no cause of concern with regard to financial soundness. The Z-scores of these companies are well above 3 indicating very safe zone. Aurobindo and Sun Pharma fall in the healthy zone having Z-scores between 1.8 and 2.99. Hence, it can be concluded that the companies in the pharmaceutical sector are financially quite healthy and there is no scope of bankruptcy or any cause of concern as regards the financial health of companies in this sector in the coming years. Investors' investments in this sector are safe. The management also has no reason to worry as regards the financial health of these companies. Moreover, low or negative working capital in some cases indicates aggressive working capital management policy of the firms which implies minimal investment in current assets by the companies so as to derive a higher rate of return. But it has to be remembered that risk of default and bankruptcy increases when a firm adopts more aggressive working capital policies. In some cases, it is a sign that a company may be facing bankruptcy or serious financial trouble.

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