

## **Assessing the Feasibility of Altman's "Z" Score Model in Identifying Companies on the Verge of Financial Collapse: A Study on Select Indian Pharma Companies**

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### **Abstract:**

It has become increasingly important for companies to anticipate financial troubles since the 2008 financial crisis. Both large and small businesses are impacted by financial difficulties. It's costly because it encourages bad behaviour on the part of firms, which hurts debt holders and other stakeholders, making it harder for the enterprises to get loans and worsening their relationships with other groups. If a company's financial woes encourage its rivals to increase their own aggressive market share-grabbing tactics, the company's woes could escalate quickly and at high costs. The reason for empirical study in corporate bankruptcy prediction is obvious: corporate governance and early identification of financial trouble are superior to legal bankruptcy protection. If failing businesses can be identified in advance, the proper step to be occupied to stop the process before it is too late. In this research it is attempted to examine the financial difficulties of a few chosen drug manufacturers using Altman's "Z" Score Model. This model has been used successfully in numerous studies on financial difficulties and bankruptcy. The study spans a 12-year period from 2010–2011 to 2021–2022. Only secondary data is used for the investigation's purposes. The data have been analyzed using Altman's "Z" score test methodology. It is evident that the pharmaceutical sector is in good financial shape.

**Keywords:** Predicting, Pharmaceutical, Bankruptcy, Stakeholders, *Corporate governance*

## **Introduction**

The principal objective of a business entity is to continue its operation as a going concern for indefinite period of time. How management runs the business from both financial and non-financial aspects has a direct impact on its overall performance and which become the deciding factor whether the business unit will survive or not. The performance of the business plays an important role in determining an organization's competitive ability. A business is said to be in financial distress if it has shown signs of declining performance and may become bankrupt if the problem is not swiftly rectified. Many organizations were unable to conduct their business in US and Europe due the financial crisis in 2008. Therefore, it has become crucial for every stakeholder to be aware of the financial status of their organizations.

Financial difficulty arises when a company's income is insufficient to pay all of its debts. We can also state that a company is in financial distress when its liabilities exceed its assets. Generally speaking, undercapitalization, a lack of sufficient cash on hand, improper resource management, ineffective management of all activities, declining sales, and unfavourable market conditions are the causes of financial distress. Financial difficulty can also result from a company's inability to meet its obligations to customers or suppliers.

Stakeholders are currently aware of how fraud and scams defrauded investors and caused the financial markets to rise and fall. Management and stakeholders are therefore under pressure to learn about the firms' liquidity positions as soon as possible.

The current research attempt to increases our knowledge and informs management, stakeholders, and other interested parties on the economic health of the companies engaged in drug manufacturing sector in India. The researcher has made an effort to offer a thorough understanding of the financial factors that affect the financial status of Indian pharmaceutical firms with the help of the Edward Altman's Z-score model.

## **Indian Pharmaceutical Sector: An overview**

The Bengal Chemical and Pharmaceutical Works, established by Professor P.C. Roy in Kolkata in 1901, was the first pharmaceutical company in India. The British also set up a number of pharmaceutical research institutes, including as the King Institute of Preventive Medicine in Madras in 1904, the Central Drug Research Institute in Kasauli in 1905, and the Pasteur Institute in Conoor in 1907. Although, until independence, the nation heavily depended on developed nations like the UK, France, Germany, etc. for a variety of medicines. The pharmaceutical business expanded its production at the time of First World War as local demand increased on a sudden but imports were restricted. India started producing synthetic leprosy and dysentery medications as well as certain other conventional medications, serums, and vaccinations during

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the Second World War. After independence, India made some progress in making the basic chemicals that are needed to make drugs. At that time, the Indian government made some efforts to reduce its dependency on imports. The establishment of Hindustan Antibiotics Ltd. in the public sector in 1954 marked development and advancement in this field. Currently, the pharmaceutical sector leads India's science-based sectors because of its broad range of production capabilities, which enable it to create anything from basic painkillers to advanced antibiotics and complicated cardiac components, as well as the COVID-19 vaccine, etc.

India is well-known for its low-priced immunisations and generic medicines, and is the world's largest supplier of generic drugs. India's pharmaceutical industry has grown into a formidable force; it grows at a CAGR (compound annual growth rate) of 9.43% during the previous nine years and become world's third largest producer of pharmaceuticals by volume. The most important pharmaceutical products are generic pharmaceuticals, OTC medications, bulk medications, vaccines, contract research and manufacturing, biosimilars, and biologics. India has 500 API (active pharmaceutical ingredients) firms, which represent around 8% of the worldwide API market, and the most FDA-compliant pharmaceutical manufacturing facilities (USFDA).

India's pharmaceutical industry supplies about half of the world's vaccinations, 40% of US generic medications, and 25% of UK medicines. 10,500 manufacturing facilities and 3,000 pharmaceutical companies meet global and domestic drug and vaccine demand. India dominates the pharmaceutical industry. The country has many scientists and engineers who could boost the sector. Indian pharmaceutical businesses supply about 80% of AIDS-treating antiretroviral. India is known as the "pharmacy of the world" for its high-quality, low-cost drugs. The Indian pharmaceutical industry accounts for 2% of GDP and 8% of exports.

One of India's most prosperous industries is the pharmaceutical industry, which supports the growth and economic development of a nation, the creation of strong human capital, and the preservation of intellectual property rights. This is a result of the industry's great performance, ongoing expansion, and quality.

### **Review of Important Literature:**

**Tanjung (2020)** conducted a study to make a comparative analysis of selected Indonesian pharmaceutical companies during 2013–2017. Financial distress was assessed using a number of different methods in this research; these included the Altman Z-Score, the Springate, the Zmijewski, and the Ohlson models. The study revealed that no samples were expected to be in financial difficulty during the study period. Also, the study recommended that the most effective methodology for forecasting financial distress circumstances in pharmaceutical sector was the Z-score model.

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**Lord et al. (2020)** conducted a thorough investigation using modified Altman Z-score model into the ability to foresee financial crisis in the United States nursing care industry during the period 2000 to 2015. In this research liquidity, profitability, efficiency, and net worth ratio were considered as independent factors, while variables such as distress, risk of distress, and no distress were taken as dependent variable. According to the results of the survey, a significant number of selected firms were experiencing severe financial difficulties during the study, and they are on the verge of bankruptcy.

**Panigrahi (2019)** conducted a study applying Altman Z-score model during a five-year period, from 2013 to 2017, to assess the financial difficulties of select Indian drug companies. The research revealed that the financial health of the selected company was excellent and there was no possibility of bankruptcy during the study period. Investing in this industry is risk-free, and management has no cause for concern over the financial stability of these companies.

**Tahu (2019)** conducted a study to compare between Altman Z-score and Springate Model for detecting economic hardship of selected eight construction companies of Indonesia from 2014 to 2018. The study revealed that out of the 8 companies, 4 were identified as financially distressed under Springate as well as in Altman's Z-score Model. The study also discloses that in comparison to Z-score Model, the Springate model is more accurate at forecasting economic hardship in any industry.

**Nayak and Dakhwani (2014)** used Altman's Z-score Model to investigate the economic woes of a few drug producers between 2006 and 2016. The study showed that the financial health of the selected pharmaceutical enterprises was quite strong, and there was no risk of bankruptcy or any reason for concern regarding their future financial health during the period under study.

**Chouhan et al. (2014)** undertook a study to inspect the reliability of Altman's Z-score in forecasting the economic hardship of a sample of 30 BSE-listed companies over a five-year period. Except HDFC Bank and BHEL, whose Z-score values were below or close to the threshold limit, the study found that the chosen companies were in a healthy zone and in a sound financial position. The study also came to the conclusion that the Altman Z-score method was a better model for determining creditworthiness across all types of industries

**Diakomihalis (2012)** conducted research by three variants of the Altman Z-score to forecast insolvencies and appraise the financial wellness hospitality industries. The study looked at 146 privately owned hotels, of which 30 were five-star, 29 were 4-star, 51 were 3-star, and 36 were 2-star. The study showed that one-fourth of the hotel enterprises out of the total sample were located in the bankruptcy zone, and all the Z scores for these enterprises were found to be less than 0.8.

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**Ray (2011)** carried out a study on the automobile industry in India to analyze the financial distress by using different ratios such as profitability, liquidity, leverage, solvency, and activity during 2003 to 2010. In this research, the Altman's Z-score techniques were used. The findings of research revealed that the Z score value has been falling rapidly since 2007–2008 in the Indian automobile industry. The outcome derived from the Z-score model also showed that the Indian automobile enterprises were financially distressed and were going into bankruptcy in the near future.

### **Objectives of the Study:**

The aim of this research is to gauge the economic stability and economic health of the selected 10 Indian drug manufacturers which are listed in NSE over the period of 12 years, applying Altman's Z-Score model which is widely recognized as the perfect and reliable method of estimating a company's economic strength, and distress.

1. To investigate the economic stability of a subset of Indian pharmaceutical firms.
2. To appraise the financial outcomes with the Altman's Z-score model.
3. To find out the economic factors those have maximum effect on company bankruptcy in selected Indian pharmaceutical companies.

### **Methodology and Data Source of the Study:**

The purpose of this research was to use the Altman Z-score model for twelve years (from 2011 to 2022) to determine whether or not ten randomly chosen Indian pharmaceutical companies are in a financially sound or distressed position. For the examination, the data of the selected companies was collected from the CMIE Report, the Prowessiq data base, Moneycontrol.com, and the annual reports of the concerned companies. The study is based on selected ten Indian companies which deal in the pharmaceutical sector and listed on the National NSE and also those whose market capitalization was more than 3,300 cores as on Jan 2023. Selected companies were Aurobindo Pharma Limited (APL), Cipla Ltd., Divi's Laboratories Limited, Dr. Reddy's Laboratories Ltd., Ipca Laboratories Limited, Lupin Limited, Sun Pharmaceutical Industries Ltd. (Sun Pharma), Torrent Pharmaceuticals Ltd., Wockhardt, and Zydus Lifesciences Limited.

### **Theoretical framework of Altman's Z-Score model:**

This model is a popular statistical technique for standardizing data on a single index for comparison developed by Dr. Edward Altman in the late 1960s to foresee the likelihood of economic failure of a company. The model uses multiple ratios which are financial in nature to appraise a company's economic wellbeing and assign it a score. The Z-score is calculated by multiplying each of the ratios by its respective weight and summing the products. The weights

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are based on the coefficients of a multiple discriminant analysis of a sample of companies that had experienced bankruptcy.

### **Z-score Model Estimation:**

This model was propounded by Edward I. Altman, who used the following ratios: liquidity, profitability, solvency, activity, and leverage. Z-score analysis is a metric that combines the results of several ratios. The value of Z-score is computed as follows:

$$\text{Z-Score} = 1.2(X_1) + 1.4(X_2) + 3.3(X_3) + 0.6(X_4) + 1.0(X_5)$$

Where,

$X_1$  = Net Working Capital to Total Assets.

$X_2$  = Retain Earning to Total Assets.

$X_3$  = Operating Profit to Total Assets.

$X_4$  = Market Capitalization to Total Liabilities.

$X_5$  = Total Turnover to Total Assets.

The greater the Z score, the better the financial position and the lower the risk of bankruptcy.

### **Analysis of Ratios used this model:**

**Net working capital/total assets ( $X_1$ ):** This ratio help to know how well a business can pay its short-term bills. When this ratio improves over time, it's a good sign that the company's liquidity is on the rise; when it drops, it may be a sign that the company has too many total current liabilities.

**Retain Earning/Total Assets ( $X_2$ ):** This ratio measures the amount of earnings that are reinvested in the company. The lower the ratio, indicate that the company funding its total assets by borrowed fund instead of using its own fund or retain earning and the higher ratio indicate that the company properly utilized it's retain earning to funding of total assets.

**Operating Profit/Total Assets ( $X_3$ ):**It is used to compute a firm's operating competence in generating revenue using its accessible resources. This explains the relationship between financial and operational income to its total available assets over the course of a financial year. This ratio measures how well a business utilized its resources to yield profits or generate income.

**Market Capitalization/Total Liabilities ( $X_4$ ):** It is the ratio between company's market value of equities and total book debts within its capital structure. This ratio shows how much an organization's assets can decline before liabilities outweigh assets and the organisation goes insolvent.

**Total Turnover/Total Assets ( $X_5$ ):** This ratio provides an insight into how successfully a corporation is utilizing its property to generate profits. A superior ratio indicates that the business is generating more sales revenue from each dollar of assets, which is generally viewed as a positive indicator of efficiency.

### Findings:

The chosen Pharmaceutical Industry's average Z-Score was 3.93 over the research, that is higher than the bankruptcy threshold limit of 1.8, as established by Altman's Z-Score Model's twelve-year scrutiny of the economic healthiness of selected Indian drug manufacturers. Under As per the above model, if the Z-Score lies between 1.8 and 3, the company is financially healthy, and if it's 3, it's in a sphere with no probability of collapse.

The findings the research explains that the selected firms are financially strong it does not have any risk of bankruptcy in near future and investors can safely park their hard earned savings in Pharma sector. Divi'S Laboratories Ltd. obtained highest value based on average of Z score (5.77) followed by Lupin Ltd. (4.74), Sun Pharma ltd. (4.38), Ipca Laboratories Ltd. (4.06), Cipla Ltd. (4.03), Dr. Reddy'S Laboratories Ltd. (3.76), Zydus Lifesciences Ltd. (3.58), Torrent Pharmaceuticals Ltd. (3.57) and Aurobindo Pharma Ltd. (3.34), where all the stated companies Z-score value was fall under “**Too Healthy Zone**”. However, Wockhardt Ltd. Z-score value was 2.04 which fall under Healthy Zone and have chances of insolvency in neat future if precautionary measures will not be taken to solve those issues.

For the pharmaceutical business, the year 2014–2015 was successful since they recorded the highest average Z-score ratio of 4.58, followed by 2012–13, 2015–16, 2013–14, 2020–21, 2010–11, 2021–22, 2011–12, 2016–17, 2018–19, 2019–20, and 2017–18. Aurobindo Pharma's Z-score for the 2011–12 financial year was 1.74, which means the company falls within the bankruptcy zone because the value is less than the 1.8 threshold limit. However, in 2012–13, it came into the healthy zone, and in 2015–16 to 2021–2022, it came into the "too healthy" zone. The Z-score of Wockhardt Ltd. in the years 2011–12, 2013–14, 2018–19, 2019–20, 2020–21, and 2021–2022 was 1.16, 1.68, 1.23, 0.46, 1.72, and 0.98, respectively. It fell below the 1.8 threshold level and entered the insolvency zone. However, in 2011–12, 2015–16, 2016–17, and 2017–18, it fell into the healthy zone, and in 2012–13 and 2014–15, it fell into the too-healthy zone. All other businesses fall far outside of the "healthy zone" and the "too healthy zone," enjoying robust financial health, a solid financial position, and little risk of insolvency.

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## **Conclusion:**

The financial health of Divi'S Laboratories Ltd., Lupin Ltd., Sun Pharma ltd., Ipca Laboratories Ltd., Cipla Ltd., Dr.Reddy'S Laboratories Ltd., Zydus Lifesciences Ltd., Torrent Pharmaceuticals Ltd. and Aurobindo Pharma Ltd. are excellent except Wockhardt Ltd, based on Altman's Z-Score. So by inference, these businesses are financially stable and safe to invest in. The Z-Score values of these companies are significantly higher than 3, which indicate that these companies remain in highly safe zone in terms of financial health while Z-Score value of Wockhardt Ltd was 2.04 during the study period which indicates that it remain under only "healthy zone" and there is chances of bankruptcy in near future if the companies fails to manages its liquidity, profitability, solvency, activity and leverage in proper manner. The study also revealed that Wockhardt Ltd. declared bankruptcy in the year 2011-12 followed by 2013-14, 2018-19, 2019-20, 2020-21 and 2021-2022 as value of Z-Score in these years were less than threshold limit i.e. 1.80. It follows that the pharmaceutical firms chosen for the study are solvent, with no imminent risk of insolvency or other factors warranting concern for their continued viability in the years ahead. Investors and other stakeholders of these companies may invest freely without any hesitation and feel secure about their investment.

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**Table: 1 Altman’s Z- Score scale for financial health measurement**

| <b>Recommended Score</b>   | <b>Interpretation</b>  | <b>Zones</b>     |
|----------------------------|--|------------------|
| Z Score less than 1.80     | The business will definitely fail and shut down.   | Bankruptcy Zone  |
| Z score between 1.80 and 3 | The business is continuously working to improve its solvency, if no action is taken, than the business may declare bankruptcy. | Healthy Zone     |
| Z Score More than 3        | There is no risk of bankruptcy, and the firm is financially stable.  | Too Healthy Zone |

Source: Author’s Calculation

**Table: 2 Statement showing the Z-score healthy and distressed zone for selected Pharmaceutical companies**

| <b>Sr. No</b> | <b>Name of the Company</b>   | <b>Mean of Z Score Value</b> | <b>Decision</b>  |
|---------------|------------------------------|------------------------------|------------------|
| 1             | Aurobindo Pharma Ltd.        | 3.34                         | Too Healthy Zone |
| 2             | Cipla Ltd.                   | 4.03                         | Too Healthy Zone |
| 3             | Divi'S Laboratories Ltd.     | 5.77                         | Too Healthy Zone |
| 4             | Dr.Reddy'S Laboratories Ltd. | 3.76                         | Too Healthy Zone |
| 5             | Ipca Laboratories Ltd.       | 4.06                         | Too Healthy Zone |
| 6             | Lupin Ltd.                   | 4.74                         | Too Healthy Zone |
| 7             | Sun Pharma Ltd.              | 4.38                         | Too Healthy Zone |
| 8             | Torrent Pharmaceuticals Ltd. | 3.57                         | Too Healthy Zone |
| 9             | Wockhardt Ltd.               | 2.04                         | Healthy Zone     |
| 10            | Zydus Lifesciences Ltd.      | 3.58                         | Too Healthy Zone |

Source: Author’s Calculation

**Table: 3 Analysis & Interpretation of Altman's Z-Scores**

| Year      | AUROBINDO PHARMA LTD. | CIPLA LTD. | DIVI'S LABORATORIES LTD. | DR.REDDY'S LABORATORIES LTD. | IPCA LABORATORIES LTD. | LUPIN LTD. | SUN PHARMA LTD. | TORRENT PHARMACEUTICALS LTD. | WOCKHARDT LTD. | ZYDUS LIFESCIENCES LTD. | MEAN | CV   |
|-----------|-----------------------|------------|--------------------------|------------------------------|------------------------|------------|-----------------|------------------------------|----------------|-------------------------|------|------|
| 2010-2011 | 2.51                  | 4.20       | 5.26                     | 3.42                         | 3.85                   | 4.27       | 6.26            | 3.57                         | 1.16           | 4.88                    | 3.94 | 0.36 |
| 2011-2012 | 1.74                  | 4.23       | 5.23                     | 3.49                         | 3.78                   | 4.72       | 6.22            | 3.51                         | 2.25           | 3.71                    | 3.89 | 0.34 |
| 2012-2013 | 2.29                  | 4.13       | 4.93                     | 3.31                         | 4.31                   | 5.45       | 7.21            | 3.59                         | 5.19           | 3.15                    | 4.36 | 0.32 |
| 2013-2014 | 3.49                  | 3.59       | 5.31                     | 3.75                         | 4.89                   | 6.59       | 5.28            | 3.90                         | 1.68           | 3.85                    | 4.23 | 0.32 |
| 2014-2015 | 4.57                  | 4.06       | 5.44                     | 3.83                         | 3.43                   | 8.37       | 4.02            | 3.64                         | 3.45           | 4.94                    | 4.58 | 0.32 |
| 2015-2016 | 4.31                  | 4.00       | 6.54                     | 3.99                         | 2.97                   | 5.99       | 4.21            | 4.62                         | 2.34           | 4.55                    | 4.35 | 0.28 |
| 2016-2017 | 4.21                  | 4.00       | 4.01                     | 3.68                         | 3.22                   | 5.20       | 3.66            | 3.90                         | 1.95           | 3.39                    | 3.72 | 0.22 |
| 2017-2018 | 3.38                  | 3.87       | 4.52                     | 3.07                         | 3.30                   | 3.41       | 2.81            | 2.12                         | 2.05           | 3.42                    | 3.20 | 0.23 |
| 2018-2019 | 3.56                  | 3.99       | 5.91                     | 4.12                         | 4.13                   | 3.57       | 2.81            | 2.92                         | 1.23           | 3.07                    | 3.53 | 0.34 |
| 2019-2020 | 3.00                  | 3.55       | 6.10                     | 4.03                         | 4.60                   | 3.06       | 2.70            | 3.01                         | 0.46           | 2.50                    | 3.30 | 0.44 |
| 2020-2021 | 3.82                  | 4.20       | 8.11                     | 4.50                         | 5.46                   | 3.53       | 3.13            | 3.75                         | 1.72           | 2.84                    | 4.11 | 0.42 |
| 2021-2022 | 3.25                  | 4.51       | 7.93                     | 3.94                         | 4.79                   | 2.74       | 4.28            | 4.28                         | 0.98           | 2.64                    | 3.93 | 0.46 |
| Mean      | 3.34                  | 4.03       | 5.77                     | 3.76                         | 4.06                   | 4.74       | 4.38            | 3.57                         | 2.04           | 3.58                    | 3.93 |      |
| CV        | 0.25                  | 0.07       | 0.22                     | 0.10                         | 0.19                   | 0.35       | 0.35            | 0.18                         | 0.62           | 0.23                    |      |      |

Source: Author's Calculation