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Comparative Analysis of Credit-Strength among Industries of Bangladesh: Altman's Z-score Measurement

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ABSTRACT

The main motive of the study is to explore the financial position of prominent industries in Bangladesh to give direction to investors for sound investment decisions. The Altman Z-score model has been used to assess the financial soundness of the 23 companies of five prominent industries in Bangladesh. Secondary data have been collected from the annual reports of the selected companies. This study found that 20% and 40% of the selected companies of the ceramic industry and tannery industry fall on the safe form respectively that means where investors can invest without any doubt as they are financially sound. Similarly, 28.57%, 40%, and 25% of the selected companies of cement, ceramic, and paper and printing industries stand in the grey zone respectively which indicates the companies have a good chance of bankruptcy within two years. Again 71.43%, 40%, 75%, 60%, and 100% of companies in the cement, ceramic, paper & printing, tannery, and jute industries' financial conditions are not satisfactory respectively as they fall in the distress zone. And only 20% of the selected industries fall in the safe zone. That means the overall financial soundness of the selected industries is not well. This study will be an important source for further study in the field of credit strength measurement. Every actor of society those are involved in the business (investors, lenders, workers, suppliers, financial institutions as well as the economy itself) can be able to make adequate decisions by the findings of the study.

Keywords: Credit-strength; Z-score; Financial ratios

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1. Introduction

Financial soundness is the fundamental performance of the business. Financing is strongly related to the financial soundness or credit strength of the business. Capital structure means various combinations of debt or equity, which is related to financing. One of the prominent capital structure theories is the "Pecking Order Theory", which tells that an internal fund is preferred to an external fund, and debt is preferred to equity if an external fund is required. Therefore, the firm uses retained earnings first then goes for debt, and finally goes for issuing external equity if the firm required more additional funds [1]. Retained earnings are connected to profitability, which is an important indicator of the financial soundness of a company. Investors invest funds in the firms intending to receive dividends or capital gain. Besides, lenders lend funds to firms to get back the funds with interest. These can be ensured by the financial soundness or credit strength of the firm. Therefore, the financial soundness of a firm can ensure the active participation of investors or lenders in the capital market, which is inevitable for the smooth functioning of the market. Moreover, a smooth functioning capital market is also inevitable for better economic growth and development.

The stock market is the collection of markets and exchanges where buying, selling and issuance of publicly held companies' shares are taken place. It is called the stock exchange is the mirror of the economy of a country. The importance of the stock exchange is massive because it helps a country indirectly by developing its industries and commerce. Some of the important functions of the stock market are an economic barometer, pricing of securities, the safety of transactions, contributing to economic growth spreading of equity, providing scope for speculation, liquidity, and better allocation of capital, promoting the habits of savings and investment, etc. The stock exchange is referred to as an important barometer to identify the present economic situation of a country. Small funds are accumulated into large ones with the help of the stock market but investing in the stock market is not a soft task. A profitable investor

in the share market should be aware of the factors related to the market [2]. "Bangladesh stock market had experienced a mushroom growth and crack-up anecdote in 1996. After the mushroom growth there increases noticeable participation of the investor in the market. Again, after the increasing trend of share price, a share market crash had experienced by the market in 2010- 2011 [3]. An acute and unanticipated downfall of stock price within a short period of time is called a stock market crash. Investors and speculators lose momentous capital because of the stock market crash [4]. Therefore, they lost their confidence regarding the capital market, which makes them reluctant to actively interact with the market despite having Tobin's Q less than one means the stock is undervalued. One of the important reasons is lacking proper analytical knowledge of investors about the respective companies in the market. It is noticeable that the cement industry in Bangladesh is not an old industry but rather a recently established industry. The industry started its first journey in 1992 though there are 70 cement factories at present in Bangladesh. The overall demand for cement is met by 60 % from the local industry and the rest amount by import. The per capita consumption of cement is 38 kg which is inevitably slight in India (89 kg), Indonesia (127 kg), Malaysia (582 kg) [5]. The cement industry of Bangladesh has experienced some of the fastest growth in recent years. Bangladesh also exports cement to foreign countries. And the majority of destinations for the export of cement are in India. Cement manufacturers in Bangladesh largely depend on the import of raw materials like oil, clinker, limestone, and gypsum. It exports quality ceramic products to foreign markets. The journey of the ceramic industry started in Bangladesh in the year 1958. Now about 62 ceramic manufacturers produce various tiles, porcelain, tableware, and sanitary products, etc. The main problems in the industry are the lack of supply of natural gas. The ceramic industry is playing a vital role in the export market after readymade garments thus a proper incentive and support from the authorities are urgently required [6].

The paper industry has become a successful sec-

tor in Bangladesh. It has a great potential to become one of the country's major foreign currency earners, experts say. After readymade garments (RMG) and the leather industry, this sector is playing a vital role in our national economy. There are three state-owned paper mills in the country, including Khulna Newsprint Mill (KNM) near Khalishpur, Pakshi North Bengal Paper Mills at Ishwardi in Pabna, and Karnaphuli Paper Mills (KPM) in Chittagong. Among them, only KPM, the largest paper factory in Bangladesh, is still in operation. Though it is a flourishing industry nowadays it is facing various problems like shortage of raw materials such as bamboo and softwood from the local forests. Recently many factories in China and European countries experienced disturbance for higher production costs and environmental concerns. It has opened prospects for our country. So sufficient attention should be given to this industry [7]. From 1970 leather industry extended on a large-scale basis. Leather processing is an old assembling sub-segment in Bangladesh with a long legacy of more than 6 decades [8]. Despite the development of the economy of a country, the industry bears a bad image for its contribution to the pollution of the environment. As a result, the leather industry is trying to find out sustainable manufacturing practices [9]. Adopting sustainable supply chain management (SSCM) includes a high amount of pressure. So, it is crucial to find out the most appropriate approach to sustainable supply chain management. Though there is a decline in export earnings from the tannery industry. So, it is high time to take the necessary steps for the advancement of the industry [10]. The jute industry of Bangladesh is an industry that is culturally and historically important that once was the biggest in the region but has declined since then. In the sub-continent, the jute industry started its journey from 1855-1859 with 8 spinning capacities and 192 looms. In Bangladesh, the birth year of the jute industry is 1950-1970. In 2007, there were 131 jute mills in Bangladesh [11]. Jute has played a significant contribution to our economy. Jute and jute made goods accounted for up to a handsome percentage of total export items. Unfortunately, this industry is suffering from losses. The industry has both opportunities and objections. The stagnation and decline of the performance of the industry are largely dependent on the source of raw materials, production, distribution, and policy frameworks [12]. So, the strength and weaknesses of the related industry should be identified immediately to make it the most prosperous industry. Among various industries, these five industries are prominent in our country. Shareholders invest a lot of money in these industries. Sometimes it is noticeable that many investors are not able to earn enough profit from the investment. Because investors are not always aware of the present scenery of the respective companies. Sometimes investors also lose their investment because of the bankruptcy of the respective company. If they can know the bankruptcy position of the company, they will be able to make a profitable investment. There are various methods for the calculation of the probability of bankruptcy. Among them, Altman Z-score is a more reliable method [13]. It was first developed by Edward I. Altman in 1968 for the prediction of financial soundness or bankruptcy [14,15]. This method is used to predict the possibility of bankruptcy of a company within 2 years. That means it also measures the credit risk of a particular company. Mainly the information from the income statement and balance sheet is used here for the prediction. Five important ratios such as liquidity, profitability, solvency, sales activity, and leverage ratios are the basis of the method. Based on the result of the method an investor can decide whether to buy a share or not [16]. For this reason, the study has used the Altman Z-score to assess the financial soundness of the cement, ceramic, paper and printing, tannery, and jute industries.

A smooth functioning capital market is inevitable for better economic growth and development. Active participation of investors or lenders in the capital market is inevitable for the smooth functioning of the market. These can be ensured by the better financial performance of the industries as well as companies listed on the stock exchange. But investors have lost their confidence regarding the capital market after the share market crash in 2010-2011. Therefore, they

are very much reluctant to interact with the market properly despite the stock being undervalued, which ensured a lack of proper knowledge of investors regarding the intrinsic value of the respective companies of the market. Therefore, the present study attempts the comparative credit-strength analysis among industries to give a guideline to investors for an investment decision. Besides, lenders also will get a benchmark to lend money properly by the output of the present study. Business is the large changing agent of society. The respective social actors, such as investors, lenders of funds, workers of the business, suppliers, financial institutions as well as economy of the country are affected by the insolvency of any business. So, the research purpose is to make a study about the credit stability of the 5 prominent industries. I have selected these industries because these industries play a vital role in the development of a country's economy. The research question is whether the financial position of the industry is sound or not. Every actor in society those are involved in business can be able to make adequate decisions by the findings of the study. The respective industries, as well as companies, will get a yardstick to evaluate their credit strength, which may lead the companies to improve financial soundness and transparency. If the above-mentioned functions can be ensured then this will lead to the better function of the capital market, which will contribute to economic growth and development.

2. Review of literature

It is inevitable to measure the financial soundness of the private banks to judge their position [17]. Comparative financial soundness measurement is crucial for the commercial banks of Romania (Bangladesh) using the CAMELS [18] framework [19]. A study made by Partha Ghosh says that Z-score is a vital time-tested method to verify the bankruptcy or insolvency risk of a firm. It also shows that Dunlop India Ltd. has been using the method to evaluate the financial soundness of the company from 2007-2008 to 2011-2012 [20]. Maina and Sakwa [20] utilize the Z'-score multi-discriminant financial analysis model that

highlights a framework for finding out the financial performance of the firms listed on the Nairobi Stock Exchange. Altman's bankruptcy formula is easy to use in Slovak economic conditions and beneficial for predicting financial distress. A study develops an evaluation model for sustainable maintenance performance for the cement industry where a total of sixteen indicators related to social, economic, and environmental aspects are proposed [21]. A paper focused on the technique for order preference by similarity to the ideal solution (TOPSIS) method urges that relative preference of firms based on TOPS. It is quite diverse from the result shown by their market capitalization [22]. Another study conducted on the financial soundness of the cement industry by Altman-z score shows that most of the cement companies of Bangladesh are in distress position. Mizan and Hossain show that two (Heidelberg Cement Bangladesh Ltd. and Confidence Cement Ltd.) out of five firms (Heidelberg Cement Bangladesh Ltd., Confidence Cement Ltd., Meghna Cement Mills Ltd., Aramit Cement Limited and Lafarge Surma Cement Limited) are in a safe position in the Bangladesh cement industry. The study also used Porter's five forces model to analyse the environment (competitive environment) of the ceramic industry which indicates that the collective impact of the competitive forces is tolerable [23]. Abdullah Al Masum and Fatema Tuz Zohora combinedly conducted a study on the performance evaluation of the ceramic industry based on ratio analysis where they found that the liquidity position of all the cases of the selected companies is weak reflecting the difficulties in paying short-term obligations on the right date and the financial stability of the companies are in an upward trend [24]. A study conducted in Indonesia on the export-oriented ceramic industry center by SWOT analysis where it has been found that the export-oriented ceramic industry is in the growth position if adequately backed by the production capacity of the organization and a suggestion has also been given to improve the internal environment of the business [25]. A study conducted on the performance evaluation of selected ceramic industry based on the ANOVA test

found that the asset and sales management of the impoverished performers is to be improved as well as liquidity position has also to be improved [26]. A study made in Portugal on "environmental performance of printing and writing paper using Life Cycle Assessment" found that the life cycle of printing and writing papers includes various stages like a forest, pulp production, paper production, final disposal energy production, chemical production, and transports [27]. In an empirical study made by Jiang-Liang Hou on quantitative performance evaluation of RFID applications in the supply chain of the printing industry-focused the printing supply chain is classified into six fundamental models and the ideal approach for RFID application in the printing supply chain is the item-tagging mechanism [28]. The tannery industry has been an area of export thrust with footwear having been identified as an area of extreme focus. This overgrowing sector has received much criticism on environmental as well as health issues though this industry has massive potential. Fundamentally, the way of tanning is to retain the skin's natural properties, store its structure, and at the same time chemically process it will no longer be subject to putrefaction. It is one of the most energy-dependable industries in Bangladesh creating Ecotoxicity like water pollution, and solid waste generation. Eco-toxicity evaluation of any aquatic environment has not been accepted on a large scale in Bangladesh [29]. Research on risk-adjusted performance analysis of the cement, ceramic, tannery, and IT industry concluded that for finding out the stated goal the study used various traditional tools and risk-adjusted-performance measuring tools such as Treynor ratio, Jensen alpha Fama's net selectivity ratio, and Sharpe ratio. It is also noticeable that MONNOCERA from the ceramic industry, SAMATALETH from the tannery industry, DAFODILCOM from the IT industry are comparatively the best performers. Again, STANCERAM from the ceramic industry, LEGACYFOOT from the tannery industry, ISNLTD from the IT industry also have a positive results [30]. Mahbuba [31] made a study on "Assessing Financial Soundness of Tannery Industry in Bangladesh: An Empirical investigation Using Z-score" by taking all the listed companies of Dhaka stock exchanges here he found that only two firms are financially sound and others have not to sound financial condition. The study has found two different views such as operational measures and financial measures [32]. Khan [33] has shown in research on privatization and employment: A study of the jute industry in Bangladesh that the proportion of reduction of employment was significantly larger among white-collar employees compared to permanent manual workers. The study also summarized that five external factors political climate, competition, industrial relations, government regulations, and aid agencies were deemed to affect budget-related factors such as budget flexibility, participation, interactions among managers, accountability for budget, budget analysis, and budget evaluation [34]. Alcalde and Roberto [35] have shown the possibility of bankruptcy for the supply chain of different industries by Altman's Z-score. They found the building industry has the highest chance of bankruptcy. Research has been performed using a sample of 10 manufacturing companies on the Nigeria Stock Exchange by Altman's Z-score which found that Z-score is a very vital tool for finding companies having deteriorating performance in the country [36]. Laitinen [37] has indicated some evidence that Z-score models of bankruptcy vatication have been super performed by comparing market-based or hazard models. In other studies, Altman's Z-score models perform in a vital manner. Maruthy [38] has made a study that finds that Altman's Z-score is a powerful diagnostic tool for forecasting bankruptcy and measurement of the firm's proficiency and the level of danger status of the firm. Cindik [39] has predicted the financial soundness of 80 Turkish companies using four different models Altman's Z-score, Revised Altman's Z-score (Linear discriminant Analysis) and Quadratic Discriminant Analysis, Random Forest Machine Learning Model by the use of variables suggested by Altman's Z-score. The above studies show that Altman's Z-score model is applicable to evaluate the credit strength of the company. But most of the studies applied this model to evaluate the

credit strength of a single company or industry. Therefore, the present study is conducted to allow investors, lenders, even the companies to compare the credit strength among the companies in industries as well as among the industries listed on the stock exchange. By the methods and findings of the study, the policymakers get a guideline for the listing of companies on the stock exchange, investors get a guideline for better investment decisions, and companies and industries get a benchmark to compare their financial soundness. Therefore, this study gives practical experience for the development of the capital market. Besides, by the outcome of the study, the academic scholars, teachers, concerned authorities of the financial market, executives, and entrepreneurs of the companies will be able to compare the practical experience with the theories and principles of financial soundness.

3. Materials and methods

This study has been conducted based on quantitative data. Of a total of 23 companies in Bangladesh only five industries have been chosen. These are listed companies on the Dhaka Stock Exchange. Secondary data of the listed companies for the year 2018-2019 have been used. All the data have been collected from their annual report (annual report 2019). The name of industries includes the cement industry, ceramic industry, paper and printing industry, tannery industry, and jute industry. The listed companies include Aramit Cement Limited (ACL), Confidence Cement Ltd. (CCL), Heidelberg Cement Bangladesh Ltd. (HCBL), Lafarge Holcim Bangladesh Limited (LHBL), Meghna Cement Mills Ltd. (MCML), M.I. Cement Factory Ltd. (MICFL), Premier Cement Mills Ltd. (PCML), Shinepukur Ceramics Ltd. (SCL), Rak Ceramics (Bangladesh) Limited (RCL), Standard Ceramic Industries Ltd. (SCL), Fu-Wang Ceramic Industry Ltd. (FWCIL), Monno Ceramic Industry Ltd. (MCIL), Bashundhra Paper Mills Limited (BPML), Hakkani Pulp & Paper Mills Ltd. (HPPML), Khulna Printing & Packaging Limited (KPPL), Sonali Paper & Board Mills Ltd. (SPBML), Apex Footwear Ltd. (AFL), Bata Shoes

Ltd. (BSL), Apex Tannery Ltd. (ATL), Fortune Shoes Ltd. (FSL), Legacy Footwear Ltd. (LFL), Southern Jute Manufacturing Co. Ltd. (SJML), Sonali Ansah Industries Ltd. (SAIL). Three Z-score models have been developed. Such as models for a publicly traded manufacturing firm, private manufacturing, and non-manufacturing company. Here, the model for publicly traded manufacturing firms has been used.

The model Z-score [40] is Z= 1.2T1+1.4 T2+ 3.3T3+0.6T4+0.999T5.

In the model, T1 = working capital/Total assets, T2 = Retained Earnings/Total Assets, T3 = Earnings before interest and taxes/total assets, T4 = Market Value of Equity/Book value of total liabilities, and T5 = Sales/Total assets. The Z-score is calculated by multiplying each of several ratios by an appropriate coefficient and then summing the results.

T1 (working capital/total assets) can be found by dividing the working capital by the value of the total assets. This is a measurement of liquidity position. It indicates how many assets are tied up to working capital. And it also shows how many assets are available to meet up short-term liabilities. If the working capital is very low, then it indicates the financial difficulties of the company. That means it is not able to meet up the short-term liabilities of the company. That can be an early signal to bankruptcy where companies are not able to pay creditors and suppliers which slows down the production and sales contract.

T2 (retained earnings/ total assets) indicates the earnings relative to the total assets of the company. It can be found by dividing the retained earnings value by the total assets of the company. The ratio shows the ability of a company to generate income for reinvestment rather than using it for debt-equity of financing. It also indicates how profitably the company is being managed. It is true that in the early stage the retained earnings of a company are very low. Because they have just started operations, they did not have sufficient time to generate high earnings. In this way, very low retained earnings to total assets classify as a bankrupt company.

T3 (EBIT/total assets) similarly shows the rela-

tionship between EBIT and total assets. EBIT indicates the income before interest and taxes. And total assets value is taken from the value stated in the balance sheet. It measures the productivity or earning power capacity of the company. Based on the ratio the existence of the firm is dependent. It is a strong determiner to measure corporate failure.

T4 (market value of equity/book value of total liabilities) can be found based on the market value of equity and book value of total liabilities. Here the value of equity includes both the common stock and preferred stock, and the value of liabilities includes both short-term and long-term liabilities. It determines the level to which a company can reduce in value before it faces bankruptcy.

T5 (sales/total assets) can similarly be determined based on sales and total assets. Here the sales value is the total revenue earned during a specific period. It is a total asset turnover ratio or capital-turnover ratio. This ratio has a significant impact on the total Z-score model. It is used to determine the sales-generating capacity of the assets. The higher the ratio is the better. The score of Z-score has three different meanings based on score level. Here, the score $Z > 2.99$ implies a safe zone. Similarly, the score of $1.81 < Z < 2.99$ expresses a grey situation indicating a good chance of bankruptcy within the next 2 years of operations. Again, the score $Z < 1.81$

indicates a distressed situation with a high probability of bankruptcy within the time.

4. Results and discussion

The study has been conducted based on five important ratios of the respective company of each industry. Based on the ratio result varies from company to company and industry to industry. The Z-score of each industry has been discussed below.

In the cement industry, we have taken seven listed companies. From **Table 1** it is noticeable that among the seven companies the highest Z-score is found in Lafarge Holcim Bangladesh Limited (LHBL) which is 2.1256 indicating a grey zone. And the second-highest is in the Heidelberg Cement Bangladesh Ltd. whuch is 1.8422 which also indicates a grey zone status. The other 5 companies have a distress zone Z-score like Aramit Cement Limited (0.0049), Confidence Cement Limited (1.6686), Meghna Cement Mills Limited (0.9763), M.I Cement Factory Limited (1.4010), and Premier Cement Mills Limited (1.1563).

From **Figure 1**, we can see that the Z-score is top in the Lafarge Holcim Bangladesh Cement factory limited (2.1256) which indicates there is a chance of being bankrupt within two years. And the lowest Z-score is in Aramit Cement Limited whose score is

Table 1. Calculation of Z-score of cement industry.

Name of the Company	Working Capital / Total Assets	Retained Earnings / Total Asset	EBIT/ Total Asset	Mkt. Value of Equity / Total Liabilities	Sales / Total Assets	Z- score	Zones
Aramit Cement Limited (ACL)	–0.1374	–0.0879	–0.0302	0.0060	0.3890	0.0049	Distress
Confidence Cement Ltd. (CCL)	0.0668	0.2398	0.0514	0.9196	0.5314	1.6686	Distress
Heidelberg Cement Bangladesh Ltd. (HCBL)	–0.0583	0.2633	0.0261	0.5947	1.1006	1.8422	Grey
Lafarge Holcim Bangladesh Limited (LHBL)	0.0064	0.1576	0.0996	1.5104	0.6626	2.1256	Grey
Meghna Cement Mills Ltd. (MCML)	–0.1280	0.0454	0.0148	0.1126	0.9499	0.9763	Distress
M.I. Cement Factory Ltd. (MICFL)	0.0496	0.1093	0.0226	0.5913	0.7591	1.4010	Distress
Average	–0.0390	0.1273	0.0325	0.5893	0.7186	1.3107	Distress

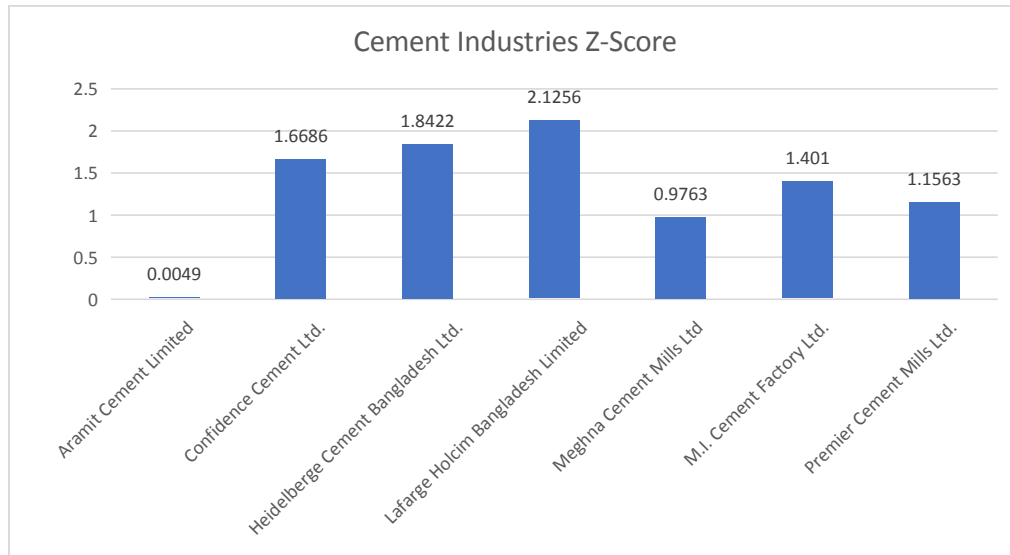Source: Annual reports of the sampling cement companies.

Figure 1. Z-score result of cement industries.

0.0049 indicating a chance of being bankrupt within one year. And the average Z-score of the cement industry is 1.3107 indicating a distressed position of the industry.

From **Table 2** it is found that Standard Ceramic Industries Limited (SCIL)'s Z-score is 3.60 indicating the highest position in the ceramic industry. Among the five companies, the other two companies are in a grey position like Rak Ceramics (2.11) and Monno Ceramic Industry Ltd. (1.84). This indicates that these companies have a possibility of being bankrupt within two years. Again, the other two companies like Shinepukur Ceramics Ltd. (1.28) and Fu-Wang Industries Ltd. (1.84) are in a distressed

position that means they have a possibility of being bankrupt within one year. In the table, we notice that Shinepukur Ceramic Limited's liquidity position is negative which has a negative impact on its Z-score. We can also see in the table that Standard Ceramics Industries Limited has a negative liquidity position, but its Z-score is sound. Its main reason is that its other ratios are in a good position. So, investors can easily invest in Standard Ceramics Industries Ltd.

From **Figure 2** it is noticeable that Standard Ceramics Limited is in the top position and Shinepukur Ceramic Limited is in the lowest position. And the average Z-score of the industry is in a gray position that is 2.086 which is not a good sign for the industry.

Table 2. Calculation of Z-score of ceramics industry.

Company Name	Working Capital / Total Asset	Retained Earnings / Total Asset	EBIT / Total Asset	Market Value of Equity / Total Liability	Sales / Total Asset	Z-score	Zones
Shinepukur Ceramics Ltd.	–0.08	0.009	0.014	1.812	0.231	1.28	Distress
Rak ceramics (Bangladesh Limited)	0.287	0.125	0.082	1.361	0.507	2.11	Gray
Standard Ceramics Industries Ltd.	–0.041	0.001	0.574	0.743	1.305	3.60	Safe
Fu-Wang Ceramic Industry Ltd.	0.212	0.032	0.044	1.538	0.237	1.60	Distress
Monno Ceramic Ltd.	0.007	0.056	0.029	2.190	0.342	1.84	Grey
Average	0.077	0.0446	0.1486	1.5288	0.5244	2.086	Grey

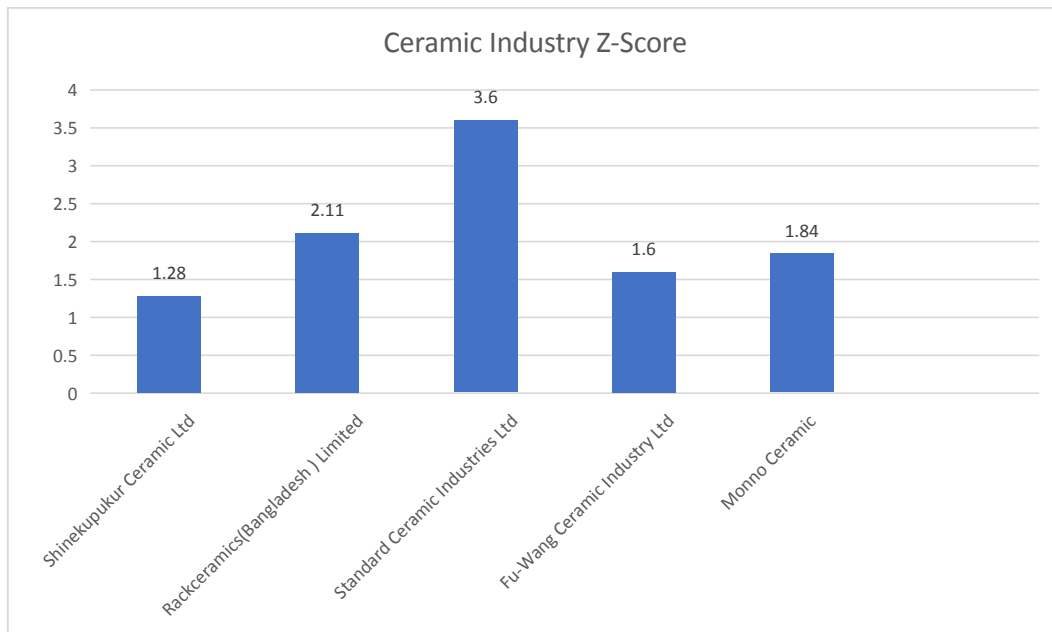Source: Annual reports of the sampling ceramics companies.

Figure 2. Z-score result of ceramic industries.

We have taken 4 listed companies of the paper and printing industry. It is noticeable from **Table 3** that among the four companies Sonali Paper and Board Mills Ltd. Z-score (2.6400) is in a gray position indicating the company has a probability of being bankrupt within two years. Investors can invest by taking a little bit of risk by considering the other position of the company. Other three companies like Bashundhra Paper Mills Limited (0.7814), Hakkani Pulp & Paper Mills Ltd. (0.7069), and Khulna Printing & Packaging Limited (1.6345) are in a distress situation that indicates these companies have the probability of being bankrupt within a year. This situation is not good for these companies. As maxi-

mum companies are in distress position, the average Z-score of the industry falls in the distress position that is 1.4407.

From **Figure 3** Sonali Paper and Board Mills Ltd.'s Z-score is at the top among the four companies. And the worst position prevails in the Hakkani Pulp and Paper Mills Ltd. that Z-score is 0.7069. This company's liquidity and EBIT/Total Assets are in a negative position. So, the company should be more concerned about the two ratios. Though its retained earnings to total assets ratios are positive (0.0001), it should also be improved for a sound financial position.

In the tannery industry five listed companies are

Table 3. Calculation of Z-score of paper and printing industry.

Name of the Company	Working Capital / Total Assets	Retained Earnings / Total Asset	EBIT/ Total Asset	Mkt. Value of Equity / Total Liabilities	Sales / Total Asset	Z- score	Zones
Bashundhra Paper Mills Limited (BPML)	0.0644	0.0633	0.0158	0.3294	0.3657	0.7814	Distress
Hakkani Pulp & Paper Mills Ltd. (HPPML)	−0.0065	0.0001	−0.0042	0.6020	0.3672	0.7069	Distress
Khulna Printing & Packaging Limited (KPPL)	0.6202	0.0224	−0.1171	1.7097	0.2194	1.6345	Distress
Sonali Paper & Board Mills Ltd. (SPBML)	−0.0511	0.0027	0.0132	3.9438	0.2875	2.6400	Gray
Average	0.1254	0.0177	−0.0184	1.31698	0.2400	1.4407	Distress

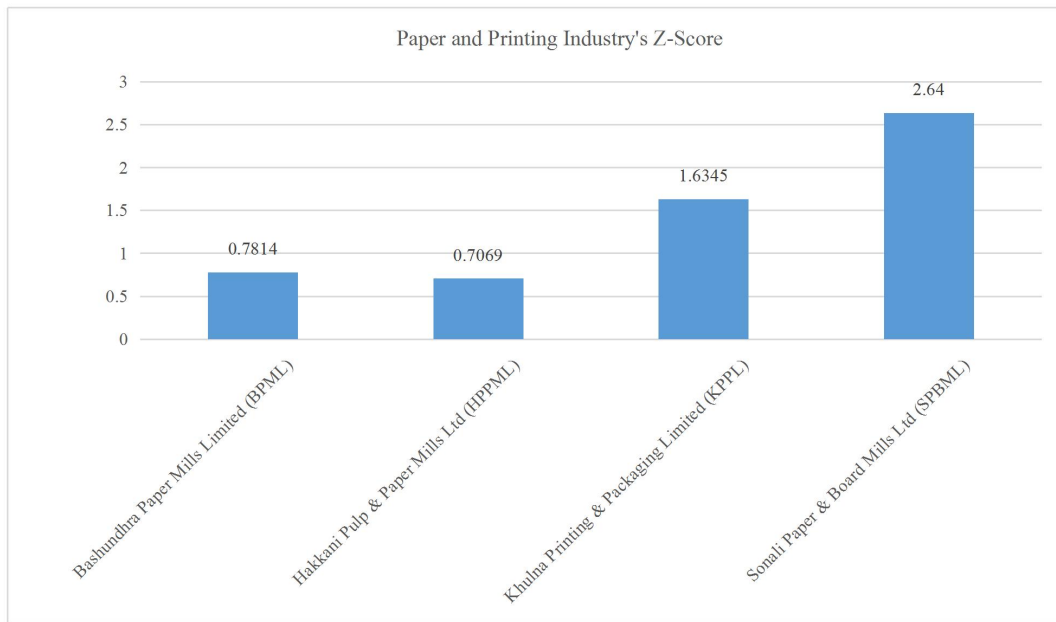Source: Annual reports of the sampling paper and printing companies.

Figure 3. Z-score result of paper and printing industries.

taken for the study. Among the five companies, we can see that Bata Shoes Ltd. and Fortune Shoes Ltd. have a sound Z-score which means their Z-scores fall in the safe zone. Fortune Shoes Ltd. and Bata Shoes Ltd. have a mentionable Z-score of 8.4197 and 3.1731 respectively. It is noticeable from **Table 4** that Fortune Shoes Ltd. has the highest Z-score in the tannery industry. Its main reason is that its market value of equity is 10 times more than its total liability. Bata Shoes Ltd.'s market value of equity to total assets and sales to total assets ratios are 1.216 and 0.943 respectively which has a great influence on its Z-score. So, investors can easily invest in these companies without any hesitation. The other three companies are in a distressed position in the case of the Z-score. Their Z-scores are 1.3842, 1.7131, and

1.4930 for Apex Footwear Ltd., Apex Tannery Ltd., and Legacy Footwear Ltd. respectively. For investing in these companies investors should be more careful. Though 3 companies among the five are in a distress situation, the average Z-score of the industry is in a safe position for the high Z-score in the company Fortune Shoes Ltd.

From the above **Figure 4**, it is mentionable that the highest and lowest Z-scores go to Fortune Shoes Ltd. and Apex Footwear Ltd. respectively. And Bata Shoes Ltd. has the second-highest Z-score.

We have chosen two listed companies in the jute industry for the analysis. They are Northern Jute Manufacturing Co. Ltd. and Sonali Aansh Industries Limited. From **Table 5**, it is noticeable that both companies' financial position is in a distressing

Table 4. Calculation of Z-score of tannery industry.

Name of the Company	Working Capital / Total Assets	Retained Earnings / Total Asset	EBIT/ Total Asset	Value of Equity / Total Asset	Sales / Total Asset	Z-score	Zones
Apex Footwear Ltd.	0.001	0.101	0.016	0.228	1.052	1.3842	Distress
Bata Shoes Ltd.	0.392	0.534	0.087	1.216	0.943	3.1768	Safe
Apex Tannery Ltd.	−0.019	0.131	0.016	1.264	0.742	1.7131	Distress
Fortune Shoes Ltd.	0.491	0.315	0.119	10.433	0.737	8.4197	Safe
Legacy Footwear	0.053	0.054	0.096	0.785	0.566	1.4930	Distress
Average	0.1836	0.227	0.0668	0.7511	0.808	3.2373	Safe

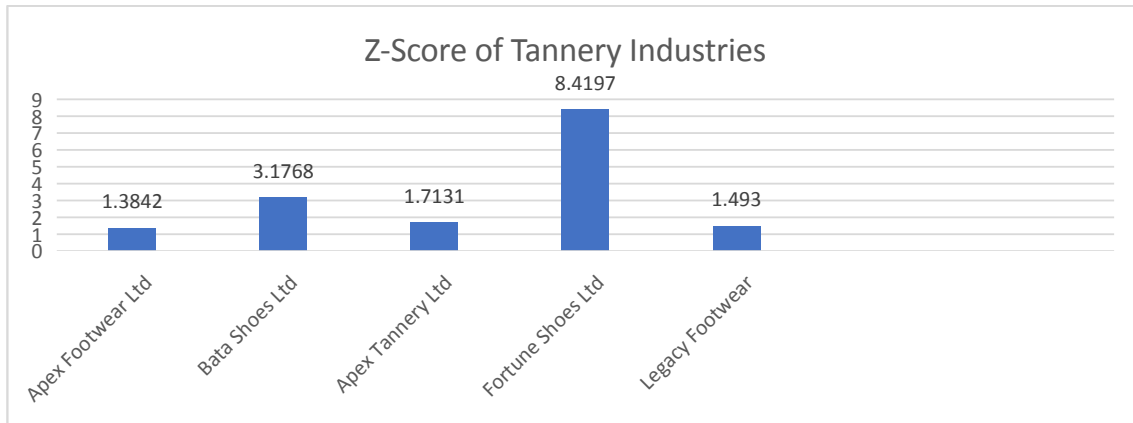Source: Annual reports of the sampling tannery companies.

Figure 4. Z-score result of tannery industries.

stage. Northern Jute Manufacturing Co Ltd.'s working capital to total assets and retained earnings to total assets are in a negative position. Sonali Aansh Industries Limited's EBIT to total assets is very poor which is 0.0017 which has a significant influence on the company's Z-score. As a result, both companies' Z-score is in a distressed position that leads the jute industry to a distressing stage. The average Z-score of the jute industry is 0.7284 indicating a high probability of bankruptcy the industry. Interested investors should be alert about the industry. Also, the owner and board of directors of the companies should be conscious of their present situation otherwise they will be bankrupt within a year.

From **Figure 5** it is prominent that between the two companies Nothern Jute Manufacturing Co. Ltd.'s Z-score is better than that of Sonali Aansh Industries Limited. Although both companies' Z-scores are in a distress position leading the industry towards a poor financial position.

Comparative analysis of financial soundness through Z-score model

Altman's Z-score model is used to determine whether a company will go into bankruptcy or not within two years. The model proposed some values for detecting the area of discrimination. Such as Z > 2.99 shows "Safe zones ", 1.81 < Z < 2.99 for "Grey zones" and Z < 1.81 for "Distress zones" (Rahman, 2016). This study has focused on 5 listed industries of Dhaka Stock Exchange. They are cement, ceramic, paper and printing, tannery and jute industries. And 23 companies of the above industries have been analyzed for showing their actual position with the bankruptcy. From **Table 1** it is noticeable that no companies in the cement industries fall in the safe zone based on financial figures. Among 7 companies only two industries (28.57% out of 100% of cement industries) such as HCBL (1.8422) and LHBL (2.1256) have fallen into the grey zone showing there

Table 5. Calculation of Z-score of jute industry.

Name of the Company	Working Capital / Total assets	Retained Earnings / Total assets	EBIT / Total Assets	Market Value of Equity / Total Liabilities	Sales / Total Assets	Z-score	Zones
Northern Jute Manufacturing Co.Ltd.	−0.1821	−0.0767	0.0725	0.2610	0.6786	0.7480	Distress
Sonali Aansh Industries Limited	0.0554	0.0478	0.0017	0.5640	0.2316	0.7088	Distress
Average	−0.0634	−0.0144	0.0371	0.0209	0.4551	0.7284	Distress

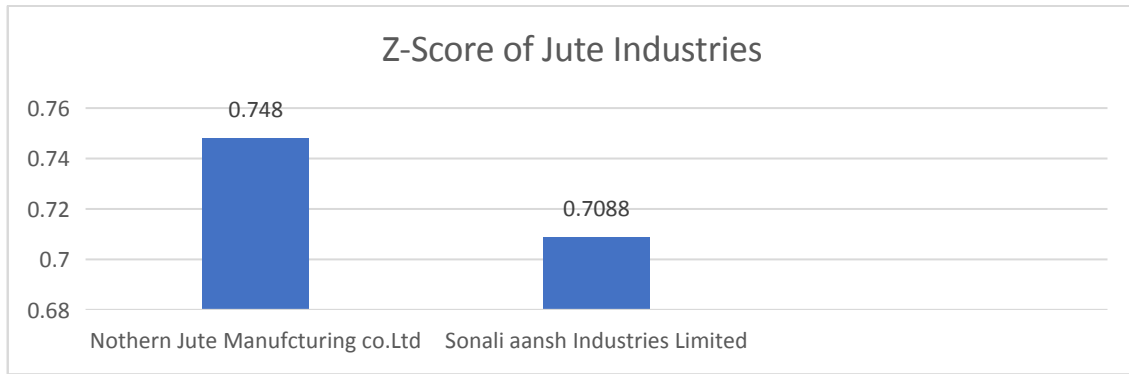Source: Annual reports of the sampling jute companies.

Figure 5. Z-score result of jute industries.

is a good chance of these companies going bankrupt within the next 2 years of operations. Again, the other five companies (71.43%) (out of 100%) of the ceramic industry such as ACL, CCL, MCML MICFL, and PCML have fallen into distress zones indicating a high probability of distress these companies within the period. It is also shown in the table that the average Z-score of the industry is 1.3107) expressing a distressed position of the industry. From **Table 2** it is found that Standard Ceramic Industries Ltd. has fallen into the safe zone (3.60) which indicates a financially sound position of the entity. Only two companies in the industry (40% of the industry) such as RCL, MCIL fall in the grey position. That means 40% companies of the ceramic industries have a chance of being bankrupt within two years. Again, it is noticeable about 40% of companies such as SCL, FWCIL are in a financial distress position. They have a chance of being bankrupt within the time. Also, the average industry Z-score has fallen to a grey position (2.086) highlighting the industry has a probability of being bankrupt within the period. From **Table 3**, understandably, Sonali Paper & Board Mills Ltd. (SPBML) has a Z-score of 2.6400 which indicates that the company is in a financially grey position. That means 25% of the paper and printing industry has a chance of being bankrupt within two years. The other three companies in the industry have fallen into a distress position. The companies are BPML (0.7814), HPPML (0.7069), KPPL (1.6345) which have a chance of being bankrupt within the period. Similarly, the industry average Z-score is 1.4407 (distress). **Table 4** highlights that two (Bata Shoes

Ltd. & Fortune Shoes Ltd.) companies in the tannery industry have fallen into a safe position. The companies are Bata Shoes Ltd. (3.1777) and Fortune Shoes Ltd. (8.4197). That means 40% companies of in the tannery industry are financially sound. The other three companies (60 % of the industry) such as Apex Footwear Ltd. (1.3842), Apex Tannery Ltd. (1.3238), and Legacy Footwear Ltd. (1.4930) are in a financial distress position. And the average industry Z-score is 3.1597. It is significant that although 60% of companies in the industry are in a distressed position, the average Z-score of the industry is in a safe position. The reason behind Fortune Shoes Ltd. Z-score is very high such as 8.4197. From **Table 5** it is highlighted that both companies in the jute industry are in a distressed condition. That means the jute industry is in a financial distress position indicating the industry has a probability of being bankrupt within the period. From the above discussion among the 23 companies only 3 companies fall in a safe position, 5 companies in a grey position, and 15 companies fall in a distressed position. And only the tannery industry's average Z-score is in a safe position. From **Table 6** it is mentionable that only the tannery industry's average Z-score is in a safe position. The ceramic industry's financial condition has fallen into a grey position. And the rest 3 industries' Z-Scores have fallen in distress condition.

From **Figure 6** we have found a citable thing that among the five industries tannery industry's Z-score is in the top position while the jute industry is in the lowest one. The ceramic industry's Z-score is 2.086 which is the 2nd highest in the industry. So,

Table 6. Comparison among industry.

Serial No.	Name of the Company	Z-score	Zones
1	Cement Industry	1.3107	Distress
2	Ceramic Industry	2.086	Gray
3	Paper and Printing Industry	1.4407	Distress
4	Tannery Industry	3.2373	Safe
5	Jute Industry	0.7284	Distress

Source: Calculation of Z-score shown in the Table 1 to Table 5.
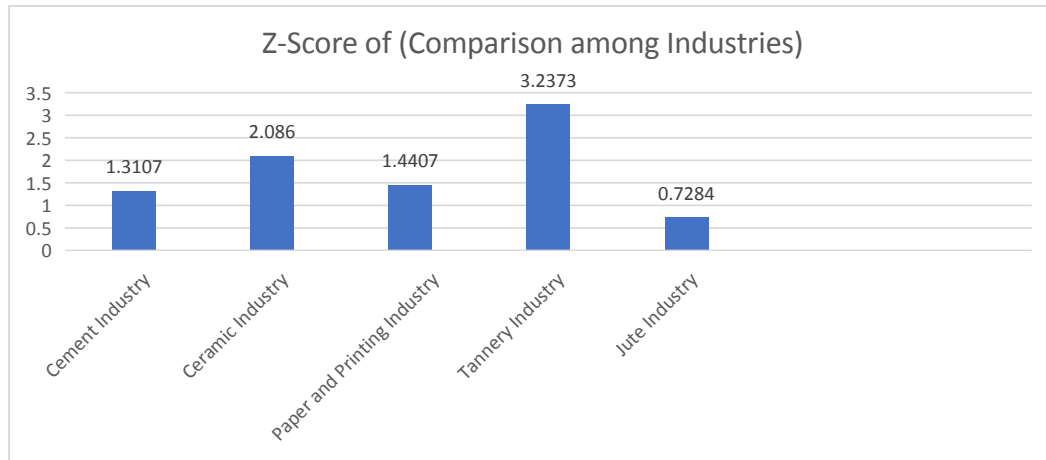
Figure 6. Comparison Z-score result among all the selected Industries.

an investor can easily think about investment for the first time. Investors should be alert about the jute industry.

5. Discussions and implications

The present study attempts to address some gaps and in doing so makes important contributions. First, the study extends the limited research on the Comparative Analysis of Credit-Strength among the five prominent industries of Bangladesh by Altman's Z-score. Secondly it finds some company's financial position is very sound and some are poor. This finding is very important for the stakeholders of the concerned industry. This research has also several important practical implications. Companies should improve their financial soundness and transparency. The respective authorities should be more concerned regarding listing the companies on the stock exchange. Investors, as well as lenders of funds, should be more alert to invest funds in these industries. After all, every actor of society those are involved in

business, as well as the capital market, should have knowledge regarding the financial soundness of the companies. They also should have the ability for calculating the intrinsic value of the companies. The strength of this study is the application of Altman's Z-score Model for the comparative credit-strength analysis among the selected industries listed in the Dhaka Stock Exchange but also has a limitation. Therefore, the findings of the study can vary in the case of changing the industries and expanding the sample size. The findings of the study can be compared by conducting more research considering the industries listed on Chittagong Stock Exchange. The findings of the study also can be compared by conducting separate research applying other models (Amat et al. scoring mode) for analyzing credit strength. It is recommended to conduct further research incorporating the effect of the financial leverage along with this model. Some research can also be conducted by addressing social performance, managerial performance, etc. along with this model.

6. Conclusions

The value of the Z-score depends on the value of various ratios like working capital to total assets, retained earnings to total assets, EBIT to total assets, the market value of equity to book value of total liabilities, and sales to total assets. If the value of these ratios is positive and high, then the value of the Z-score will also be high and vice versa. And the positivity of the value depends on the efficiency and effectiveness of the overall activities, management policies, government policy, etc. of the respective companies. If the value of the Z-score is high and positive, the companies will be saved from a financially distressed situation. Based on the study, it is noticeable that 20% and 40% of the selected companies of ceramic industries and tannery industries fall into the safe zone respectively which means here investors can invest without any doubt as they are financially sound. Similarly, 28.57%, 40%, and 25% of the selected companies of cement, ceramic, and paper and printing industries stand in the grey zone respectively which indicates the companies have a good chance of bankruptcy within two years. Again 71.43%, 40%, 75%, 60%, and 100% of companies in the cement, ceramic, paper & printing, tannery, and jute industries' financial conditions are not satisfactory respectively as they fall into distress zone. And only 20% of the selected industries fall in the safe zone. That means the overall financial soundness of the selected industries is not well. The majority of companies of the industries hold profitably to attain the safe zone from the distress zone. Again, the companies should arrange necessary initiatives to increase their sales. Another important issue is to keep their cost and expenses within a relevant range. Finally, they should take the necessary steps to increase the value of stockholders' equity.

Conflict of Interest

There is no conflict of interest.

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Appendix

Table A1. Financial data of cement industries 2019.

Name of the Company	Sales	EBIT	Total Assets	Total Liabilities	Retained Earnings	Working Capital	Market Value of Equity
Aramit Cement Limited (ACL)	1862,346,781	(144,664,201)	4,787,488,934	4,758,858,539	(420,869,605)	(657,825,136)	28,630,395
Confidence Cement Ltd. (CCL)	4,832,893,768	467,356,459	9,094,076,082	4,737,604,158	2,180,660,604	607,421,136	4,356,471,924
Heidelberge Cement Bangladesh Ltd. (HCBL)	11,986,319,000	284,296,000	10,890,944,000	6,829,511,000	2,867,140,000	(634,420,000)	4061,433,000
Lafarge Holcim Bangladesh Limited (LHBL	17,839,756,000	2,680,761,000	26,924,292,000	10,725,065,000	4,242,436,000	171478000	16,199,227,000
Meghna Cement Mills Ltd. (MCML)	7,709,220,427	120,183,284	8,115,986,912	7,294,627,463	368,366,308	(1038277248)	821,359,449
M.I. Cement Factory Ltd. (MICFL)	14,628,432,591	435,412,444	19,270,753,264	12,110,275,975	2,106,437,216	956,693,569	7,160,477,708
Premier Cement Mills Ltd. (PCML)	11,999,430,660	809,825,966	18,825,925,977	13,046,093,694	3083,637,540	(1,359,689,382)	5,095,668,479

Source: Annual report of 2019 year.

Table A2. Financial data of ceramic industries 2019.

Name of the Company	Sales	EBIT	Total Assets	Total Liabilities	Retained Earnings	Working Capital	Market Value of Equity
Shinepukur Ceramic Ltd.	1,533,121,181	92,477,713	6,622,962,269	2,355,035,295	61,923,172	(533,103,357)	4,267,926,974
Rack Ceramics Bangladesh Limited	6,463,857,312	1,044,404,413	12,759,857,163	5,405,245,263	1,601,275,518	3,662,178,880	7,354,610,507
Standard Ceramics Industries Ltd.	323,854,117	142,373,106	248,159,944	142,373,106	125,507	(10,182,777)	105,786,838
Fu-Wang Ceramic Industry Ltd.	595,171,949	110,868,851	2,507,457,117	987,924,081	80,779,754	532,321,842	1519,533,036
Monno Ceramic Industry Ltd.	1,071,078,136	92,166,897	3,135,473,480	983,028,018	176,835,458	20,773,400	2,152,445,462

Source: Annual report 2019 of year.

Table A3. Financial data of paper & printing industries 2019.

Name of the Company	Sales	EBIT	Total Assets	Total Liabilities	Retained Earnings	Working Capital	Market Value of Equity
Bashundhra Paper Mills Limited (BPML)	11,039,126,581	477,445,356	30,186,245,753	22,705,993,454	1,910,028,348	1,943,976,708	7,480,252,300
Hakkani Pulp & Paper Mills Ltd. (HPPML)	484,009,189	(5,507,957)	1,318,248,648	822,861,434	138,309	(8,634,095)	495,387,034
Khulna Printing & Packaging Limited (KPPL)	313,122,186	(167,074,886)	1,427,378,800	526,770,243	31,962,365	885213763	900,608,557
Sonali Paper & Board Mills Ltd. (SPBML)	1,836,468,625	84,572,595	6,388,335,310	1,292,197,775	17,427,178	(326,194,938)	151,263,500 (10*15,126,350)

Source: Annual report of 2019.

Table A4. Financial data of tannery industries 2019.

Name of the Company	Sales	EBIT	Total Assets	Total Liabilities	Retained Earnings	Working Capital	Market Value of Equity
Apex Footwear Ltd.	15,947,536,058	243,766,161	15,160,224,860	12,349,642,422	1,533,380,657	15,608,209	2,810,582,438
Bata Shoes Ltd.	8,573,497,561	792,275,987	9089215031	4,100,845,750	4,851,569,281	3,563,859,594	4,988,369,281
Apex Tannery Ltd.	2,041,083,000	43,292,000	2,749,987,000	1,695,295,000	359,750,000	(51,920,000)	2,142,744,000 (140.60* 15,240,000)
Fortune Shoes Ltd.	1,540,815,769	249,776,266	2,091,972,665	182,974,582	659,638,083	1,027,345,943	1,908,998,083
Legacy Footwear Ltd.	299,776,900	50,846,133	529,542,650	296,669,066	28,732,221	28,269,485	232,873,584

Source: Annual report 2019.

Table A5. Financial data of the jute industries 2019.

Name of the Companies	Sales	EBIT	Total Assets	Total Liabilities	Retained Earnings	Working Capital	Market Value of Equity
Northern Jute Manufacturing Co. Ltd.	564,219,402	60,288,517	831,473,827	659,400,272	(63,785,284)	(151,373,115)	1,72,073,555
2. Sonali Aansh Industries Limited.	393411449	28,19, 856	169,90,08,573	1,086,339,992	812,37,610	94,180,222	612,668,581

Source: Annual report 2019.