

An Intensive Analysis to Anticipate the Economic Fitness of Listed Pharmaceutical Companies in Bangladesh Using Altman Z-Score Model

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Abstract: *Financial strength analysis is of great substantial matter for pharmaceutical industry. The COVID-19 pandemic had an impact on global economy, especially on the drug industry. So, the abrupt pandemic breakout has affected the pharmaceutical industry of Bangladesh. Considering the COVID-19 pandemic, this paper attempts to predict the probability of bankruptcy of 15 publicly traded pharmaceutical companies of Bangladesh using Altman Z-Score Model. This study investigates the past five years' financial data of Square Pharmaceuticals Ltd, Beximco Pharmaceuticals Ltd, Reneta Ltd, ACME Laboratories Ltd, Orion Pharma Ltd, Beacon Pharmaceuticals Ltd, Active Fine Chemicals Ltd, Central Pharmaceuticals Ltd, Far Chemical Industries Ltd, GHCL, ACI Ltd, IBN SINA Pharmaceuticals Ltd, Ambee Pharmaceuticals Ltd, Indo-Bangla Pharmaceuticals Ltd, Marico Bangladesh Ltd, and the data were collected from company's annual report. The result shows that among 15 listed companies, 53% is in safe zone, 34% is in grey zone and 13% is in distress zone in 2017; 67% is in safe zone, 20% is in grey zone and 13% is in distress zone in 2018; 53% is in safe zone, 27% is in grey zone and 20% is in distress zone in 2019; 53% is in safe zone, 13% is in grey zone and 34% is in distress zone in 2020; 53% is in safe zone, 13% is in grey zone and 34% is in distress zone in 2021.*

Keywords: *Altman Z-score, Bankruptcy, Financial performance, Pharmaceutical companies.*

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I. Introduction

SQUARE Pharmaceuticals Limited is one of the largest pharmaceutical companies in Bangladesh, consistently ranked number one among all domestic and multinational companies since 1985. It was founded in 1958 and became a public limited company in 1991 and listed on the stock exchanges in 1995. Square Pharma's revenue was BDT 50.87 billion (US\$609.18 million) with a market share of approximately 16.95% and a growth rate of approximately 10.85% (July 2018-June 2019). Their aim is to operate transparently based on market mechanisms within a legal and social framework with the aim of achieving the mission reflected in their vision.

Beximco Pharmaceuticals Ltd (Beximco Pharma) was founded in 1976 and began operations in 1980. It is a publicly listed company of the Dhaka Stock Exchange and the mission of the company is to improve human health and well-being by providing affordable and advanced medicines.

Renata Limited is one of the largest and fastest growing pharmaceutical companies in Bangladesh, and it was established in 1972 as Pfizer (Bangladesh) Limited. It has been listed on the Dhaka Stock Exchange. It has a market capital of around BDT 87 billion. The company exports its products to many countries around the world. The company is focused on long-term growth and helping its employees thrive. Caring for employees, helping members with difficult circumstances, and building a sustainable environment are the main social responsibilities of this company.

ACME Laboratories Ltd. is a leading company in manufacturing high quality and world class pharmaceutical products in Bangladesh with annual turnover of USD 60 million and having about 3000 employees. It was founded in 1954 and listed on stock exchanges in 2016.

Orion Pharma, part of the Orion Group, was incorporated as a pharmaceutical manufacturing company in 1965 and it also commenced its operation in 1965. In 2013, Orion Pharma listed its shares on the Dhaka stock exchange. It owns about 21.76% stocks of Orion Infusion Limited. Orion Pharma has grown to become one of the Bangladesh's leading pharmaceutical companies that manufactures and markets over-the-counter medicines with a mission to serve around the world.

Beacon Pharmaceuticals Limited started its operations in 2006 with the aim of providing and developing innovative, life-saving medicines to combat a range of life-threatening diseases. It was listed on the Dhaka Stock Exchange and the Chittagong Stock Exchange.

IBN SINA Pharmaceutical Industry Ltd was founded in 1983 in Gazipur with modern art and technology. The company is equipped with quality machinery and has established itself as a leading company in the pharmaceutical industry of Bangladesh. It has two production segments such as pharmaceuticals and organic or herbal medicine production plants. Affordable and top-quality medicines are the main goals of IBN SINA.

The Advanced Chemical Industries Ltd (ACI) is one of the Bangladesh's largest companies which was founded in January 24, 1973. It has four business segments, such as ACI Agrobusiness, ACI Retail Chain, ACI Consumers brands, and ACI pharmaceuticals. ACI Pharmaceuticals is concerned about combining knowledge, expertise, and modern technology to lead a quality health care system in Bangladesh.

Ambee Pharmaceuticals Limited (2020) was founded on February 4, 1976. It is registered as a public limited company under the Companies Act 1913. They have nationwide sales network and have established a quality control system to ensure stable quality. They comply with regulatory requirements in all countries and follow Good Manufacturing Practices (GMP) recommended by the World Health Organization in their business.

Active Fine Chemicals Limited (AFCL) was established with the vision of providing innovative products and services to the healthcare sector in Bangladesh. The company was founded in December 2004 and listed on stock exchanges in 2010. The company achieved a net profit after tax of BDT 3.82 billion in 2021-21 financial year.

Global Heavy Chemicals Ltd. (GHCL) was incorporated in September 19, 2000 as a sister concern of OPSONIN Group. Global Heavy Chemicals Ltd. manufactures and sells industrial chemicals. Products include caustic soda, liquid chlorine, hydrochloric acid, sodium hypochlorite, chlorinated paraffin wax, and calcium hypochlorite. In 2021-2022 financial year, this company reported turnover of BDT 579, 148,111 which was BDT 25, 494,016, an increase of 5% compared to the previous year.

Central Pharmaceuticals Limited was incorporated as a private company in November 13, 1980 and began commercial operations in December 1, 1980. The company was registered as a public limited company in December 20, 2010. The headquarter of this company is stationed in Dhaka. The company's net sales increased by BDT 14.82 million in 2020-21 financial year. This corresponds to an increase of 5.78% over the previous year.

Far Chemical Industries Limited manufactures, exports, and sells chemicals to export oriented textile and apparel industries in Bangladesh. This industry products include softening, retarding, leveling, anti-foaming, and scouring. This company was founded in 2007 and listed on stock exchanges in 2014. Their mission is to produce and export the best quality textile dyeing chemicals for the textile industry, maintain ethical standards in business activities as well as ensure the benefits for shareholders, stakeholders and society as a whole.

Indo-Bangla Pharmaceuticals Limited, the flagship company of the IBP Group, was established in 1954 and was incorporated as limited company under the Companies Act in 18th June, 2014 and converted to a public limited company in 21st October, 2014. Since its establishment in 1954, Indo-Bangla Pharmaceuticals Ltd. stands for quality, business success and entrepreneurship. Their heritage and values are the foundation to ensure the health, warmth and well-being of people.

Marico Bangladesh Limited was founded in 1999. It is registered as a public limited company under the Companies Act of 1913. The enterprise touches the lives of one out of each two Bangladeshis with an array of manufacturers in numerous categories, which includes hair nourishment, fit to be eaten oil and male grooming.

Based on the foregoing, it is high time to assess and scrutinize the performance of pharmaceutical companies of Bangladesh. But performance evaluation is a dynamic matter rather than static as performance has changes yearly, monthly, daily, even within a moment (Majumder & Rahman, 2011). This study has carried out to assess the performance of 15 listed pharmaceutical companies in Bangladesh. The results of this research provide an insight into the company's position compared to its financial situation. Using a model to assess a company's financial health can help company officials to take proper actions to avoid bankruptcy in future, and it also helps creditors, shareholders, and regulators to analyze the financial performance of the companies. Many studies have been carried out on bankruptcy prediction using different models so far, but the most popular one is Edward Altman's Multivariate Discriminate Analysis (MDA) called Z-score. A search of the literature in this area reveals that several studies using Z-scores have been conducted in Bangladesh. Hence, this study focuses on analyzing the financial position of selective pharmaceutical companies listed on Bangladesh Securities and Exchange Commission using Altman Z-score Model.

II. Objectives of the Study

The objectives of this study are to assess the financial condition of 15 BSEC's (Bangladesh Securities and Exchange Commission) listed pharmaceutical companies in Bangladesh and compare the probability of bankruptcy among selected pharmaceutical companies using Altman's Z-score Model. The paper also proposes some recommendations and insights regarding the financial stability of the selected pharmaceutical companies.

Significance of the Study

Financial viability of business organization is one of the top-tier concerns for internal and external stakeholders. The internal stakeholders like managers, executives, and other employees always feel interested in whether their services add value to the firm and secure their jobs or not. The external stakeholders like investors, credit providers, and government might be interested about the financial viability, credit risks and financial distress of the firm. To address these issues, this study will be of immense benefit to them. Having a clear picture of company's financing and investment portfolio decisions, is critical for managers in making more effective strategic decisions about allocating and directing organization's resources. The findings of this study will play an important role in attracting investors and raising capital finance of the company.

This study will help companies to assess their financial performance, and thus management can detect financial problems and take necessary actions to use resources more effectively and efficiently. In addition, it will assist investors to analyze their investment decisions.

III. Methodology

This study has been carried out based on secondary data from the annual reports of selected pharmaceutical companies during the period of 2017-2021. To predict the financial distress of the companies, required secondary data have been collected from company's Statement of Financial Position for the period, Statement of Comprehensive Income at the end of the period, Notes and Disclosures of the company's published annual reports. Categories of financial information have been collected from Dhaka Stock Exchange research department and publication. In this study, the amalgamated data have been tabulated, analyzed, and interpreted with the help of different financial ratios and Multivariate Discriminate Analysis (MDA) developed by Prof. Altman.

Data Sampling

Data have been collected from a sample of 15 listed pharmaceutical companies in Bangladesh. In this study, both A and B category pharmaceutical companies are considered. The firms which hold annual general meeting (AGM) and declares dividend minimum 10% regularly are considered under "A" category pharmaceutical company. Share trading time of "A" category pharmaceutical companies is T+3. However, the companies which hold annual general meeting (AGM) on regular basis but regularly declare dividend for shareholders at a rate below 10% are considered "B" category pharmaceutical companies. The trading time of "B" category pharmaceutical company's shares is also T+3. Another category is "Z" category of company which indicates that these types of firms neither declare the dividend nor hold annual general meeting on a regular basis. The trading time of its share is T+7. In this study, data have been collected from 9 listed "A" category pharmaceutical companies and 6 listed "B" category pharmaceutical companies based on the market capital of the companies, availability of information, and establishment year.

"A" category	"B" category
SQUARE Pharmaceuticals Limited	Beacon Pharmaceuticals Limited
Beximco Pharmaceuticals Limited	Active Fine Chemicals Limited
Reneta Limited	Central Pharmaceuticals Limited
The ACME Laboratories Limited	Far Chemical Industries Limited
Orion Pharmaceutical Limited	Global Heavy Chemicals Limited
ACI Limited	Indo-Bangla Pharmaceuticals Limited
IBN SINA Pharmaceuticals Limited	
Ambee Pharmaceuticals Limited	
Marico Bangladesh Limited	

Data Analysis Method

Altman's Z-score model was published by Edward I. Altman in 1968 to predict business failure. This study has been conducted using Altman's Z-score formula including five ratios of X1, X2, X3, X4, and X5. These are the independent variables that are calculated and incorporated into the formula to calculate the Z-score for each company. After the Z-score is calculated, the value is compared to the criteria set by the model to determine if the company is in the safe zone, grey zone, or distress zone. The findings of the study determine whether the company will go bankrupt in near future. Finally, each company's Z-score is compared to each

company's average Z-score to provide a comparative analysis of company's performance. For publicly traded manufacturing firm, the applicable Altman Z-score equation is given below:

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

Where:

X1= working capital (current assets- current liabilities)/ total assets

X2= retained earnings/ total assets

X3= earnings before interest and tax/ total assets

X4= market value of equity/ total assets

X5= sales/ total assets

The criteria for interpreting the Z-score model are:

Zones of discrimination

Score	Zone	Description
$Z > 2.99$	Safety (risk free)	Do not go for bankruptcy within next two years
$1.80 \leq Z \leq 2.99$	Grey (at risk)	Reasonable chance to go for bankruptcy within next two years
$Z < 1.80$	Distress/bankruptcy	Certainly, goes for bankruptcy within two years.

IV. Results and Discussion

SQUARE Pharmaceuticals Limited

Variable/year	2017	2018	2019	2020	2021	Mean
X1=Net Working Capital/Total Assets	0.3962	0.4283	0.4912	0.5395	0.5437	0.4798
X2=Retained Earnings/Total Assets	0.7344	0.7533	0.7692	0.7942	0.8250	0.7752
X3=EBIT/Total Assets	0.2433	0.2308	0.2042	0.1800	0.1689	0.2054
X4=Market Value of Equity/ Total Liabilities	14.0490	16.8486	15.9141	17.3679	19.9456	16.8250
X5=Sales/Total Assets	0.8049	0.7489	0.7051	0.6469	0.6113	0.7034
Z-Score	11.5408	13.1883	12.5936	13.4210	14.9435	13.1374

Source: Annual Reports of SQUARE Pharmaceutical Ltd (2017-2021).

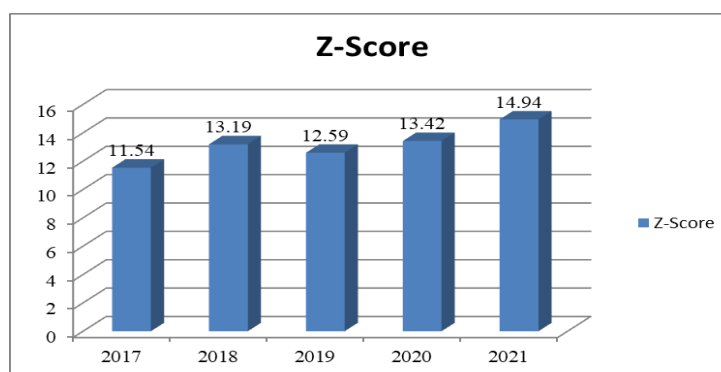


Figure 01: Z-score value of the SQUARE Pharmaceuticals Ltd.

The figure 01 shows that the Z-score of SQUARE Pharmaceuticals Ltd has increased in the year of 2018 and 2020. It has decreased in 2019 but it has increased to the highest in 2021. The results reveal that the Z-score is above 2.99 in each study period, which means that the company is in safe zone and the financial stability is sound enough that the firm is not likely to go under bankruptcy near future.

Beximco Pharmaceuticals Limited

Variable/year	2017	2018	2019	2020	2021	Mean
X1=Net Working Capital/Total Assets	0.0023	0.7938	0.7410	0.7734	0.8096	0.6240
X2=Retained Earnings/Total Assets	0.3688	0.3340	0.3484	0.4002	0.4628	0.3828
X3=EBIT/Total Assets	0.0299	0.0431	0.0462	0.0205	0.1911	0.0662

X4=Market Value of Equity/ Total Liabilities	2.7822	1.6691	1.5434	1.8935	2.5279	2.0832
X5=Sales/Total Assets	0.5179	0.5431	0.6352	0.6497	0.7287	0.6149
Z-Score	2.8049	3.1072	3.0906	3.3417	4.4955	3.3680

Source: Annual Reports of Beximco Pharmaceuticals Ltd (2017-2021).

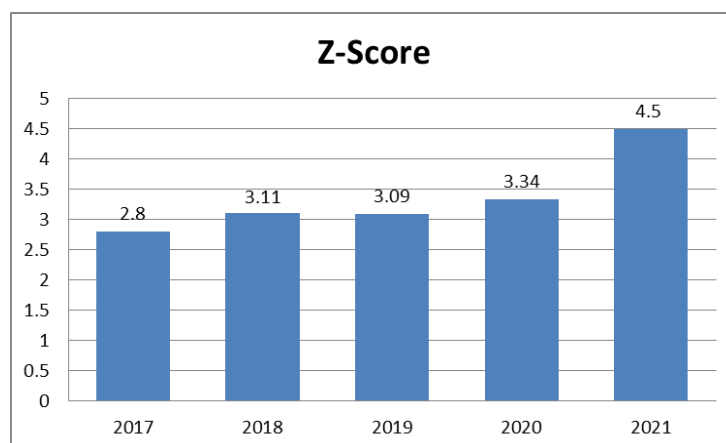


Figure 02: Z-score value of the Beximco Pharmaceuticals Ltd.

The figure 02 reveals that the Z-score value is below 2.99 in 2017 which indicates that it is in grey area of 1.8 to 2.99. But, the Z-score value has increased in 2018 and 2020, and the Z-score value has decreased in 2019. It got the highest Z-score value in 2021. The result shows that the firm has Z-score value above 2.99 in each period except in 2017. So, it indicates that the firm is in safe zone and it is not likely to be bankrupted in next two years.

Reneta Limited

Variable/year	2017	2018	2019	2020	2021	Mean
X1=Net Working Capital/Total Assets	0.1832	0.2617	0.3192	0.3185	0.2831	0.2731
X2=Retained Earnings/Total Assets	0.3903	0.4367	0.4816	0.5212	0.6013	0.4862
X3=EBIT/Total Assets	0.2496	0.2518	0.2548	0.2455	0.2294	0.2462
X4=Market Value of Equity/ Total Liabilities	2.2080	2.6611	3.0905	2.8610	2.8490	2.7357
X5=Sales/Total Assets	0.8852	0.8939	0.0917	0.8320	0.8507	0.5627
Z-Score	3.7998	4.2468	3.8441	4.4760	4.4987	4.0250

Source: Annual Reports of Reneta Pharmaceuticals Ltd (2017-2021).

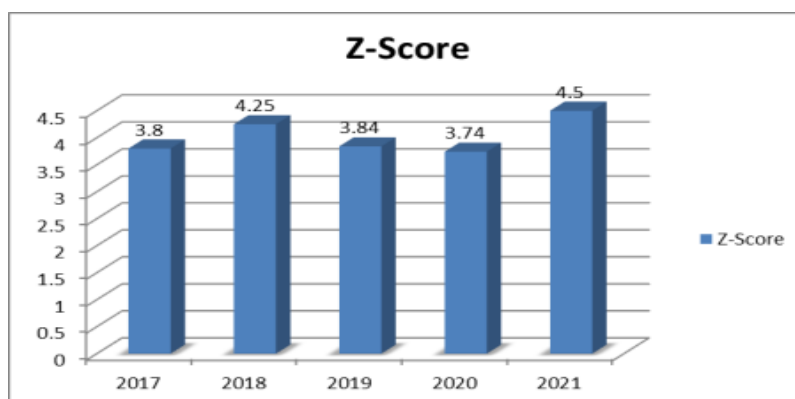


Figure 03: Z-score value of the Reneta Ltd.

The figure 03 shows that the Z-score value of the company has decreased in 2017, 2019, and 2020. It has the lowest Z-score value in 2017 and the highest Z-score value in 2021. The study shows that it has increased Z-score value in 2018. This firm has the value above 2.99 in each period which indicates that this firm

has sound financial performance throughout the study period. It means that the firm is unlikely to be bankrupted in next two years.

The ACME Laboratories Limited

Variable/year	2017	2018	2019	2020	2021	Mean
X1=Net Working Capital/Total Assets	0.0787	0.0337	-0.0241	0.0183	0.0457	0.0305
X2=Retained Earnings/Total Assets	0.2229	0.2311	0.2311	0.2198	0.2180	0.2246
X3=EBIT/Total Assets	0.1015	0.0935	0.0959	0.0961	0.0504	0.0875
X4=Market Value of Equity/ Total Liabilities	1.3052	1.1780	1.0435	0.9347	0.9875	1.0900
X5=Sales/Total Assets	0.4533	0.4541	0.4540	0.4821	0.5131	0.4713
Z-Score	1.9778	1.8333	1.6913	1.6898	1.6321	1.7649

Source: Annual Reports of the ACME Laboratories Ltd (2017-2021).

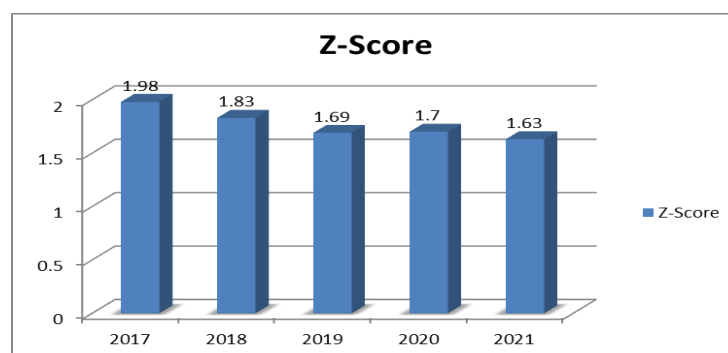


Figure 04: Z-score value of The ACME Laboratories Ltd.

From the figure04, it is shown that the Z-score value of the company is 1.98 and 1.83 in 2017 and 2018 respectively, which indicates that it has entered into the grey zone ($1.80 < Z < 2.99$). But it has entered into distress zone ($Z < 1.80$) in 2019, 2020, and 2021 respectively. It has a Z-score value of 1.69, 1.70 and 1.63 in 2019, 2020, and 2021 respectively which is lower than 1.80. The lower Z-score value indicates that the firm performance became poor due to the decline in market value of shares, total assets, EBIT, total liabilities, and decline in liquid assets during the study period. Hence, it can be predicted that the company has a probability to go into bankruptcy near future.

Orion Pharmaceutical Limited

Variable/year	2017	2018	2019	2020	2021	Mean
X1=Net Working Capital/Total Assets	0.3288	0.3777	0.3747	0.4707	0.3730	0.3850
X2=Retained Earnings/Total Assets	0.1516	0.1547	0.1719	0.1539	0.1512	0.1567
X3=EBIT/Total Assets	0.0585	0.0497	0.0515	0.0431	0.0368	0.0479
X4=Market Value of Equity/ Total Liabilities	1.6575	1.4386	1.5316	1.0871	0.9019	1.3233
X5=Sales/Total Assets	0.3385	0.3394	0.2809	0.2076	0.2559	0.2845
Z-Score	2.1329	2.0364	2.0603	1.7823	1.5776	1.9179

Source: Annual Reports of the Orion Pharma Ltd (2017-2021).

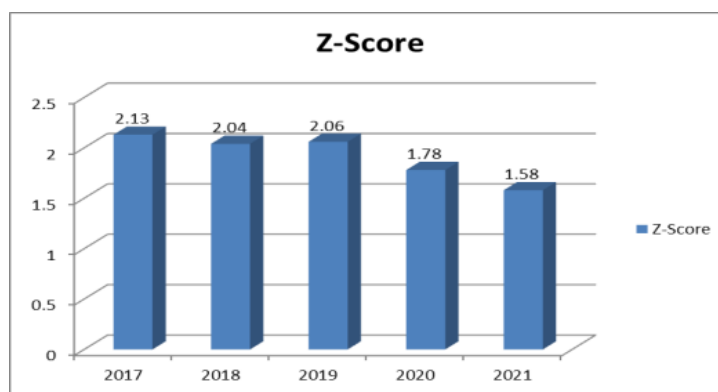


Figure 05: Z-score value of the Orion Pharmaceutical Ltd.

The figure 05 shows that the Z-score value of Orion Pharma Ltd has decreased in 2018 comparative to 2017. But it has increased in 2019. On the contrary of that, the Z-score value has also declined in 2020 and 2021. It means that the firm has entered into grey zone in 2017, 2018 and 2019 fiscal year respectively, but the firm has entered into distress zone in 2020 and 2021 which indicates that the firm’s financial stability is poor in recent years. Hence, it can be predicted that the firm has a probability to be bankrupted near future.

Beacon Pharmaceuticals Limited

Variable/year	2017	2018	2019	2020	2021	Mean
X1=Net Working Capital/Total Assets	0.2520	0.2175	0.2704	0.2413	0.2839	0.2530
X2=Retained Earnings/Total Assets	0.0738	0.8281	0.0810	0.1022	0.1913	0.2553
X3=EBIT/Total Assets	0.0523	0.5493	0.0646	0.0477	0.1666	0.1761
X4=Market Value of Equity/ Total Liabilities	1.4145	1.5730	1.4770	1.8183	1.6838	1.5933
X5=Sales/Total Assets	0.5775	0.7662	0.9301	0.7790	0.8343	0.7774
Z-Score	2.0047	4.9428	2.4672	2.4602	3.0027	2.9755

Source: Annual Reports of the Beacon Pharmaceuticals Ltd (2017-2021).

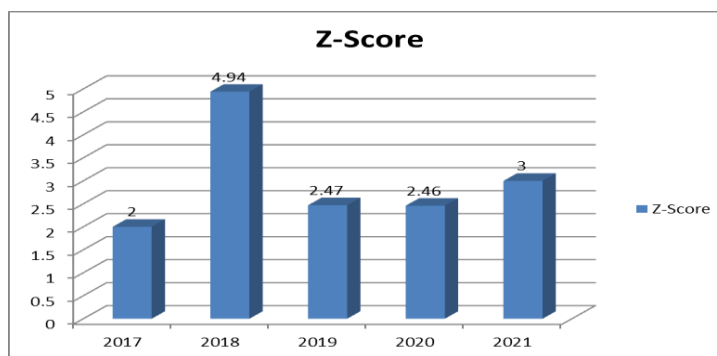


Figure 06: Z-score value of the Beacon Pharmaceuticals Ltd.

The figure 06 shows that the results of Z- score in each study period is above 1.80, which indicates that it is in the grey zone ($1.80 < Z < 2.99$) throughout the study period. So, the result shows that the financial stability of the company is in good condition, and it indicates that the firm is unlikely to go into bankruptcy in next years.

Active Fine Chemicals Limited

Variable/year	2017	2018	2019	2020	2021	Mean
X1=Net Working Capital/Total Assets	0.4291	0.3603	0.3255	0.2933	0.3916	0.3510
X2=Retained Earnings/Total Assets	0.2191	0.2501	0.2461	0.2165	0.2048	0.2273
X3=EBIT/Total Assets	0.1552	0.1224	0.1252	0.0183	0.0129	0.0868

X4=Market Value of Equity/ Total Liabilities	2.3819	2.5828	2.4429	1.8440	1.5226	2.1548
X5=Sales/Total Assets	0.3833	0.3281	0.3211	0.1618	0.2082	0.2805
Z-Score	3.1465	3.0642	2.9350	1.9836	1.9211	2.6101

Source: Annual Reports of the Active Fine Chemicals Ltd (2017-2021).

From the figure 07, it is revealed that Z-scores of Active Fine Chemicals limited have been declined from 3.15 (2017) to 1.92 (2021). Although the Z-score value was greater than 2.99 in 2017 and 2018, which indicates that the company was in safe zone with a sound financial position, but the company entered into the grey zone ($Z < 2.99$) in 2019, 2020 and 2021 respectively as the Z-score values have decreased gradually. Hence, it suggests that the company is in the moderate bankruptcy zone and needs to take proper actions before being bankrupted in the future.

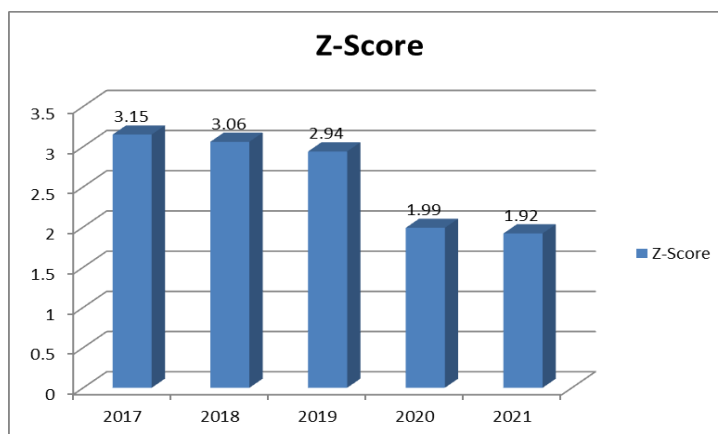


Figure 07: Z-score value of the Active Fine Chemicals Ltd.

Central Pharmaceuticals Limited

Variable/year	2017	2018	2019	2020	2021	Mean
X1=Net Working Capital/Total Assets	0.3726	0.3964	0.3805	0.0685	0.0844	0.2605
X2=Retained Earnings/Total Assets	0.0824	0.0614	0.0279	-0.6803	0.6820	-0.2381
X3=EBIT/Total Assets	0.0730	0.0412	0.0412	-0.8114	0.0049	-0.1302
X4=Market Value of Equity/ Total Liabilities	3.1672	3.1310	2.5780	1.3910	1.3424	2.3255
X5=Sales/Total Assets	0.1989	0.1345	0.1243	0.1034	0.1086	0.1339
Z-Score	2.9027	2.7163	2.3028	-2.6047	0.0766	1.0787

Source: Annual Reports of the Central Pharmaceuticals Ltd (2017-2021).

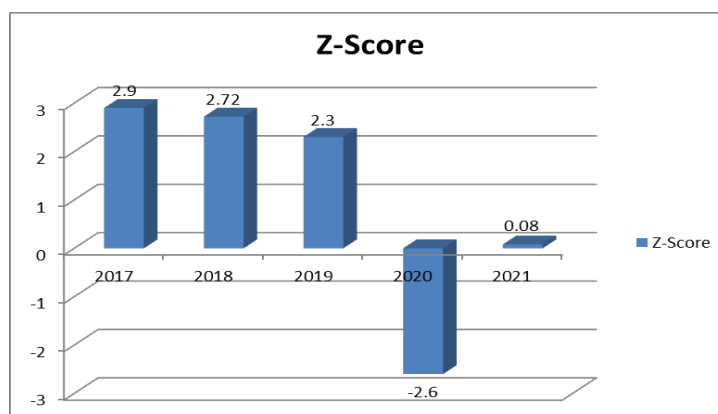


Figure 08: Z-score value of the Central Pharmaceuticals Ltd.

The figure 08 shows that the Z-score of the Central Pharmaceuticals Limited has been decreased from 2.90 (2017) to 0.08 (2021). It has been gradually declined resulting in poor Z-scores. The results suggest that the company's financial health is not sound. In 2017, 2018 and 2019, the Z-scores value of the firm were between 1.80 to 2.99, which means that the firm was in grey zone in those respective years, but in 2020, the Z-score value has declined to -2.6 from 2.30, 2019. Although, the Z-score value has increased to 0.08 in 2021, it still is in the distress area. Hence, it is to be expected that the company has a probability to be bankrupted in recent years.

Far Chemical Industries Limited

Variable/year	2017	2018	2019	2020	2021	Mean
X1=Net Working Capital/Total Assets	0.4188	0.3863	0.3722	0.3607	0.2090	0.3494
X2=Retained Earnings/Total Assets	0.3373	0.3418	0.3279	0.2797	0.2522	0.3078
X3=EBIT/Total Assets	0.1153	0.0949	0.0696	0.02387	-0.0093	0.0589
X4=Market Value of Equity/ Total Liabilities	50.9409	55.8206	61.5772	65.5826	13.7442	49.5331
X5=Sales/Total Assets	0.5641	0.4753	0.3927	0.2447	0.1845	0.3723
Z-Score	35.2229	38.4745	40.4974	9.0043	35.2229	31.6844

Source: Annual Reports of the Far Chemical Industries Ltd (2017-2021).

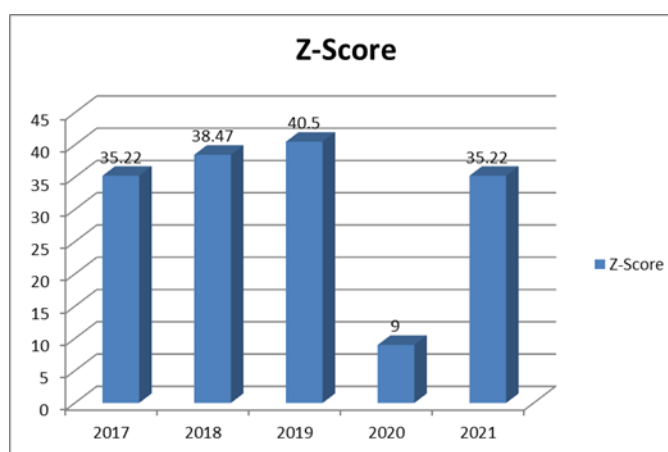


Figure 09: Z-score value of the Far Chemical Industries Ltd.

The figure 09 shows that the results of Z-score in each study period is above 2.99, which indicates that it is in the safe zone ($Z > 2.99$) throughout the study period, which means the financial fitness of the company is good. It eventually indicates that the firm is not likely to go into bankruptcy in near future.

Global Heavy Chemicals Limited

Variable/year	2017	2018	2019	2020	2021	Mean
X1=Net Working Capital/Total Assets	0.0938	0.0999	0.0666	0.0622	0.0222	0.0689
X2=Retained Earnings/Total Assets	0.1228	0.1341	0.1384	0.1377	0.1323	0.1331
X3=EBIT/Total Assets	0.0267	0.0280	0.0239	0.0155	0.0131	0.0216
X4=Market Value of Equity/ Total Liabilities	6.7854	6.7739	5.2919	4.7751	3.5539	5.4360
X5=Sales/Total Assets	0.1211	0.1245	0.1173	0.1167	0.1149	0.1189
Z-Score	4.5648	4.5889	3.6449	3.3004	2.5052	3.7208

Source: Annual Reports of the Global Heavy Chemicals Ltd (2017-2021).

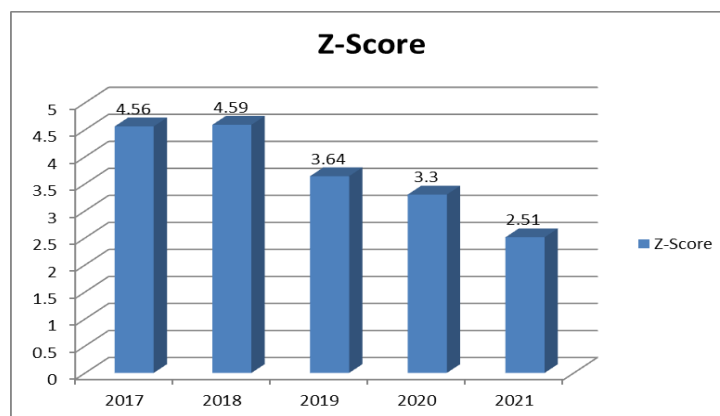


Figure 10: Z-score value of the Global Heavy Chemicals Ltd.

The figure 10 shows that the results of Z-score in each study period is above 2.99 except in 2021, which indicates that it is in the safe zone ($Z > 2.99$) in 2017, 2018, 2019 and 2020. But in 2021, the firm has entered into grey zone ($1.80 < Z < 2.99$) which slightly can be overlooked in comparison with other years. It means that the financial fitness of the company is sound which eventually indicates that the firm is not likely to go into bankruptcy in near future.

ACI Limited

Variable/year	2017	2018	2019	2020	2021	Mean
X1=Net Working Capital/Total Assets	-0.0713	-0.0953	-0.1556	-0.2119	-0.1809	-0.1430
X2=Retained Earnings/Total Assets	0.1097	0.0966	0.0627	0.0359	0.0228	0.0655
X3=EBIT/Total Assets	0.0466	0.0262	0.0028	-0.0016	0.0303	0.0209
X4=Market Value of Equity/ Total Liabilities	0.2928	0.2472	0.1770	0.1343	0.1820	0.2067
X5=Sales/Total Assets	1.0149	1.0322	1.0293	1.1285	1.1199	1.0650
Z-Score	1.4123	1.2878	1.0457	0.9997	1.1436	1.1778

Source: Annual Reports of the ACI Ltd (2017-2021).

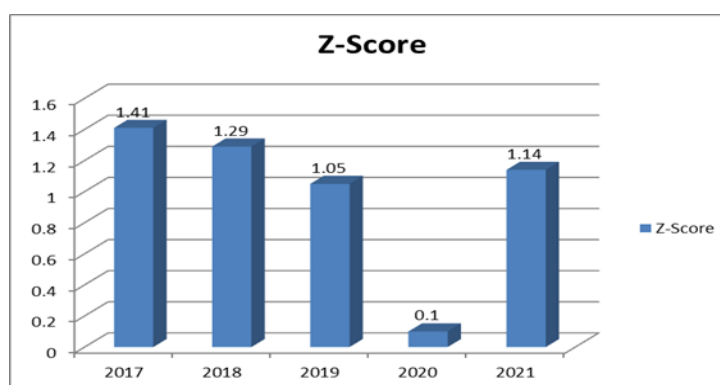


Figure 11: Z-score value of the ACI Ltd.

The figure 11 suggests that the Z-scores value of the ACI limited have been gradually declined from 2017 to 2020, which means that this firm's economic performance has become poor due to the decline in market value of shares, total assets, EBIT, total liabilities and decline in liquid assets during the period of study. But, the Z-score value has increased in 2021 due to the high demand of their sanitizing and other medical products during COVID-19. As the Z-scores value in each year of this company were less than 1.80, the company is in distress zone ($Z < 1.80$) and has a probability to head bankruptcy in next two years.

IBN SINA Pharmaceuticals Limited

Variable/year	2017	2018	2019	2020	2021	Mean
X1=Net Working Capital/Total Assets	-0.0385	-0.0830	-0.0637	-0.0653	0.0787	-0.0343
X2=Retained Earnings/Total Assets	0.2566	0.3845	0.4107	0.4250	0.4757	0.3905
X3=EBIT/Total Assets	0.1422	0.2299	0.1599	0.1644	0.1832	0.1759
X4=Market Value of Equity/ Total Liabilities	1.0525	1.0104	1.0949	1.0709	1.2675	1.0992
X5=Sales/Total Assets	1.8605	1.9074	1.8611	1.8018	1.9181	1.8697
Z-Score	3.2744	3.7111	3.5441	3.5036	4.0436	3.6153

Source: Annual Reports of the IBN SINA Pharmaceuticals Ltd (2017-2021).

The results of the Z-score value of IBN SINA Pharmaceuticals Ltd. reveal that the company is in safe zone since its Z-score value throughout the study period is above 2.99. It means that the financial health of the company is satisfactory, which indicates that the firm is not likely to head bankruptcy in near future.

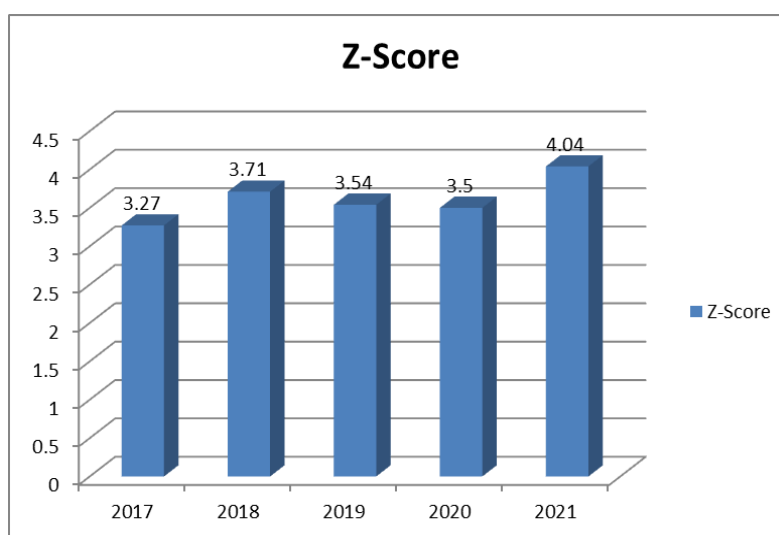


Figure 12: Z-Score value of the IBN SINA Pharmaceuticals Ltd.

Ambee Pharmaceuticals Limited

Variable/year	2017	2018	2019	2020	2021	Mean
X1=Net Working Capital/Total Assets	-0.0960	0.0924	-0.1039	0.0910	0.1098	-0.0986
X2=Retained Earnings/Total Assets	0.0696	0.0732	0.0712	0.0671	0.0373	0.0637
X3=EBIT/Total Assets	0.0229	0.0261	0.0342	0.0121	0.0291	0.0133
X4=Market Value of Equity/ Total Liabilities	0.1549	0.1613	0.1675	0.1563	0.1191	0.1518
X5=Sales/Total Assets	0.7791	0.7871	0.7971	0.6665	0.2349	0.6529
Z-Score	0.9300	0.9618	0.9855	0.7851	0.1306	0.7586

Source: Annual Reports of the Ambee Pharmaceuticals Ltd (2017-2021).

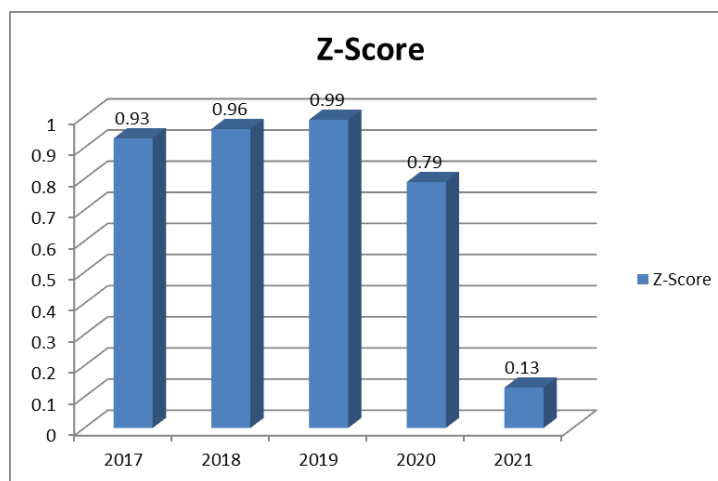


Figure 13: Z-score value of the Ambee Pharmaceuticals Ltd.

From the figure 13, it's found that in 2017, the Z-score value of Ambee Pharma Ltd is 0.93 but in 2018 and 2019 it has increased to 0.96 and 0.99 respectively. Apparently, the Z-score values have been decreased to 0.79 and 0.13 in the fiscal year of 2020 and 2021. The Z-score values of this company were below 1.8 ($Z < 1.8$) throughout the study period. It means that the company is in distress zone and has high probability to go into bankruptcy in next two years.

Indo-Bangla Pharmaceuticals Limited

Variable/year	2017	2018	2019	2020	2021	Mean
X1=Net Working Capital/Total Assets	0.9055	0.9044	0.9090	0.9270	0.9168	0.9125
X2=Retained Earnings/Total Assets	0.1926	0.2509	0.2217	0.2314	0.2581	0.2310
X3=EBIT/Total Assets	0.1325	0.1304	0.1198	0.1310	0.0940	0.1215
X4=Market Value of Equity/ Total Liabilities	6.6942	5.6351	6.5111	6.8463	6.1238	6.3621
X5=Sales/Total Assets	0.5723	0.5410	0.4671	0.0498	0.4137	0.4088
Z-Score	6.3822	5.7890	6.1699	6.0263	5.8598	6.0454

Source: Annual Reports of the Indo-Bangla Pharmaceuticals Ltd (2017-2021).

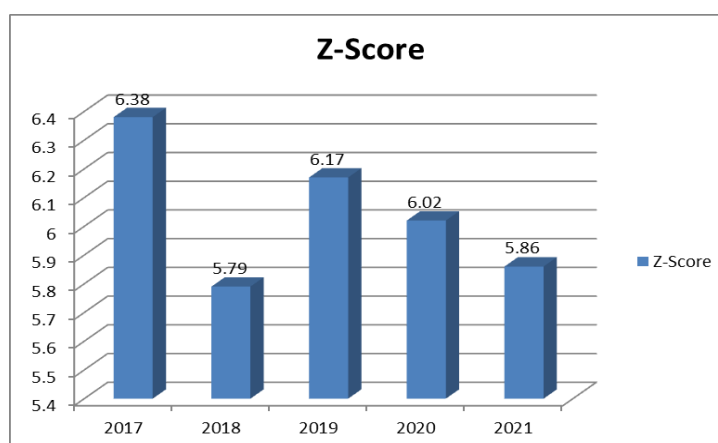


Figure 14: Z-score value of the Indo-Bangla Pharmaceuticals Ltd.

The figure 14 shows that the results of Z-scores value of Indo-Bangla Pharmaceuticals ltd in each period are above 2.99, which indicates that the company is in safe zone in the study period. However, it can be assessed that the company's financial health is sound, which means that the company is not likely to go into bankruptcy near future.

Marico Bangladesh Limited

Variable/year	2017	2018	2019	2020	2021	Mean
X1=Net Working Capital/Total Assets	0.2380	0.2077	0.1729	0.1516	0.0203	0.1581
X2=Retained Earnings/Total Assets	0.2700	0.2076	0.1606	0.1651	0.1846	0.1976
X3=EBIT/Total Assets	0.5136	0.5033	0.6009	0.7184	0.7239	0.6120
X4=Market Value of Equity/ Total Liabilities	0.7275	0.5033	0.3977	0.3879	0.3937	0.4820
X5=Sales/Total Assets	1.8433	1.7528	1.9160	1.9702	1.9515	1.8867
Z-Score	4.6381	4.2554	4.5698	4.9867	4.8595	4.6619

Source: Annual Reports of Marico Bangladesh Ltd (2017-2021).

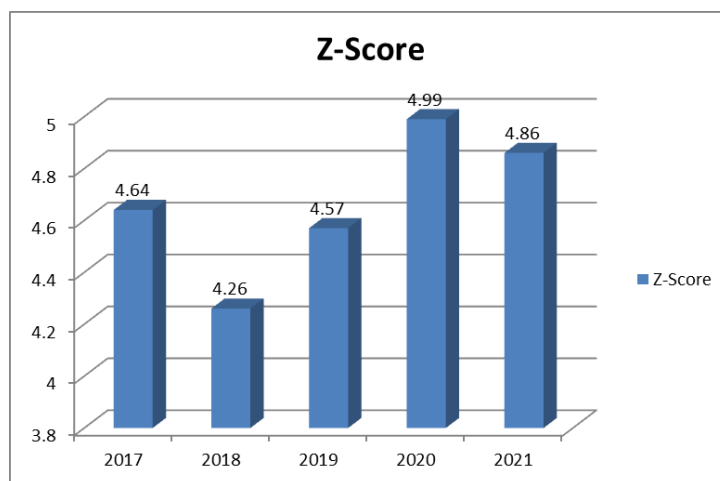


Figure 15: Z-score value of the Marico Bangladesh Ltd.

The figure 15 shows that the results of Z-score value of Marico Bangladesh ltd in each study period are above 2.99, which indicates that the company is in safe zone over the study period. However, it can be assessed that the company’s financial health is sound which indicates that the company is not likely to go bankruptcy near future.

Companies Z-Scores at a Glance

Company/year	2017	2018	2019	2020	2021	Average
SQUARE Pharmaceuticals Limited	11.5408	13.1883	12.5936	13.4210	14.9435	13.1374
Beximco Pharmaceuticals Limited	2.8049	3.1072	3.0906	3.3417	4.4955	3.3680
Reneta Limited	3.7998	4.2468	3.8441	4.4760	4.4987	4.0250
The ACME Laboratories Limited	1.9778	1.8333	1.6913	1.6898	1.6321	1.7649
Orion Pharmaceutical Limited	2.1329	2.0364	2.0603	1.7823	1.5776	1.9179
Beacon Pharmaceuticals Limited	2.0047	4.9428	2.4672	2.4602	3.0027	2.9755
Active Fine Chemicals Limited	3.1465	3.0642	2.9350	1.9836	1.9211	2.6101
Central Pharmaceuticals Limited	2.9027	2.7163	2.3028	-2.6047	0.0766	1.0787
Far Chemical Industries Limited	35.2229	38.4745	40.4974	9.0043	35.2229	31.6844
Global Heavy Chemicals Limited	4.5648	4.5889	3.6449	3.3004	2.5052	3.7208
ACI Limited	1.4123	1.2878	1.0457	0.9997	1.1436	1.1778
IBN SINA Pharmaceuticals Limited	3.2744	3.7111	3.5441	3.5036	4.0436	3.6153
Ambee Pharmaceuticals Limited	0.9300	0.9618	0.9855	0.7851	0.1306	0.7586
Indo-Bangla Pharmaceuticals Limited	6.3822	5.7890	6.1699	6.0263	5.8598	6.0454
Marico Bangladesh Limited	4.6381	4.2554	4.5698	4.9867	4.8595	4.6619

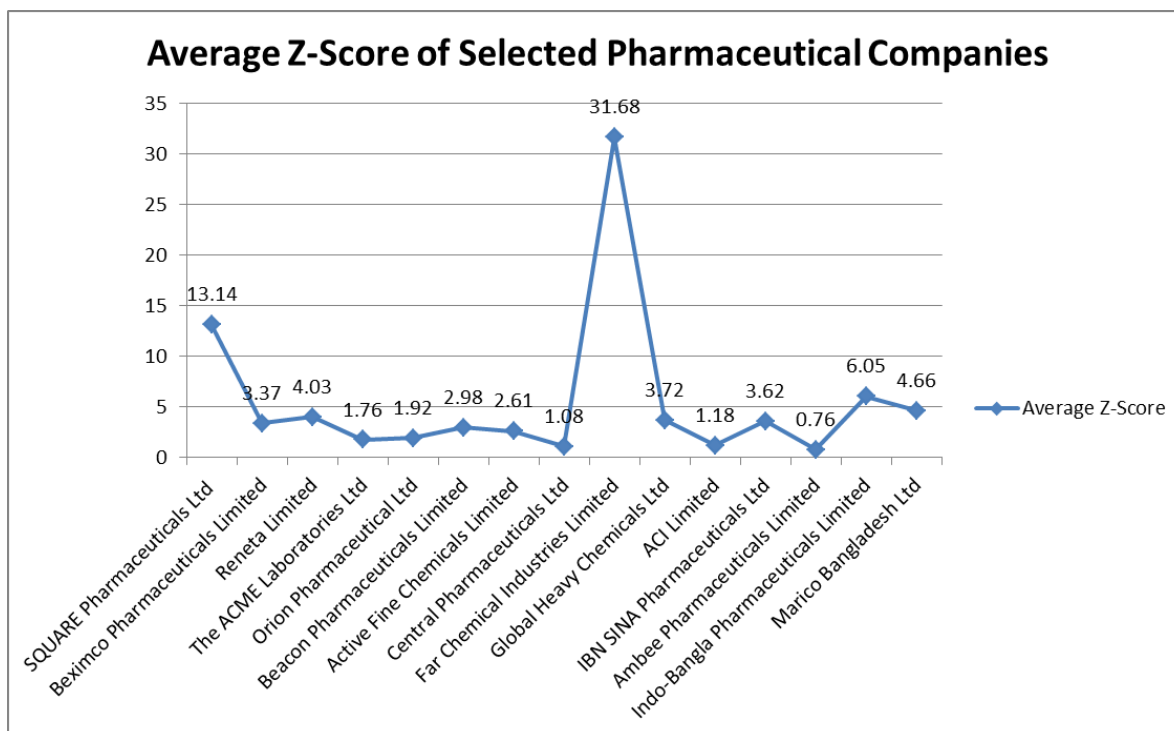


Figure 16: Average Z-score value of the selected pharmaceutical companies.

The above figure represents that the Z-score value of SQUARE pharma ltd is above average in all years except in 2017 and 2019, which are 11.54 and 12.59. Beximco Pharmaceutical Ltd has lower Z-score value than average from 2017-2020, but it has increased above average in the year of 2021. The Z-score value of Reneta Ltd is lower than average in the year of 2017 and 2019, but it has increased above average in 2018, 2020 and 2021. The Z-score values of ACME laboratories Ltd and Orion Pharmaceuticals Ltd are above average in the year of 2017, 2018 and 2019 but it became lower than average in 2020 and 2021. The Z-score value of Beacon Pharma Ltd is above average in the year of 2018 and 2021, but it has the lowest Z-score value in 2017, 2019, and 2020. The Z-score value of Active Fine Chemicals Ltd and Central Pharmaceuticals Ltd are above average for the first three years, but it has started declining in the last two years. The Z-score value of Far chemicals Ltd is above average in all years except in 2020 which is 9.00. The Z-score value of GHCL and ACI Ltd were positioned above average in the first two years, but it has become lower in the last three years of 2019, 2020 and 2021. The Z-score value of IBN SINA pharma Ltd is above average in 2017, 2018 and 2021, but it has Z-score value below average in 2019 and 2020. Ambee Pharmaceutical Ltd has the highest Z-score value which is above average in all years except in 2021. The Z-score value of Indo-Bangla Pharmaceutical Ltd is above average in 2017 and 2019, but it has a declining value in 2018, 2020 and 2021. The Z-score value of Marico Bangladesh Ltd stands below average in the first three years, but it has started increasing in the last two year ,2020 and 2021.

Overall, Far Chemical Industries Limited, SQUARE Pharmaceuticals Ltd, Indo-Bangla Pharmaceuticals Limited, Marico Bangladesh Ltd, Reneta Limited, Global Heavy Chemicals Ltd, IBN SINA Pharmaceuticals Ltd and Beximco Pharmaceuticals Limited have the highest Z-score values than the other companies, which implies that these companies are in sound financial position and good for investment. Orion Pharmaceuticals Ltd, Beacon Pharma Ltd, and Active Fine Chemicals Ltd are heading towards securing good economic fitness in the industry. The ACME Laboratories Ltd, ACI Limited, Central Pharmaceuticals Ltd, and Ambee Pharmaceuticals Limited have the lowest Z-score value than the other companies, which indicates that these companies are not holding sound position for investment.

Comparative Analysis

Years	Number of Firms		
	Z<1.81	1.81 ≤ Z ≤ 2.99	Z ≥ 2.99
2017	2	5	8
2018	2	3	10
2019	3	4	8
2020	5	2	8
2021	5	2	8

Zone	2017		2018		2019		2020		2021	
	No.	%	No.	%	No.	%	No.	%	No.	%
Safe	8	53%	10	67%	8	53%	8	53%	8	53%
Grey	5	34%	3	20%	4	27%	2	13%	2	13%
Distress	2	13%	2	13%	3	20%	5	34%	5	34%
Total	15	100%	15	100%	15	100%	15	100%	15	100%

The result shows that 15 selected pharmaceutical companies of them, 53% is in safe zone, 34% is in grey zone, and 13% is in distress zone in the year of 2017; 67% is in safe zone, 20% is in grey zone, and 13% is in distress zone in the year of 2018; 53% is in safe zone, 27% is in grey zone, and 20% is in distress zone in the year of 2019; 53% is in safe zone, 13% is in grey zone, and 34% is in distress zone in the year of 2020 and in the year of 2021, 53% is in safe zone, 13% is in grey zone and 34% is in distress zone.

V. Conclusions

Pharmaceutical industry is an integral part of Bangladesh's economy. The progress of this industry is very crucial for all stakeholders of this industry including Bangladesh's government. From the overall discussion, results, and analytical test of 15 pharmaceutical companies using the Altman Z-Score model, it can be concluded that most of the pharmaceutical companies are in safe zone. Among nine "A" Category Companies, Beximco Pharma, IBNSINA Pharma, Marico Bangladesh Ltd, Reneta Ltd, and Square Pharma have the average Z-score values that are above 2.99 ($Z > 2.99$), which means that they don't have the chance to be defaulter in near future, but the Orion Pharma is in grey zone, and also the average Z-score values of ACI Ltd, ACMELAB, and AMBEE Pharma Ltd have fallen into distress zone, and they have the high probabilities to be bankrupted in near future. Among six "B" Category Companies, the average Z-score values of the Far Chemical Industries Ltd, Indo-Bangla Pharma Ltd, and GHCL are in safe zone, but the Beacon Pharma Ltd and Active Fine Chemicals Ltd are in grey zone and they have reasonable probabilities to be defaulter, but the Central Pharmaceuticals Ltd has the highest probability of being defaulter in next two years. In 2020-2021, COVID-19 has caused a drastic crisis in Bangladesh's pharmaceutical supply chain, impacting the country's pharmaceutical industry and healthcare system due to the shortage of active pharmaceutical ingredients (API) which are imported from foreign countries. However, in this study, it is revealed that most of the pharmaceutical companies are in safe zone due to the increase demand of sanitizing chemicals, and other medication during the pandemic situations.

Based on the findings of this study, the followings recommendations are provided for further development in this sector.

- i. The overall management in particular sales, purchase, and inventory control need to be motivated so they perform all of their assign duties cordially, effectively and honestly.
- ii. Ratio analysis should be used by the pharmaceutical companies often, and steps should be taken to reduce negative ratios at least to the level of the industry average.
- iii. It is important to appoint management employees that are qualified, skilled, and experienced.
- iv. By cutting costs, eliminating waste, and enhancing management and operating capabilities, operational efficiency should be ensured and there should be availability of enough working capital.
- v. By lowering current liabilities, the liquidity position of the large cap pharmaceuticals companies should be strengthened.
- vi. Appropriate lending policies should be implemented so that the majority of profits are not spent on fixed payments.

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