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Predicting Bankruptcy Risk of Domestic Pharmaceuticals Company in Bangladesh Using Altman's Z Score Model

Bachelor's thesis

International Business Administration, specialization in accounting

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and all works, important standpoints, and data by other authors

have been properly referenced and the same paper

has not been previously presented for grading.

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ABSTRACT

Bankruptcy risk is one of the major business risks that could lead a firm toward dissolution or capital restructuring. This study aims to predict the riskiness of the pharmaceutical industry in Bangladesh using the Altman Z score model and to empirically investigate the impact of each component on the overall z score of the selected companies. This study has selected 9 publicly listed companies that are listed on the Dhaka Stock Exchange (DSE), while the data was collected from the annual report of companies from 2015 to 2020. This study used Altman's Z score model to categorize the companies into the "Distress", "Grey", and "Safe" categories to predict the bankruptcy risk of the company. A one-sample t-test was performed and found that the pharmaceutical industry is at a significant risk of bankruptcy. Besides, the pooled regression and generalized least square regression have shown that the one unit change in each component of the Z score model has a significant impact on the overall Z score in a diverse manner. This study is a novel contribution to the literature of the pharmaceutical industry, which would be used by policymakers while establishing different policies to reduce the bankruptcy risk of the companies.

Keywords: Pharmaceuticals, Z score, financial distress, Bankruptcy,

INTRODUCTION

Financial distress is generally referred to as the situation when a firm faces difficulties to meet short-term financial obligations. Using debt capital in a capital structure necessarily incurs some financial obligations in exchange for enjoying a tax shield for leveraging the capital structure. The static theory of capital structure postulates that the firm can use debt capital in its capital structure up to the point where the marginal benefits of the tax shield and the marginal cost of leverage equal each other (Ross et al. 2005). Debt capital allows the firm to get a tax advantage because of the tax-exemption feature of interest on debt capital. However, the benefits from tax exemption outweigh the cost of financial obligations after exceeding the optimal level of debt capital. This excess cost leads the firm towards financial distress, and subsequently toward bankruptcy at its extreme.

The empirical works of literature have revealed that Bangladesh's manufacturing firms are highly leveraged and the consequences for financial stability are quite alarming. Studies have found that approximately half of the textile firms are facing financial distress because of excessive debt capital in their capital structures (Ali et al. 2016).

This study aimed to identify the current condition of pharmaceutical firms regarding financial distress using Altman's Z score model from 2015 to 2020. Altman (1993) developed a model to predict the financial distress and bankruptcy of firms that use debt capital in their capital structure. This model is quite popular for manufacturing firms to know the possibilities of financial distress. The pharmaceutical industry is one of the most profitable industries in terms of the export income of the Bangladesh economy.

Financial difficulty has a wide range of negative consequences for a business. The expense of bankruptcy diminishes a company's ability to utilize borrowed funds for productive reasons. Both direct and indirect expenses are associated with financial difficulty. Legal and administrative costs are the direct costs of financial distress, and they are incurred for legal proceedings, auditing and

accounting activities, the liquidation process, and other similar activities. Many indirect expenses are extremely difficult to quantify. Distress hinders a company's ability to execute routine business operations. The pharmaceutical industry accounts for a significant volume of international trade in the Bangladeshi economy. The amount of debt capital has risen in the manufacturing sector as well as in the pharmaceutical industry. Excess debt capital may rise the risk of bankruptcy.

Numerous empirical studies have contributed to the literature examining the risk of bankruptcy and financial distress of different types of publicly listed manufacturing firms in Bangladesh, while the pharmaceutical industry was somehow left behind to be empirically investigated in terms of bankruptcy risk using the Altman Z score model. To facilitate the contribution to the literature, this study aimed to empirically investigate the risk of the pharmaceutical industry in Bangladesh using the Altman Z score model from the data from 2015 to 2020 for the selected companies. This study is a novel contribution to the empirical literature that has hypothesized that the pharmaceutical industry of Bangladesh is not free-from bankruptcy risk rather the companies are at significant risk of being bankrupt in near future. Since there are few pieces of empirical literature focusing on the scenario of the pharmaceutical industry of Bangladesh, this study has aimed to calculate the z score of the selected companies of the pharmaceutical industry and assess the riskiness of this industry using the Altman Z score model.

This thesis is organized as follows: The first chapter examines bankruptcy definitions, a theoretical framework with various concepts related to literature, two bankruptcy theories, and three developed bankruptcy prediction model, as well as a short summary of Bangladesh's pharmaceutical business. The second chapter examines the methodology of the study, which covers data collection, sample size, objective, and model specification. The third chapter addresses the empirical analysis and results, summary of findings, recommendations and the conclusion is illustrated in the fourth chapter.

1. THEORETICAL BACKGROUND

This part of the thesis provides the theoretical framework for different concepts that are discussed throughout the thesis, as well as the foundation concept of the area of study that this thesis is intended to answer. This part has discussed the basics of financial distress; the previous literature that is relevant to this thesis; the critical discussion of these relevant works; the methodology and

models that were followed in previous works; the Altman's Z score model; and the corresponding determinants of this model.

1.1 Defining Bankruptcy

The definition of bankruptcy is the first problem that needs to be settled or concurred upon before discussing the further theoretical aspect of the study. The terms "failed businesses" or "business failure" were used in a few early research reports between 1930 and 1965, but it did not clarify in legal terms "are these firms insolvent" or just underperforming when compared to more successful organizations (Bellovary et al. 2007). The term "bankruptcy" was first introduced in 1966 (Beaver 1966) and has been commonly used ever since to indicate the failure of a business.

Bankruptcy is a state where the financial obligations of a firm are greater than the equity capital of that firm. Using excessive debt capital in a capital structure can cause fixed financial obligations, and a firm could be suffering from paying off the financial obligations from its earnings. That is why it is important to predict the risk of bankruptcy so that the management can get to know the upcoming threats and take the necessary measures.

Financial distress has been defined as the state of declined revenue, shortage of cash, and deferred debt (Chen 1983). It is generally termed when a firm has inadequate cashflows to meet its fixed financial obligations that lead the firm toward either bankruptcy or capital restructuring. The level of financial distress of each firm might not be the same. Foster (1986) has termed the four stages of financial distress of a firm regarding debt payments, liquidity capacity, dividend payments, and bond default.

There are differences between financial distress and bankruptcy. A firm that is in financial distress might face difficulties in paying off the debt, but, simultaneously, it might not be in the position of bankruptcy. It's hard for a company to pay its debts if it goes bankrupt, but a company that is in debt might have problems only (Lim et al. 2012).

Cash is the most liquid asset that a firm uses to meet its financial obligations. The firm reserves the liquid or short-term assets that are created by cash inflows and reduced by the outflows of cash to meet debt obligations. A firm can be said to be solvent if the cash inflows of the firm become greater in amount than the outflows of cash. Insolvent businesses are more likely to run out of money or not be able to pay their debts when they become due (Lim et al. 2012).

The financial metrics of a company are the most crucial factors in measuring the bankruptcy risk of the company. A firm might be categorized as "excellent" if the financial metrics indicate a healthy condition of liquidity capacity, profitability, efficiency, and net worth, while poor financial metrics would predict the risk of bankruptcy of the firm.

1.2.1 Bankruptcy Theories

The theories relating to bankruptcy are the most crucial factors to understand while discussing bankruptcy issues with companies. The bankruptcy of a company requires its stakeholders to be aware of their stake in the company's worth, and several theories have discussed the rule of distributing stakeholders' ownership in case of bankruptcy.

1. **The Creditor Bargaining Theory:** The Creditor Bargaining Theory was developed by Professor Jackson (Jackson 1982), acknowledging that corporate bankruptcy could act as a collective remedy for corporate creditors. This theory proposes that the rights of creditors of a defaulted debtor should be paid on a collective basis that enables the debtor to decide the deployment of the company's assets if it is going to liquidate or reorganize the capital structure of the bankrupt company (Ayotte & Jr 2013). This theory opposes the common law of the first claim principle, since the unsecured creditors would get paid as soon as they submit their claims to the defaulted debtor. This practice could minimize the opportunity for the debtor to reorganize the company and would eventually divide it into pieces. The creditor bargaining theory mitigates the possible race of the creditors in submitting the property claims to the courthouse and allows the debtor and creditors to make a collective decision that is economically efficient for all of the parties involved in the bankruptcy event. However, the creditors should pursue their interests in case of failing to make an efficient decision (Jackson 1982).
2. **The Absolute Priority Rule:** The absolute priority rule postulates that the claims of creditors should be paid in case of bankruptcy following the time they were created (Ross et al. 2005). This rule proclaims the general notion that the creditors should be paid first, and the equity holders will be paid if there are any assets left after the creditors are satisfied. Moreover, the secured creditors should get priority over the unsecured creditors in case of a bankruptcy liquidation. However, there is a significant violation of this rule in practice

that takes place in the case of unsecured creditors and equity holders (Weiss 1990) for several reasons, including the tendency of the creditor to avoid litigation costs.

The creditor bargaining theory proposes to make an efficient decision that is collectively beneficial to all, while the absolute priority rule only proposes the order of payment to the stakeholders in case of bankruptcy. This study has focused on the creditor bargaining theory to recommend efficient policies for companies.

1.3 Bankruptcy Prediction Models

1.3.1 Altman's (1993) Z-Score Model

Altman (1993) developed a model to predict the financial distress and bankruptcy risk of firms that use debt capital in their capital structure. This model is quite popular for manufacturing firms to know the possibilities of financial distress. As Beaver (1966) developed a model using univariate discriminant analysis to predict bankruptcy and compare the financial ratios of distressed and non-distressed firms, Altman (1993) developed a new model by extending the previous model of Beaver (Beaver 1966) by incorporating the MDA, or multiple discriminant analysis techniques, and this is the first study to use the multivariate technique.

Multiple discriminant analysis has allowed the model to assign specific weights to each of the components concerning their contribution to the interaction with the dependent variable. The MDA has also allowed the model to incorporate effect of all ratios on the score. Another advantage of this model is that it uses financial metrics rather than only using the qualitative indicators of the financial performance of the company. Besides, using the factors that could lead a firm toward bankruptcy has ensured the high accuracy of redictability of this model (Altman et al. 2017).

The main criticism of this model is that the predictability of Altman's Z Score (AZS) model has been questioned in many studies. A recent study (Heaton 2020) has postulated that the model is quite obsolete in predicting bankruptcy as it does not consider the market factors affecting the bankruptcy. Moreover, another study (Russ et al. 2004) has suggested incorporating new components into the model itself. One of the model's major limitations is its applicability and rationality in current market conditions. The model was developed in the early 1990s and was

based on the sample companies selected by Altman, irrespective of their size. Besides, current market conditions have changed significantly more in recent years than in the 1990s. Moreover, the model is inapplicable to small companies that have a total asset value of less than $1 million. In the z score, the ambiguity of accounting practice isn't taken into account by the components. The value of the components is based on the company's corporate decisions and financial policy, which could be changed to make the z score go against the real situation.

1.3.2 Ohlson O-Score Model

Despite the wide use of the Altman Z Score model (Altman, 1993) it is criticized a lot because of its limitations regarding the normality of multivariate assumption and the independence of explanatory factors. Ohlson (Ohlson, 1980) has addressed these limitations and developed a new model using logit analysis assumptions with the set of nine different financial ratios. This model was developed from a study that had considered the case of 2000 companies while the original Altman z score model had only considered 66 companies to develop the model. That is why this model has resulted in increased distress predictability than that of the Z-score model. This model is of binomial. However, this model is still lacking the incorporation of market factors that drive the probability of bankruptcy.

1.3.3 Blums D-score Model

One of the major limitations of the previous two models is that they are lacking a strong conceptual framework. Blums (2003) has addressed this issue and developed a new model, namely the D-score model. While the debate has been in the field of academia for a long period that if the predicting models should be market-based and incorporate market factors that are crucial in causing firms to be bankrupt, this model has made an impactful contribution to this debate. The accounting-based model only uses accounting indicators to predict the bankruptcy of the firm, while this type of model lacks the market factors to be considered to predict with more accuracy. The D-score model has outperformed the other models regarding the market related factors because this model has incorporated the market-related and accounting factors with the strong conceptual framework that the previous models were lacking. Incorporating the accounting-based and market-based factors into a single independent model has increased the implacability of this model. However, the accuracy level of this model is only 70.7% (Ashraf et al. 2019), which is far behind the other accounting-based models in terms of level of accuracy.

1.4 Related Literature

The Z-Score model of Altman is used to assess a company's financial difficulty. Financial distress is described by (Ross et al. 2005) as a condition in which a company's operational cash flows are insufficient to pay short-term obligations. A study on the Bangladeshi cement industry used Altman Z score model to predict the risk of bankruptcy and found that the industry is at a significant risk of bankruptcy while most of the firms are at a risk of bankruptcy (Mizan & Hossain, 2014) except for two firms. Another study, (Jahur & Quadir 2012) looked at the causes and solutions to SMEs' financial difficulties in Bangladesh. They discovered that financial difficulty had a negative influence on sales, management competence, financial planning, and other aspects of the business. Poor fund management, financial control, and profitability were among the causes of the financial disaster. Using Altman's Z score methodology, (Ali et al. 2016) assessed the financial integrity of 18 textile enterprises in Bangladesh. According to the survey, 28 percent of firms are in the safe zone, 22 percent are in the grey zone, and 50 percent are in the distress zone. A group of researchers conducted research to uncover the financial hardship of Bangladesh's publicly traded pharmaceutical firms. Two of the six enterprises studied were found to be in the safe zone, with no risk of bankruptcy (Mizan et al. 2011). However, the other four firms were most likely to go bankrupt within a few years. During the period from 2014 to 2018,

During the period 2011–2015, Sajjan (2016) performed research to estimate the likelihood of bankruptcy of both manufacturing and service-oriented enterprises listed on Indian stock exchanges. According to the findings, most businesses are financially challenged and may file for bankruptcy in future years. In her study, Pradhan (2014) calculated Z scores for three Indian commercial banks from 2001 to 2008, and then used these numbers and a neural network to calculate Z ratings for future years. According to the study, every year the scores were over 6, and every observation was in the safe zone. His thesis (Aasen 2011) used Altman's Z-score methodology to quantify the financial distress of 180 publicly traded Norwegian companies. According to the study, manufacturing enterprises had a lower Z-score than non-manufacturing firms. The issuing of stock has a favorable relationship with financial difficulty. Siddiqui (2012) stated that distress may be successfully projected using the Z score model 3 years after summarizing Altman's findings. In their study, (Khaddafi et al. 2017) studied the Z scores of 29 Indonesian banks from 2011 to 2013 and found a significant number of banks in the financially

distressed zone every year, along with the firms that were in the "safe zone" falling into the distress zone.

(Gopalakrishnan et al. 2019) conducted research to analyze the financial health of ten Indian steel businesses. The biggest cause of financial instability, according to the study, was a drop in working capital. Two huge and ancient steel businesses were in the distress zone, while two minor steel enterprises were in the safe zone. (Iheduru & Okoro 2018) looked at the factors that influence retained profits in Nigerian-listed manufacturing enterprises. According to the study, the price of oil has a beneficial impact on manufacturing company retention, while the conversion rate and lending rate have a negative impact. In their study, (Hillary et al. 2018) looked at the influence of financial solvency and strength on the competency of Kenyan-listed manufacturing businesses from 2011 to 2015. The Z score methodology was used to assess financial health. According to the findings, using the debt-to-equity ratio as a measure of solvency has a negative and small influence on financial performance. One business was in the grey zone, three were in crisis, and five were in the safe zone, out of a total of nine. (Egbunike et al. 2019) investigated the relationship between financial hardship and profitability in 21 consumer product companies listed on the Nigerian stock exchange.

Return on assets was favorably connected to financial hardship, although gross profit margin was adversely related. (Masum & Johora 2012) used the Z score to examine the financial health of four ceramic enterprises in Bangladesh from 2006-07 to 2010-11. According to the findings, two enterprises were in trouble and two firms were in the grey zone in the first year of the research period. In 2010–11, the enterprises in the crisis zone transitioned to the safe zone, implying that the financial health of ceramic companies was steadily improving. In their study, (Ikpesu & Eboiyehi 2018) looked at the influence of capital structure on financial distress in Nigerian manufacturing enterprises. The long-term debt-to-asset ratio was employed as a capital structure indicator, and Altman's Z score was utilized to assess financial distress. According to the findings, the long-term debt to asset ratio has a negative impact on financial hardship, but profitability, tangibility, and business age have a positive impact. In their study, (Sadiq et al. 2017) discovered that the right mix of debt and equity capital maximizes a bank's return on investment.

1.4.1 Justification of Choosing Altman Z score Model

Despite the limitations of this model, it is argued that the model is still ahead of other contemporary prediction models in predicting bankruptcy (Ashraf et al. 2019). This model is quite effective in predicting the level of bankruptcy risk before two years of distress, and the predictability declines simultaneously with the increase in time before distress. The Altman Z score model is quite satisfactory as it has outperformed the level of accuracy in predicting bankruptcy compared to the other market-based models (Altman et al. 2017; Karam Zadeh 2013; Renalita & Tanjung 2020). Although there are some other market-based and hazard-based models, the accounting-based model of Altman performs well in predicting short-term bankruptcy with more accuracy compared to the Ohlson O-Score and Blums D-Score models.

1.5 Brief Overview of the Pharmaceuticals Industry of Bangladesh

The pharmaceutical industry is one of the most developed industries in Bangladesh with the efficient use of modern technology (BAPI 2021). This industry is quite self-sufficient in that it meets approximately 98% of local demand, while 54 local companies export drugs and related raw materials to 148 overseas countries (Bangladesh Economic Review 2021). The pharmaceutical industry of Bangladesh is currently comprised of more than 300 companies (ITA 2021), including 13 publicly listed companies on the Dhaka Stock Exchange, the major stock exchange of the country, while the major ten manufacturers hold two-thirds of the total market share (ITA 2021).

Despite the industry's starting in the early 1950s, it started to expand after the liberation in 1971 with some local and foreign companies. The companies were exempted from the patent rules under the "British Patent and Designs Act-1911" as a least developed country category at that time. Since its inception, the industry has grown to become one of the most developed in the country, ranking 71st out of 134 countries in the world as a global exporter (Hossan 2021). This industry has contributed 1.83% of the total GDP of the country (Hossan 2021) with a market value of approximately $3 billion in 2021, followed by annual growth of approximately 10.72% in the respective year (BAPI 2021). The pharmaceutical industry of Bangladesh earned a total of $3,195 million in revenue in 2021, while the industry earned a total of $2,886 million in 2020.

The pharmaceutical industry of Bangladesh produces different types of generic medicine, including medicine for metabolism systems, nervous systems, cardiovascular systems, respiratory systems, skeletal systems, and systematic anti-infectives since its early inception in the 1980s

(BAPI 2021). The industry has made it possible to export $169 million in the fiscal year 2021 by exporting to approximately 150 overseas countries (ITA 2021).

The increase in the industry size and its growth has brought some financial issues that have caused the companies to fall into difficulties in meeting financial obligations raised from the short and long-term debt capital. The Altman z score of the companies was calculated to show the trend of the average z score for each year throughout the study period.

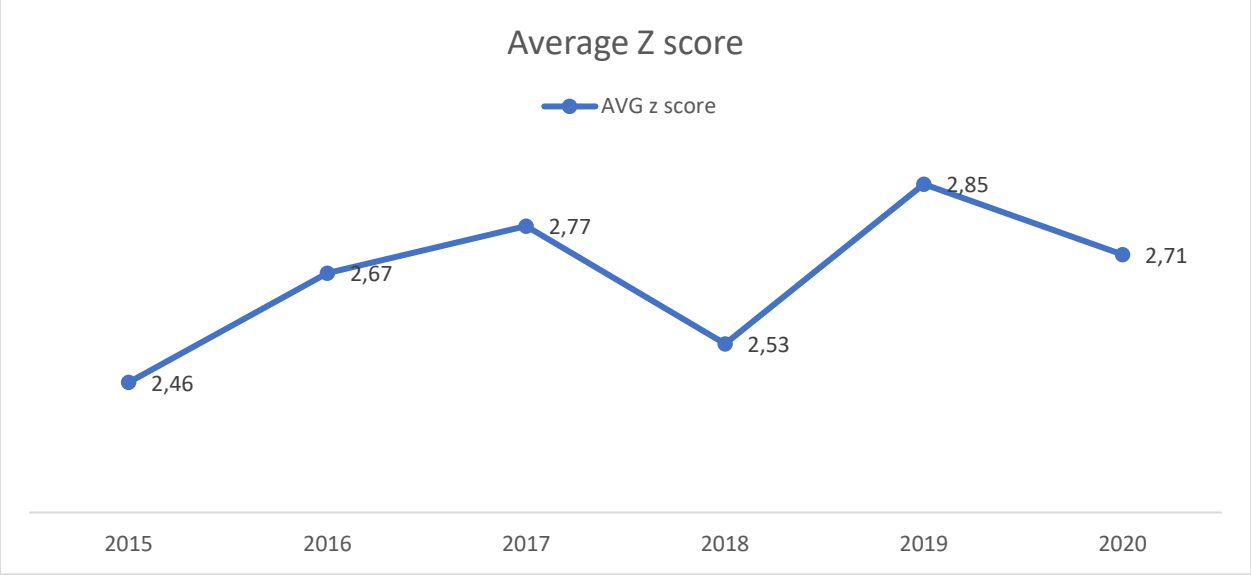

Figure1: Average Z score of each year of the pharma industry; Source: Author's calculation.

The graph shows the average z score of the selected companies each year was greater than 1.81 (z score > 1.81) revealing that the industry is in a grey zone regarding the risk of bankruptcy.

$H1_0$: The pharmaceutical industry of Bangladesh is not in a risk-free position of financial distress under the z score model.

$H1_a$: The pharmaceutical industry of Bangladesh is in a risk-free position of financial distress under the z score model.

2. METHODOLOGY

2.1 Research Design

This study aims to calculate the Z score of the pharmaceutical industry in Bangladesh and thus predict the risk of bankruptcy of this industry. To facilitate this objective, the study is designed using a two-step strategy. The first strategy is to calculate the Z score using the Altman Z score model (Altman 1993) for each company and each year of the study period, thus labeling the firms as "Safe", "Grey", or "Distress". The study has empirically investigated the impact of each of the components of the Z score model on the overall Z score to calculate the magnitude of the impact of explanatory factors on the dependent variable. This second step has shown the effects of the change in the model's components on the Z score, including how the score changes with the change in debt, equity, and other factors.

2.2 Data and Sample

This study is deliberately concentrated on the pharmaceutical industry of Bangladesh for some crucial reasons. The fundamental reason is the lack of empirical literature on this industry in Bangladesh. The study has considered the pharmaceutical companies listed on the Dhaka Stock Exchange (DSE) and those engaged in active trading. There are 13 listed public limited companies in this industry. The data of these listed firms has been collected from the annual report that is published on the official websites of the corresponding companies (see Appendix). The study has considered investigating the data of these companies from 2015 to 2020.

Description	Number of companies	Ratio of the population
TOTAL PUBLICLY LISTED COMPANY	13	100%
SAMPLE TAKEN	09	70%
SAMPLE EXCLUDED	04	30%

Source: Author's Own Calculation

The sample for this research consists of nine companies chosen based on the information provided in their annual reports. Despite the existence of 13 publicly traded pharmaceutical companies on the Dhaka Stock Exchange (DSE), this research chose just nine companies since four companies' annual reports lacked the necessary information.

2.3 Aim of the study

This study has the following aims to answer the research question mentioned above.

1. To analyze the riskiness measured by the Z score of pharmaceutical firms in Bangladesh.
2. To investigate the impact of the model's component on the overall Z score.

2.4 Model specification

This study will use Altman's (Altman 1993) Z score model which was developed by Altman to predict the risk of financial distress and the risk of bankruptcy. This model is used to predict the bankruptcy risk of publicly listed manufacturing firms though an updated formula has been introduced for private manufacturing firms too (Ross et al. 2005). The model is stated as follows.

$$Z = 1.2X_1 + 1.4X_2 + 3.3X_3 + 0.6X_4 + 1.0X_5$$

Here,

1. $X_1 = \frac{Net\ Working\ Capital}{Total\ Assets}$

A company's net working capital to total assets ratio is an indicator of the liquidity capacity of a company that allows the company to meet its current financial obligations with its current assets. The net working capital reflects the volume of assets that have been deployed as current assets against the current liabilities of the company. Net working capital is the difference between total current assets and total current liabilities. The relative measure of net working capital to total assets reveals the capacity to pay fixed financial obligations on-demand, while the greater score indicates a greater liquidity capacity.

2. $X_2 = \frac{Accumulated\ Retained\ Earnings}{Total\ assets}$

This component is the indicator of profitability. Accumulated retained earnings is the measure of cumulative reinvested profit or loss since the inception of the company. It has a strong relationship with EBIT as the undistributed profit is generally transferred to the retained earnings fund.

3. $X_3 = \frac{EBIT}{Total\ Sales}$

This ratio reveals the efficiency of a company as the earnings before interest and tax (EBIT) result from the differences between the gross profit and the operating expenses. A company that has an

efficient cost control strategy can minimize the volume of operating expenses and eventually have a declining EBIT for the respective accounting period.

4. $X_4 = \frac{Market\ Value\ of\ equity}{book\ value\ of\ debt}$

The market value of equity to book value of debt ratio unpacks the net worth of a company by how much equity the company possesses against each unit of debt capital in the capital structure. A low equity-debt ratio indicates that the company is mostly financed with debt capital and has a leveraged capital structure. The market value of the equity could be calculated by multiplying the year-end market value of the equity shares by the total number of shares outstanding in the corresponding year, while the book of debt could be found in the liabilities section of the statement of financial position of the company.

5. $. X_5 = \frac{Sales}{Total\ assets}$

The sales to total assets ratio are the indicator of asset utilization, or how much income has been generated by using the assets of the company. A high ratio of asset utilization indicates that the company has the capacity to earn cash inflows using its assets, while a lower ratio reveals the inefficiency of the asset's utilization.

2.5 Data Analysis Technique

This study has used different parameters of descriptive statistics, including mean and standard deviation, to calculate the central tendency and the dispersion of the Z score of each company. Besides, the study has also shown the impact of each of the components of the model on the overall Z score of each company. However, this study has identified the distress or safe zone of the companies in the concerned industry.

3. EMPIRICAL ANALYSIS AND RESULT

3.1 Calculation of Company-wise Z score and its components

Table 3.1.1: The ACME Laboratories Ltd.

YEAR	NWC/TA	RE/TA	EBIT/TA	MV/TL	TS/TA	Z SCORE	Category
2015	0.01	0.12	0.06	0.69	0.49	1.27	Distress
2016	0.11	0.11	0.05	0.83	0.44	1.39	Distress
2017	0.08	0.13	0.07	0.61	0.45	1.33	Distress
2018	0.03	0.15	0.06	0.39	0.45	1.14	Distress
2019	-0.02	0.16	0.05	0.44	0.45	1.09	Distress
2020	0.02	0.16	0.05	0.46	0.48	1.18	Distress
Average	.037	0.138	0.057	0.572	0.463	1.23	Distress

Source: Author's Own Calculation

This table is showing the Z score and the value of its components in each of the years under the study period. The company has been facing financial distress since 2015. The z score of the company is too low compared to the average range prescribed by the model itself. The company facing financial distress because of the consistent lower z score than the z score of 1.81 which is considered the grey margin. The EBIT to total assets ratio is consistently poor over the study period with an average ratio of only 5.7% (0.057) with the highest value of 7% in 2017. The consistent poor EBIT to total assets ratio has resulted in lower cash inflows that have negatively resulted in the net working capital to total assets ratio. The net working capital to total assets ratio is also consistently low with a negative value of (-0.02) in 2019 which indicates that the current liabilities were greater than the total amount of current assets. The average net working capital to total assets ratio is only 3.7% (0.037) which indicates the company has kept only 3.7% of its total assets as net working capital. The lower amount of net working capital has resulted in the lower capacity of short-term debt payments compared to a company that maintains a healthy working capital volume. The ratio of the market value of equity to the book value of debt has been facing a subsequent decline throughout the study period that indicates that the company has kept increasing the value of the debt in its capital structure. Besides, the market value of the share of this company is declining which might have affected the market of the equity capital of the company to decrease.

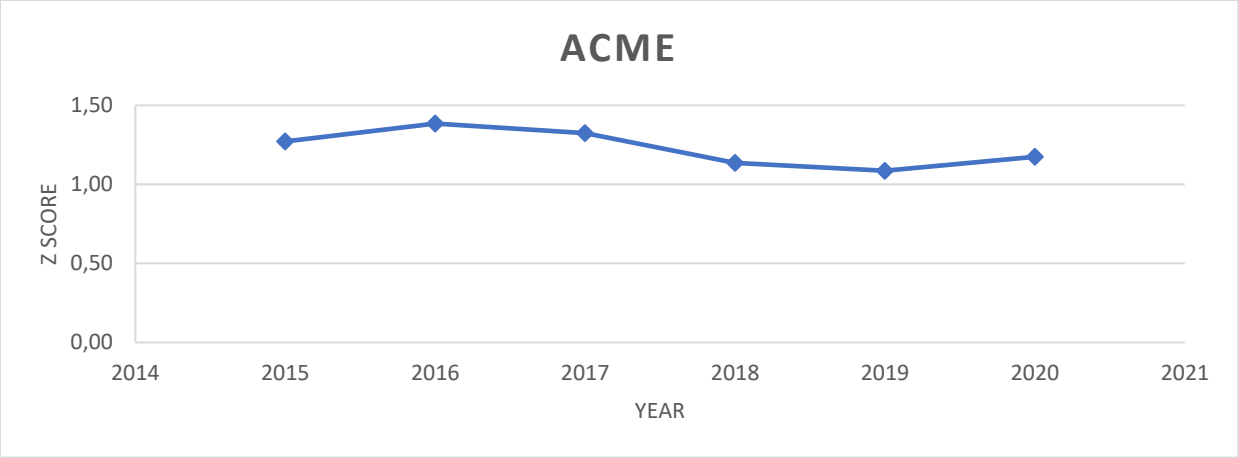

Figure 2: The ACME Laboratories Ltd. Source: Author's Own

The graph shows that the yearly z score of ACME Laboratories Limited has fluctuated over the study period while it had declined in earlier years till 2018 and has been followed by a rise in z score since 2019. This rise in z score indicates that the risk of bankruptcy of this company has started to decrease with the increase in financial stability of the company.

Table 3.1.2: AMBE Pharmaceuticals Ltd.

YEAR	NWC/TA	RE/TA	EBIT/TA	MV/TL	TS/TA	Z SCORE	Category
2015	0.04	0.07	0.02	2.16	0.79	2.28	Grey
2016	-0.07	0.07	0.01	2.20	0.41	1.77	Distress
2017	-0.10	0.07	0.02	4.11	0.78	3.30	Safe
2018	-0.09	0.07	0.02	2.18	0.79	2.17	Grey
2019	-0.10	0.07	0.03	2.67	0.80	2.48	Grey
2020	-0.09	0.07	0.01	2.57	0.67	2.23	Grey
Average	-0.068	0.070	0.019	2.650	0.704	2.37	Grey

Source: Author's Own Calculation

This table shows that the z score of this company throughout the study period has been fluctuating as the company has been experiencing the grey zone between distress and safe in 2016 and 2017 respectively. The z score of this company has experienced two recent breakdowns in 2016 and 2018 and, fluctuated till 2020, though the z scores are within the grey area. The EBIT to total assets ratio of the company has an average value of approximately 2% (0.019), which indicates the poor capacity to earn pre-tax profit using the company's assets. The net working capital to total assets

ratio of the company is consistently negative except for the year 2015, which indicates that the current liabilities of the company are greater than the current assets of the company. As the current assets are lower than the current debt of the company, the company will eventually face difficulties in meeting the short-term financial obligations with its current assets and has a 95% chance of being bankrupt within 1 year as the z score of the company after 2017 is lower than the z score of 2.68, which is the margin that predicts the possibility of bankruptcy within 1 year. The retained earnings to total assets ratio had a consistent value of 7% (0.07) throughout the study period. However, the market value of equity to the book value of debt is quite satisfactory, with an average value of 2.65, which indicates that the company has more equity value than the value of its debt over the period. Besides, the company is holding the average capacity of generating sales using the assets at approximately 70% (0.704) level with slight fluctuations.

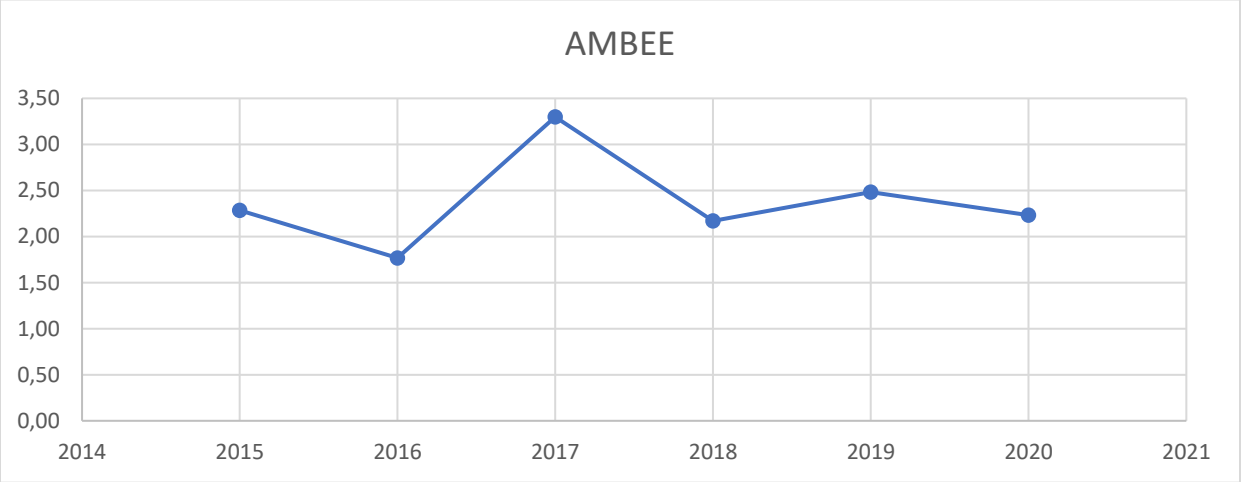

Figure 3: AMBE Pharmaceuticals Ltd; Source: Author's Own

The graph shows that the yearly z score of this company has fluctuated over the study period with a great variety in z scores, which concludes that the company is at risk of bankruptcy in the future as their capacity to meet financial obligations is fluctuating. The continuous fluctuation in the z score indicates that the risk of bankruptcy of this company has started to increase with the fluctuation in its financial stability.

Table 3.1.3: Beacon Pharmaceuticals Ltd.

YEAR	NWC/TA	RE/TA	EBIT/TA	MV/TL	TS/TA	Z SCORE	Category
2015	0.30	0.06	0.01	1.07	0.43	1.56	Distress
2016	0.28	0.07	0.01	0.98	0.50	1.57	Distress
2017	0.25	0.07	0.02	0.73	0.58	1.50	Distress
2018	0.22	0.08	0.03	2.11	0.77	2.50	Grey
2019	0.27	0.08	0.03	3.62	0.93	3.65	Safe
2020	0.24	0.10	0.03	7.83	0.78	6.00	Safe
Average	0.261	0.079	0.022	2.726	0.664	2.80	Grey

Source: Author's Own Calculation

This table shows that Beacon Pharma is in the grey zone with an average z score of 2.8, which indicates that the company does not possess the risk of being bankrupt within the next 1 year. The table shows that the z score of this company has been gradually increasing since 2015, with a slight fluctuation in 2017, without changing the status of the company in the financial soundness category till 2017. After 2017, the z score of the company has increased to a satisfactory level with consistent growth till 2020, which has turned the company into a safety concern on the edge of bankruptcy. The company is facing a poor score of EBIT to total assets ratio with an average score of approximately 2% (0.022). Though the score has been gradually increasing over the period, it has not yet increased to a satisfactory level compared to the company that is in the safe zone. The net working capital to total assets ratio has been gradually declining over the period despite the improvement in the overall z score of the company. The increase in each component of the z score model, except for the net working capital to total assets ratio, indicates that the company has increased its capacity in profitability, efficiency, asset utilization, and financial soundness. This company is in a safe zone that has reduced its risk of being bankrupt in the near future.

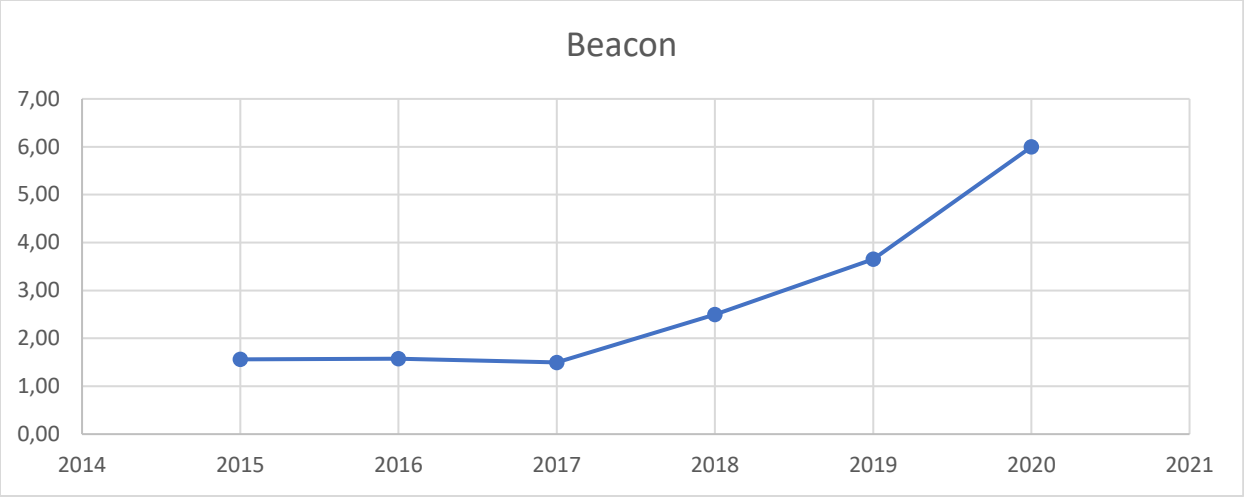

Figure 4: Beacon Pharmaceuticals Ltd; Source: Author's Own

The graph shows that the z score of this company has been gradually increasing since 2015, with a slight fluctuation in 2017, without changing the status of the company in the financial soundness category till 2017. After 2017, the z score of the company has increased to a satisfactory level with consistent growth till 2020, which has turned the company into a safety concern on the edge of bankruptcy.

Table 3.1.4: Beximco Pharmaceuticals Ltd.

YEAR	NWC/TA	RE/TA	EBIT/TA	MV/TL	TS/TA	Z SCORE	Category
2015	0.63	0.30	0.08	0.93	0.45	2.45	Grey
2016	0.18	0.34	0.12	1.17	0.64	2.43	Grey
2017	0.17	0.37	0.08	0.86	0.46	1.97	Grey
2018	0.05	0.34	0.08	0.59	0.41	1.55	Distress
2019	0.02	0.36	0.08	1.62	0.44	2.21	Grey
2020	0.04	0.41	0.09	1.61	0.48	2.36	Grey
Average	0.18	0.35	0.09	1.13	0.48	2.16	Grey

Source: Author's Own Calculation

This table shows the z score and the value of each component of the z score model for Beximco Pharma from 2015 to 2020. The z score of this company shows that it is in the grey zone with an average value of 2.16, which is greater than the value of the distress zone. The EBIT to total assets ratio of this company has fluctuated throughout the study period with an average value of 9% (0.09), which indicates that the company can generate a 9% value of the total assets as its pre-tax

profit. The net working capital to total assets ratio has been showing a simultaneous decline since 2015, except for a slight increase in 2020. This decline in net working capital to total assets ratio has resulted in a decline in the comparative value of current assets, which has eventually resulted in the decline of the overall z score of the company. The total sales to total assets ratio of this company has an average value of 0.48, which is consistent over the study period with slight fluctuations within the same range. The market's equity to book value of debt ratio is greater than 1, with an average value of 1.13, which reveals that the amount of equity is greater than the value of debt. The greater amount of equity compared to the debt indicates that the market price of the shares of this company is increasing in the secondary market and the equity holders are willing to value the company more than in the earlier years. The retained earnings of the company are increasing along with the total assets, which has resulted in the improvement of the retained earnings to total asset ratio. Despite the average value of the grey zone, the company is still at the risk of being bankrupt as the z score of 2020 is lower than the safety margin of 2.68 and the average value is far behind the safe zone. However, the z score of the company is still increasing after 2018 and is consistent throughout the study period except for 2018. The decline in the z score of the company indicates the distress that resulted from the decline in the value of each component of the z score in 2018, which indicates the fall in the overall financial performance of the company. However, the company has managed to overcome the distress zone and continues to improve its overall z score.

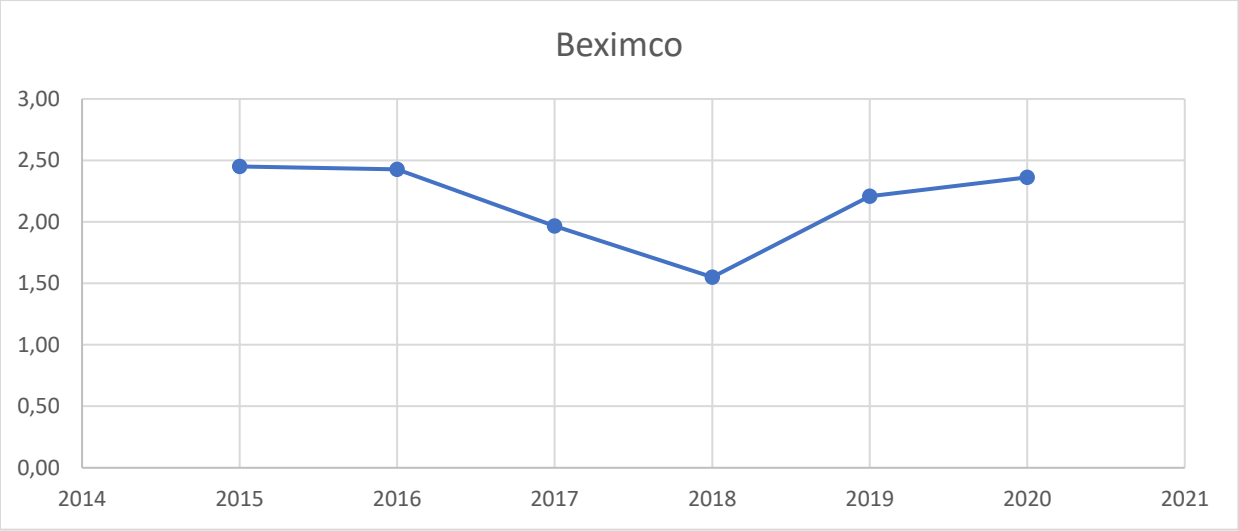

Figure 5: Beximco Pharmaceuticals Ltd; Source: Author's Own

The graph shows that the z score of this company has been experiencing fluctuations since 2016. The consistent decline of the z score till 2018 had termed the firm as risky, while the gradual increase after 2018 has reduced the risk of bankruptcy soon.

Table 3.1.5: Central Pharmaceuticals Ltd.

YEAR	NWC/TA	RE/TA	EBIT/TA	MV/TL	TS/TA	Z SCORE	Category
2015	0.28	0.10	0.10	0.79	0.33	1.62	Distress
2016	0.33	0.08	0.06	0.79	0.20	1.39	Distress
2017	0.37	0.08	0.06	0.63	0.20	1.35	Distress
2018	0.40	0.06	0.03	0.43	0.13	1.07	Distress
2019	0.38	0.03	0.03	0.59	0.12	1.06	Distress
2020	-0.01	-0.68	-0.82	1.17	0.10	-2.87	Distress
Average	0.29	-0.06	-0.09	0.73	0.18	0.60	Distress

Source: Author's Own Calculation

The z score of Central Pharma shows that the company was in a distress zone throughout the study period, with an average z score of 0.60, while the z score of 2020 was negative, which resulted from the negative value of three important components of the z score. The EBIT to total assets of the company has been declining over the study period, with the least of (-0.82) in 2020. The negative EBIT to total assets ratio results from the pre-tax loss of the company as its operating expenses are greater than its markup profit. The average value of EBIT to total assets is also negative, with a 9% loss (-0.09) compared to total assets. The net working capital to total assets ratio of the company had been increasing till 2019 and fell to negative in 2020. The fall in the net working capital to total assets ratio suggests that the current liabilities of the company have outperformed the number of current assets of the company and resulted in a negative amount of net working capital. The ratio of sales to total assets has been declining over the study period and has resulted in a gradual fall in the overall z score as the capacity to earn cash inflows has declined. The decline in the EBIT to the pre-tax loss has resulted in negative accumulated retained earnings for the company in 2020, with a gradual decline over the study period. The equity to debt ratio also shows that the market value of the equity has declined over the period compared to the book value of the debt. This decline has resulted in the value of equity being less than the value of the debt, as the average value of this indicator is 0.73 compared to 1 unit of debt.

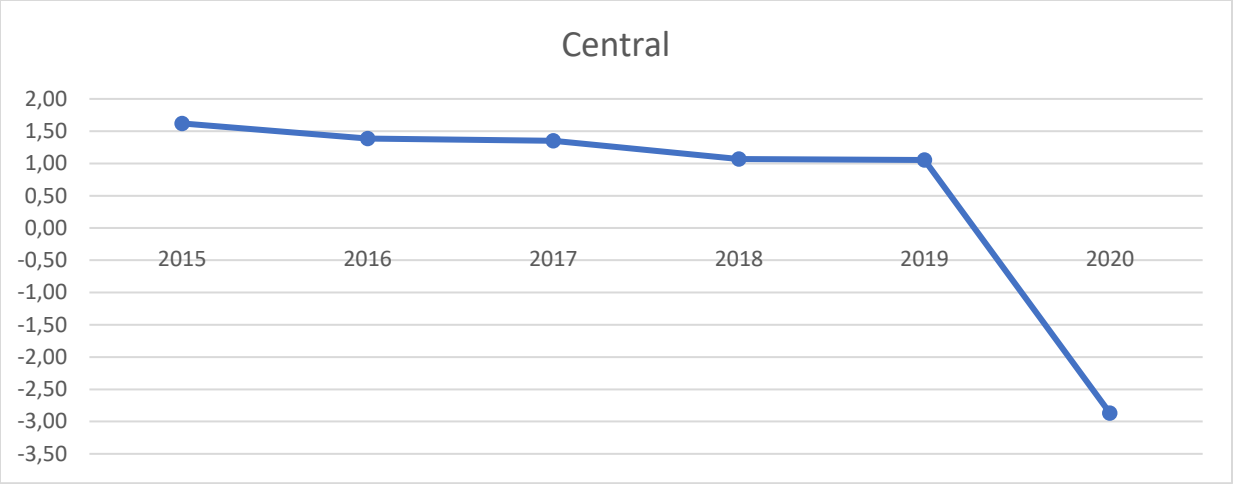

Figure 6: Central Pharmaceuticals Ltd; Source: Author's Own

This company is at great risk of bankruptcy as its z score has declined since 2015, with a straight decline to a negative z score in 2020. This company is at significant risk of bankruptcy soon if the z score, along with overall financial stability, is not improved.

Table 3.1.6: The Ibn Sina Pharmaceuticals Industry Ltd.

YEAR	NWC/TA	RE/TA	EBIT/TA	MV/TL	TS/TA	Z SCORE	Category
2015	-0.06	0.22	0.14	2.28	1.96	4.03	Safe
2016	0.66	0.22	0.17	2.88	2.02	5.39	Safe
2017	0.66	0.26	0.14	3.01	1.86	5.29	Safe
2018	-0.08	0.38	0.23	2.59	1.91	4.66	Safe
2019	-0.06	0.41	0.16	2.70	1.86	4.50	Safe
2020	-0.07	0.43	0.17	2.46	1.80	4.33	Safe
Average	0.17	0.32	0.17	2.65	1.90	4.70	Safe

Source: Author's Own Calculation

This table shows the z score of the IBN Sina pharma along with the value of each component of the z score model from 2015 to 2020. The company has secured a sustained position of being safe from the risk of being bankrupt throughout the last 6 years. The average z score of the company is 4.70, which is much greater than the minimum safety margin of 2.99 as a z score. However, the net working capital to assets ratio has been declining since 2018, which was positive in 2016 and 2017. The decline of net working capital has revealed that the amount of short-term debt has been increasing in recent years compared to the current assets. The more short-term liabilities there are compared to short-term assets, the more difficult it is to pay the fixed financial obligation.

However, the decline of current assets compared to the current liabilities indicates that the company has utilized its fund in earning assets, which has resulted in an average EBIT to total assets score of 17% (0.17). The total sales to total assets ratio has also been declining over the study period except for 2016. Despite the decline in net working capital to total assets ratio and total sales to total assets ratio, the company has managed to maintain being in the safe zone consistently because of less fluctuation in the market value of its equity. Though the market value of equity to the book value of assets ratio is good, it has changed a lot over time, so it's not a good idea to keep it. However, despite the consistent higher z score compared to the industry competitors, the company has been facing a gradual decline in the Z score since 2016, which might be a point of concern for the management of the company. The increased level of EBIT has resulted in an increase in the accumulated retained earnings to total assets ratio throughout the study period.

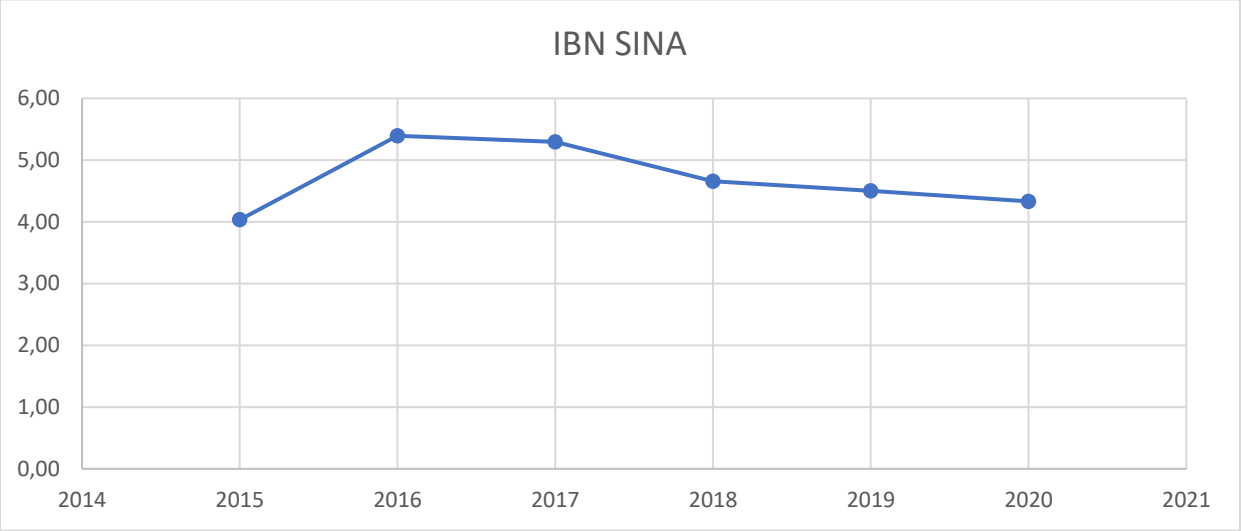

Figure 7: The Ibn Sina Pharmaceuticals Industry Ltd**.** Source: Author's Own

This graph reveals that the company is consistently facing a fluctuation in its z score with a slight decline in the z score over the period. Despite its consistent high z score, this company is at risk of bankruptcy as the z score is declining, which means that the capacity to meet financial obligations is declining even though its current position belongs to the safe zone of the z score category.

Table 3.1.7: Orion Pharma Ltd.

YEAR	NWC/TA	RE/TA	EBIT/TA	MV/TL	TS/TA	Z SCORE	Category
2015	0.24	0.08	0.03	0.62	0.10	0.96	Distress
2016	0.26	0.08	0.02	0.73	0.16	1.07	Distress
2017	0.20	0.05	0.01	0.52	0.12	0.78	Distress
2018	0.28	0.04	0.01	0.35	0.11	0.76	Distress
2019	0.29	0.03	0.01	0.66	0.12	0.95	Distress
2020	0.31	0.02	0.01	1.00	0.11	1.15	Distress
Average	0.26	0.05	0.02	0.65	0.12	0.95	Distress

Source: Author's Own Calculation

This table shows that Orion Pharma is facing difficulties in meeting its fixed financial obligations with its short-term assets as the z score is below the grey margin of 1.81 in each of the years under the study period. The company is in a distress zone and has a significant possibility of being bankrupt within 1 year if the z score improves. The EBIT to total assets ratio of the company is consistently poor, with an average value of 2% (0.02), which has been declining throughout the study period. The decline in EBIT to total assets ratio indicates that the profitability of this company is decreasing as well as its capacity to generate cashflows. The net working capital to total assets ratio has increased over the study period, leading to the conclusion that the company has consistently been deploying its earning assets to pay off its fixed financial obligations to hold its position from being bankrupt. The decline of EBIT to total assets has resulted from the decline of total sales to total assets over time. The decline in turnover has caused the pre-tax profit to fall as well as the cash flows to be lower than before. The declined pre-tax profit has eventually deteriorated the amount of retained earnings of the company. It has been postulated that the company is losing its fund to meet its financial obligation rather than possessing it for future use. The market value of equity to the book value of the debt has been fluctuating over the period, as the ratio has an average value of 0.65, which indicates that the company has higher debt compared to the value of its equity capital. Moreover, the market price of the equity share is declining, which has caused the market value of the equity to fall. However, the gradual increase of the market value of equity to book value of debt after 2016 has made it possible for the company to be a nonbankrupt concern despite the significant risk of being bankrupt within 1 year.

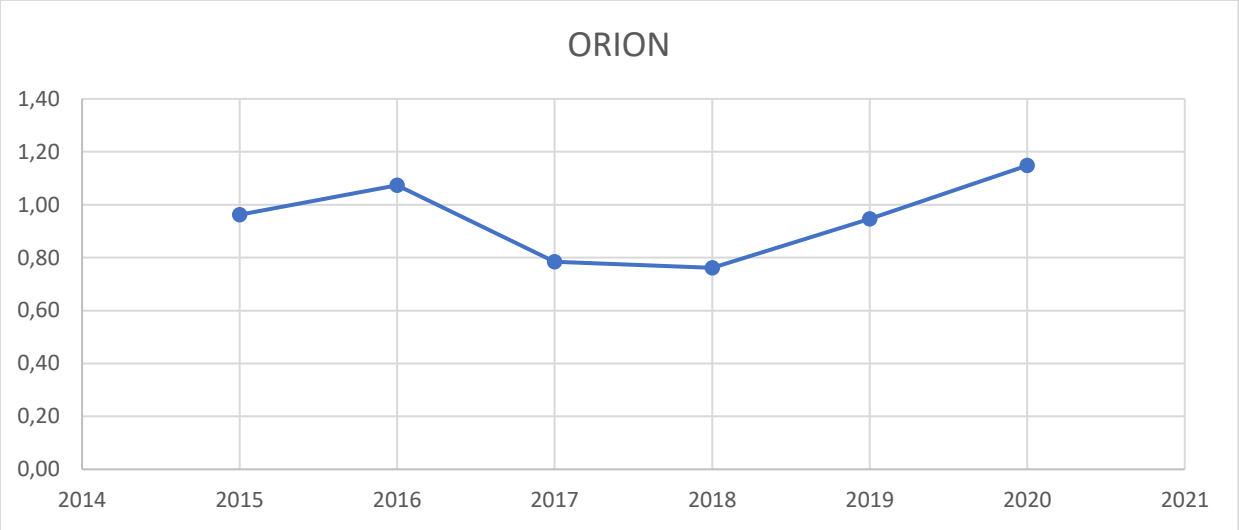

Figure 7: Orion Pharma Industry Ltd.; Source: Author's Own

The graph shows that the company is facing financial distress over the study period. However, the z score of this company has been constantly rising since 2018, which indicates that the company has been improving its overall financial condition and reducing the risk of bankruptcy in recent years despite its current distress position in the z score category.

Table 3.1.8 Renata Ltd.

YEAR	NWC/TA	RE/TA	EBIT/TA	MV/TL	TS/TA	Z SCORE	Category
2015	0.05	0.52	0.09	2.00	0.37	2.65	Grey
2016	0.11	0.59	0.11	2.32	0.44	3.15	Safe
2017	0.18	0.64	0.20	2.88	0.89	4.41	Safe
2018	0.26	0.68	0.21	3.05	0.89	4.68	Safe
2019	0.32	0.71	0.22	3.35	0.92	5.02	Safe
2020	0.32	0.71	0.21	4.00	0.83	5.29	Safe
Average	0.21	0.64	0.17	2.93	0.72	4.20	Safe

Source: Author's Own Calculation

Table 8 shows the z score and the value of each component of the z score of the Renata pharma for the study period from 2015 to 2020. The z scores of Renata Pharma are in the safe zone except for the year 2015, which falls under the study period, which indicates a lower risk of being bankrupt compared to the other firms within this industry. The EBIT to total assets ratio, which is the first component of the Altman z score model, shows the average model at 17% (0.17), meaning

that the average level of earning pre-tax profit from asset utilization is quite satisfactory, and the value of this ratio has been improving over the study period from 2015 to 2020. This has affected the value of the overall z score as this ratio is the indicator of earning cashflows. The net working capital to total assets ratio has been rising throughout the study period in a significant manner, which indicates the comparative improvement of the value of the current assets and the decline of the value of the short-term liabilities. The increase in EBIT has resulted in an increase in the equity-debt ratio, which indicates that the capital structure of the company is gradually increasing the value of the equity and eventually decreasing the value of the debt. The decline in the value of the debt has resulted in a lower fixed financial obligation to be paid with the current assets of the company. The sales to assets ratio has also been increasing, with an average value of 72% (0.72), which indicates the satisfactory capacity to earn income from the assets by the company. The z score of the company has been rising over the study period, which indicates the capacity of Renata Pharma to handle fixed financial obligations has been rising at a satisfactory level. This company is currently safe from being bankrupt with an average z score of 4.2, while the z score of 2020 was 5.29, which is greater than the average grey zone of 2.99 (5.29 > 2.99) with a consistent satisfactory z score over the period.

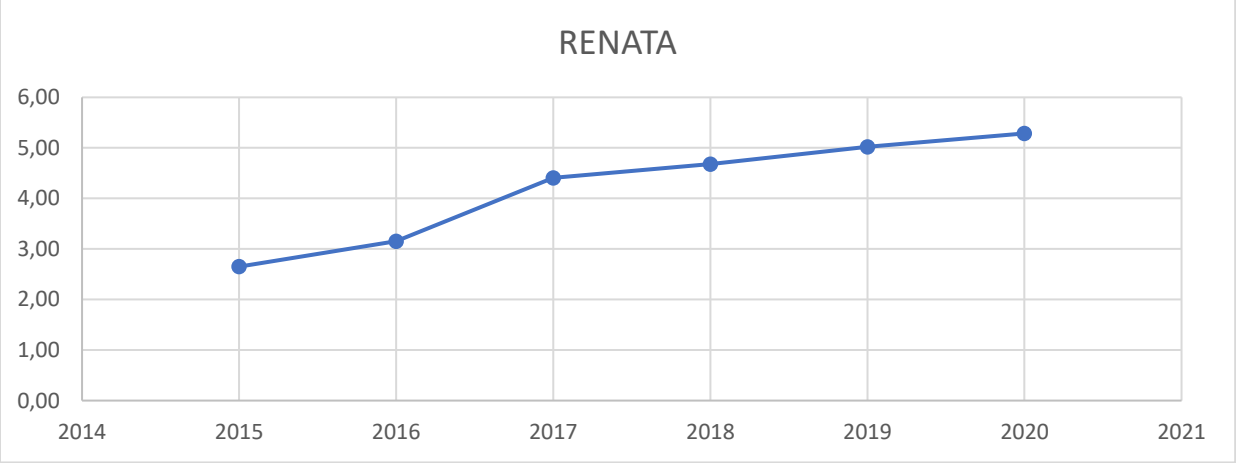

Figure 8: Renata Ltd; Source: Author's Own

The graph shows that the company is safe from financial distress over the study period, with the constant rise in its z score since 2015, which indicates that the company is improving its z score along with furnishing its overall financial condition, which has reduced its risk of bankruptcy.

Table 3.1.9: Square Pharmaceuticals Ltd.

YEAR	NWC/TA	RE/TA	EBIT/TA	MV/TL	TS/TA	Z SCORE	Category
2015	0.23	0.64	0.27	3.41	1.15	5.28	Safe
2016	0.37	0.69	0.31	4.00	1.06	5.90	Safe
2017	0.41	0.69	0.23	3.39	0.73	4.97	Safe
2018	0.41	0.69	0.20	2.50	0.65	4.28	Safe
2019	0.54	0.74	0.21	2.66	0.69	4.68	Safe
2020	0.59	0.77	0.23	2.43	0.71	4.72	Safe
Average	0.43	0.71	0.24	3.07	0.83	4.92	Safe

Source: Author's Own Calculation

The Square Pharmaceutical has made it possible to maintain a consistent high Z score that has made it safe from the risk of bankruptcy from 2015 to 2020. The z score of this company is in safe heaven because the components that affect the z score remain satisfactory in each of the years under the study period. The most influential component of the z score is the earnings of the firm before tax (EBIT), which has ranged from 20% to 31% throughout the study period. Besides, the ratio of the market value of equity to the book value of debt is also high, which indicates that the company is mostly financed with equity capital that has contributed to reducing the amount of fixed financial obligations to be paid from the short-term assets of the company. The net working capital to total assets ratio shows that the amount of net working capital has increased along with the value of total assets. But the value of assets has risen at a greater rate than the amount of net working capital. That is why the ratio of net working capital to total assets has been increasing throughout the study period. However, the market value of equity to the book value of the assets has been experiencing a slight fluctuation, and the turnover to total assets ratio has been declining throughout the study period. That is why the z score of the company has been fluctuating over the period despite the risk-free position of being bankrupt.

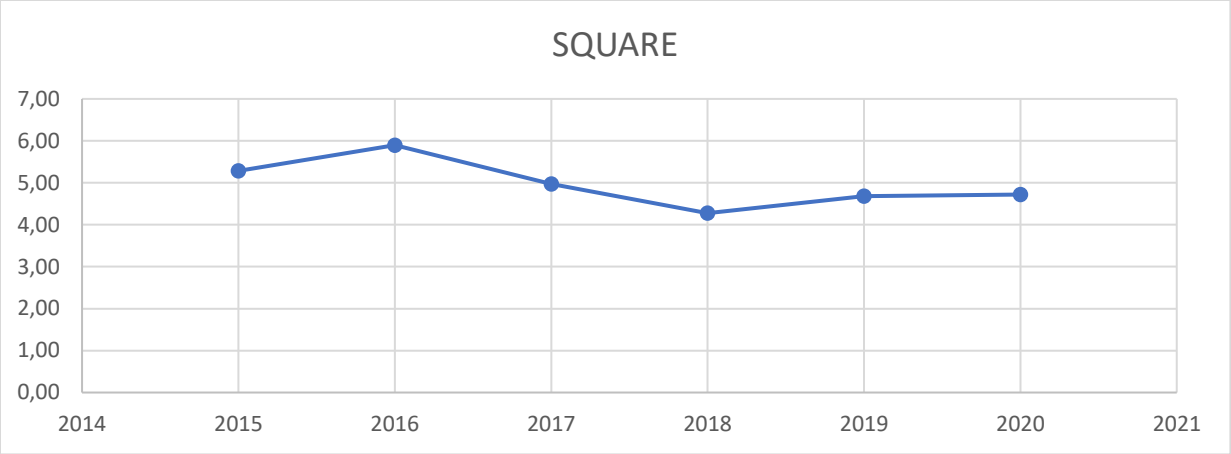

Figure 9: Square Pharmaceutical ltd.; Source: Author's Own

The Square Pharmaceutical has secured a safe category z score over the study period, with the highest score in 2016. However, the riskiness of the firm is increasing despite its favorable z score as the z score of this company has consistently fluctuated over the study period and especially declined in the last two consecutive years of the study.

3.2 Descriptive Statistics and Correlation Matrix

Table 3.2.1: Descriptive Statistics

Variable	Mean	Std.Dev.	Min	Max
Z SCORE	2.665	1.791	-2.867	5.997
EBIT/TA	0.077	0.149	-0.819	0.312
NWC/TA	0.197	0.207	-0.104	0.663
TS/TA	0.674	0.513	0.103	2.017
MV/TL	1.901	1.397	0.352	7.834
RE/TA	0.256	0.277	-0.680	0.773

Source: Author's Own Calculation

This table shows the summary statistics of the sample data of the selected pharmaceutical companies in Bangladesh. This study has selected nine companies as the sample, which were selected subject to the data available in the annual report. Despite the presence of 13 publicly listed pharmaceutical companies in Dhaka Stock Exchange (DSE), this study has selected 9 companies and the other 4 companies were left behind as the necessary data is not available at their annual report. To keep the dataset free from missing value, 9 of 13 companies were finally retained. The data of the selected companies was collected from the annual reports published on their official websites from 2015 to 2020. The table shows that the average z score of the selected companies is 2.665, with a standard deviation of 1.791. The mean value is greater than the value of the distress zone categorized by Altman (2.665 > 1.81) while it falls in the grey zone of financial distress (2.99<2.665>1.81). This mean score has equated to a margin of 2.67, which reveals that the companies in the pharmaceutical industry of Bangladesh are at risk of being bankrupt. This table also shows that the industry average EBIT to total assets ratio is 7.7% (0.077) with a standard deviation of 0.149, which indicates that the companies under study possess poor profitability capacity with a slight deviation from the mean value.

Table 3.2.1: Correlation matrix

Variables	(1)	(2)	(3)	(4)	(5)	(6)
(1) ZSCORE	1.000	-	-	-	-	-
(2) EBITTA	0.758	1.000	-	-	-	-
(3) NWCTA	0.290	0.272	1.000	-	-	-
(4) TSTA	0.729	0.435	-0.037	1.000	-	-
(5) MVTL	0.800	0.303	0.058	0.535	1.000	-
(6) RETA	0.776	0.827	0.276	0.362	0.406	1.000

Source: Author's Own Calculation

This correlation matrix shows correlation among the variables while the Z score is the dependent variable, and the rest of the variables are considered independent factors. The table shows that the z score is positively correlated with other components, as explained in the model itself, and the other independent factors have a different degree of correlation. The only negative correlation is found between net working capital and total asset ratio and total sales to total asset ratio. This negative relationship indicates that the increasing amount of investment in net working capital could eventually decrease the volume of sales because of the decline of earning assets. However, the EBIT and retained earnings are found to have a significantly high positive correlation between them, which is greater than 80% (0.827). The high correlation between these two variables might result from their high degree of dependence, as the amount to be held as retained earnings is largely dependent on the amount of profit earned by the company in a particular accounting period. This high correlation might cause collinearity in the regression model explained in the latter part of the thesis and was omitted from the model to effectively explain the significance of variables with a z score.

3.3 Regression results

Table 3.3.1: One-sample t-test for Z SCORE

	obs	Mean	St Err	t value	p value
ZSCORE	54	2.664	0.243	-1.376	.175

Source: Author's Own Calculation

This table shows the differences in the mean value of the companies under different z-score categories. In this thesis, It is hypothesized that the companies in the pharmaceutical industry of Bangladesh are at a significant risk of bankruptcy. This one-sample t-test for the average z score of the companies was tested at a 5% level of significance against the marginal value of 3, which is the safety margin of the z score for the companies to be free from bankruptcy risk. The p-value shows a value greater than 5% (0.05< 0.175) which leads us to conclude that the test is significant, and the study fails to reject the null hypothesis that the companies in the pharmaceutical industry are at significant risk of bankruptcy. The mean value of the z score of the sample companies is 2.664, which is lower than the safety margin of 3 (2.99) as prescribed by the model itself.

3.4: Summary of Findings

The earlier part of the thesis has discussed the results regarding the z score and each component of the z score for 9 companies in the pharmaceutical industry of Bangladesh. The summary of findings has listed below.

Table 3.4.1: Summary of Findings

Company Name	Average Z score	Category
The ACME Laboratories Ltd.	1.23	Distress
AMBEE Pharmaceuticals Ltd.	2.37	Grey
Beacon Pharmaceuticals Ltd.	2.80	Grey
Beximco Pharmaceuticals Ltd.	2.16	Grey
Central Pharmaceuticals Ltd.	0.60	Distress
The Ibn Sina Pharmaceuticals Industry Ltd.	4.70	Safe
Orion Pharma Ltd.	0.95	Distress
Renata Ltd.	4.20	Safe
Square Pharmaceuticals Ltd.	4.92	Safe

Source: Author's Own Calculation

This table shows that there are three pharmaceutical companies that are in a distressed position, while another three companies are in the safe zone. However, there are also three sample

companies that are in the grey zone, indicating that they are also at risk of bankruptcy compared to the safer group of companies. From the summary, it could be concluded that 33.33% of the companies fall under each of the categories about their respective z scores for the study period. The following table lists the summary of the hypotheses tested under the regression models:

Hypotheses	Comment
The companies of pharmaceuticals company of Bangladesh are at significant risk of bankruptcy under the Altman Z score model	Accepted

The null hypothesis for this study was that the pharmaceutical industry of Bangladesh is not in a risk-free position of financial distress under the z score model. The margin for being risk-free according to the Altman z score model is 2.99 that if a company has a z score lower than 2.99 is in risk of being bankrupt. To prove this hypothesis, the one sample t-test has done with the given value of 2.99 that if the mean value of the z score differ from the safety margin of z score model. The results shows that the p-value is greater than 0.05 (5% level of significance) and the test fails to reject the null hypothesis that the pharmaceutical industry of Bangladesh is not in a risk-free position of financial distress under the z score model. However, since it has proven that the overall condition of the industry is risky, the condition of the companies under study differs. As shown in company-wise analysis section, there are 3 companies who have been facing continuous decline in their z score despite their category of z score while the other 3 companies are enjoying constant improvement in their z score over the study period. However, there are three (3) companies who are facing constant fluctuation in their z score over the study period which is also indicates the riskiness of the companies.

Table 3.4.2 Summary for Trends of Z score

Trend in Z Score	Number of Companies
Continuous Increase	3
Continuous Decrease	3
Continuous Fluctuation	3

Source: Author's Own Calculation

3.5 Recommendation

Companies that are in a financial distress position should pay more attention to their cash flow management policies than their safe counterparts, as the cash inflows contribute at the highest level to the z score compared to the other components of the model. During the study period, the ratio of pre-tax profit (EBIT) to total assets has been going down for the companies that are in trouble. The market price of the shares has also gone down because the earnings ratio has been going down.

An effective debt management policy should be put in place to cut down on the number of fixed financial obligations that make up a large part of the equity to debt ratio of the model. The higher debt could eventually lead the companies to hold a greater amount of assets as working capital to meet the short-term financial obligations, which could lower the companies' earning capacity. Also, a capital structure with a lot of debt capital could make the equity-to-debt ratio worse over time and make the company's z score go down.

The firms that are in the grey zone should concentrate on increasing the z score by effectively increasing the earnings ratio and lowering the amount of short-term fixed financial obligations to free the assets to be held as current assets. Increasing the cash inflows would help the companies improve their capacity to pay financial obligations, which would lower the risk of being bankrupt for being incapable of meeting short-term debt. The companies that have been categorized as safe should be aware of the decline in their net working capital as well as the deteriorating Z score in the near future. The study would like to also suggest that the companies concentrate on increasing the retained earnings with an efficient dividend policy without deteriorating the market value of the equity shares of the companies. Moreover, the company should focus on a separate debt management policy, cash flow management policy, liquidity policy, and dividend policy to improve the overall z score with a sustained score over the period. Despite the novelty of the study, the study is limited to a specific time frame, while there was scope to compare the current scenario with an important financial event. A further study could be conducted to compare the risk of bankruptcy of two different financial events in the country. Also, the study could be made bigger by adding some more variables to see how market-specific factors affect the companies' overall z scores.

Conclusion

Financial distress has become a growing concern for manufacturing firms in Bangladesh as they have to fight the risk of bankruptcy while increasing their capacity to generate cash inflows at the same time. The pharmaceutical industry is one of the fastest-growing industries in Bangladesh, which has gone beyond the borders of the country. With the growth of the industry, companies have been falling into difficulties in fund management. The economy of Bangladesh is largely dependent on the manufacturing sector, while the pharmaceutical sector is one of the leading industries in this sector. Numerous empirical studies have contributed to the literature examining the risk of bankruptcy and financial distress of different types of publicly listed manufacturing firms in Bangladesh, while the pharmaceutical industry was somehow left behind to be empirically investigated in terms of bankruptcy risk using the Altman Z score model. To facilitate the contribution to the literature, this study aimed to empirically investigate the risk of the pharmaceutical industry in Bangladesh using the Altman Z score model from the data from 2015 to 2020 for the selected companies. There are 13 pharmaceutical companies listed on the Dhaka Stock Exchange (DSE), which is the major stock exchange in the country. Among the listed companies, this study has selected 9 companies based on the data available in the annual report published on the official websites of the companies. This study is a novel contribution to the empirical literature examining the bankruptcy risk in the pharmaceutical industry in Bangladesh. Another goal of this study was to find out how each part of the z-score model affected the z-score of the industry as a whole.

This study has described the summary statistics of the data with mean, standard deviation, and the range of the data to provide insights into the actual scenario of the industry. While some companies are in a complete distress position according to the Altman model, the others are in safe heaven. This might make it hard to figure out what is going on in the industry as a whole. To clear up any confusion, the study used statistical methods and the z score model to show the average z scores for both the company and the industry.

The results of the z score analysis and regression analysis of the companies have been discussed in the earlier section of the thesis. Some of the companies are in financial trouble under the Z score model, while the others are at a lower risk in either the grey or safe zone of the Z score model. Among the 9 selected companies, a group of 3 companies has fallen into each of the three

categories of "Distress", "Grey", and "Safe". However, the one-sample t-test has shown that the companies in the pharmaceutical industry are at a significant risk of bankruptcy as the mean of the companies is lower than the safety margin of 2.99 as a z score. The analyses have noted some warning aspects that some of the companies will be bankrupt within one year if the z score is not improved with proper management policies, while some other companies are improving their current position in the z score category. This thesis aims to suggest some management and financial policies for the companies under study to overcome the risk of being bankrupt. The study would like to also suggest that the companies concentrate on increasing the retained earnings with an efficient dividend policy without deteriorating the market value of the equity shares of the companies. Moreover, the company should focus on a separate debt management policy, cash flow management policy, liquidity policy, and dividend policy to improve the overall z score with a sustained score over the period. Despite the novelty of the study, the study is limited to a specific time frame, while there was scope to compare the current scenario with an important financial event. A further study could be conducted to compare the risk of bankruptcy of two different financial events in the country. Also, the study could be made bigger by adding some more variables to see how market-specific factors affect the companies' overall z scores.

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Appendices

Appendix 1

Pharmaceutical companies of Bangladesh are listed on the Dhaka Stock Exchange (DSE)

1. The ACME Laboratories Limited
2. Advent Pharma Limited
3. Ambee Pharmaceuticals Ltd.
4. Beacon Pharmaceuticals Limited
5. Beximco Pharmaceuticals Ltd.
6. Central Pharmaceuticals Limited
7. The IBN SINA Pharmaceutical Industry Ltd.
8. Indo-Bangla Pharmaceuticals Limited
9. Orion Pharma Ltd.
10. Renata Ltd
11. Silco Pharmaceuticals Limited
12. Silva Pharmaceuticals Limited
13. Square Pharmaceuticals Ltd

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