

Financial Risk Exposure of Publicly Traded Manufacturing Companies: Bangladesh Perspective

Ripon Kumar Dey¹ and Syed Zabid Hossain²

¹Assistant Professor, Department of Accounting, Phulbari Government College, Phulbari 5260, Dinajpur, Bangladesh, E-mail: rk@dibsru@gmail.com

²Professor, Department of Accounting and Information Systems, University of Rajshahi, Rajshahi 6205, Bangladesh, E-mail: syed6205@gmail.com

Received: 4 July 2020; Revised: 24 July 2020;
Accepted: 28 September 2020; Publication: 22 December 2020

Abstract: We explored corporate financial risks associated with firm financing decisions, which are the most important determinants of firm condition. We applied an integrated approach combining financial tools, statistical tools, and Altman Z-score to measure different elements of financial risk of the Dhaka Stock Exchange (DSE) listed publicly traded manufacturing companies from 2001 to 2017. This approach is unique and hardly find in related literature. The findings showed that the financial risk exposure of the sample companies was at a tolerable level with a few exceptions. More revealing is that some companies had enough scope for taking the advantages of financial leverage by adding more debt in their capital structure. We have also studied the financial health and insolvency risk of the sample companies using Z-score and found that 9 out of 48 sample companies had potential risks of financial distress. These findings are useful for corporate stakeholders to make informed decisions. However, we have used ratio analysis as a financial tool to assess the financial risk exposure and presented the results sector-wise to overcome some of its limitations. But, the z-score analysis does not incorporate pre-bankruptcy nonfinancial events that may result in bankruptcy.

1. MOTIVATION AND OVERVIEW

Corporate financial policy plays a vital role in most economic decisions, including investment, research, product marketing strategy, and employment, and as such corporate capital structure has got special attention from financial economists [15]. A company is exposed to financial risk resulting from the debt-equity mix in its capital structure. This risk is attached to the outcomes of the question of a company's financial policy on the debt-equity mix and fixed interest charge associated with debt [19]. An equity-financed company has no financial risk. But with debt, the company breeds financial risk. If the company decides not to use debt in its capital structure, then it can bypass financial risk [31, 13].

Keeping debt or preferred stock capital is an essential decision made by companies since their return on equity is supposed to be higher with

debt capital [7]. Leverage enhances the rate of the expected return on equity by allowing additional risk [32]. Therefore, the more the debt to asset ratio, the more will be the degree of financial leverage. Though financial leverage magnifies prospective returns to shareholders, it raises the potential risk of financial distress and business failure [34]. In modern times, a company can use leverage to maximize shareholder wealth, but if it fails to do so, then interest expense and credit risk of default payment may wipe out shareholder value [30].

Financial risk occurs mainly due to the use of debt as confirmed by leverage. The degree of financial leverage has an impact on the variability of ROE [8]. So, financial managers have to choose the debt-equity mix with great care and after a thorough assessment of exposure to financial risk.

It is worth mentioning that the study of financial risk is conducted by internal management and external stakeholders to determine the financial health of a company. Risk analysis by external users of financial statements is somewhat different from internal users. Risk assessment and management are the main tasks found in research on risk [25]. Management wants to assess the overall risk of a company and strives to learn the risk premium included in the anticipated return on the investment made by the company. If a company's financial structure bears an excessive risk for the borrowers, the market may set a lower price for the shares than it would give for similar shares, with perhaps somewhat smaller earnings but less financial risk [17]. Thus information on financial risk exposure is crucial for investors in the capital market. Financial risk is defined as the risk connected with the company's financing decisions, and the risk is one of the most important determinants of the company's condition [6]. Financial leverage increases the probability of insolvency [31]. This insolvency prediction is an essential issue in the finance literature, especially in emerging economies like Bangladesh. Predicting the future financial position of a company is even more significant [1]. Predicting bankruptcy is an advanced warning to evade all complexities and hazards and also the high cost of financial distress. Measuring the financial soundness of a firm has become an essential need in the context of hyper-competition among the firms in an industry.

An efficient capital market is the core of a market based financial system. Accelerated economic growth may be held back due to the absence of a vibrant capital market. But the capital market in Bangladesh is highly speculative, volatile, and less transparent. It is passing through a period of extreme volatility, uncertainty, and grave crisis due to a massive stock market crash in 2010-11 followed by a prolonged dejection. The stock market bubble was largely inflated and bullish by greed, envy, speculation, and

overconfidence. Contrarily, the current bearish market signifies not only a market correction but also a crisis caused by many psychological factors, for example, panic, frustration, lack of self-confidence, and lack trust in regulators [33]. Another empirical study confirms that cash reserve ratio, foreign direct investment, deposit rate, convert black money into white, banks' exposure to the capital market, and margin loan contributed enormously to the creation of the stock market bubble[21]. Following the outburst of the bubble in December 2010, all major market indicators dropped sharply [29]. These studies have not focused on the actual situation of the publicly listed companies in terms of intrinsic value, rather placed much importance on external factors only. Corporate capital structure or financial health could be one of the internal factors causing the stock market crisis in Bangladesh is yet to be studied.

Moreover, there is hardly any use of derivatives as a hedging mechanism in Bangladesh, and hence the definition of financial risk in Bangladesh is different from the perspective of developed countries (4, 24). Capital structure risk itself is a financial risk in Bangladesh, and research on the financial risk exposure of the publicly listed companies based on this definition must attract the interest of corporate stakeholders for making informed decisions.

The substantial part (61% as on December 31, 2017) of Bangladesh capital market consists of manufacturing companies in 12 industrial sectors, and these groups of companies are required to choose appropriate sources and mix (debt and equity) of finance in their capital structure to maximize shareholder value at minimal risk. The risk exposure of nonfinancial companies influences their investment decisions, profitability, and value [9]. Measuring and managing financial risk has become the prime attention of these companies. Managing exposure to key financial risks is an integral part of the corporate finance function [28, 12].

The publicly traded companies in Bangladesh can be divided into two broad categories: financial and nonfinancial. Again, the nonfinancial category can be divided into two parts: manufacturing and nonmanufacturing. The financial category has been excluded from this study because of the different nature of the capital structure, where the use of financial leverage is very **unusual**. Nonmanufacturing companies under the nonfinancial category are excluded as the original Z-score model (used in this study for estimating the likelihood of bankruptcy) is primarily for manufacturing companies.

Against the above backdrop, the present study seeks to appraise the financial risk exposure of publicly traded manufacturing companies in

Bangladesh using an integrated approach to ensure the free flow of information for an efficient and sound capital market.

2. FINANCIAL RISK: COMPONENTS AND MEASUREMENT

2.1. Components

Different scholars define the term financial risk differently, such as the chance of loss, the possibility of failure, and the likelihood of differing actual outcomes from the expected [37]. When a firm makes an investment choice, it compromises various financial risks that may be in the form of high inflation, a slowing economy, volatility in capital markets, insolvency, etc. So, giving a unique definition of financial risk is difficult.

In the finance literature, financial risk can be examined either from neutral (risk is not only a threat but also an opportunity) or negative (a threat of potential loss) perspective. In a narrow sense, financial risk means an additional risk borne by stockholders due to the substitution of debt capital for equity capital. The total risk borne by a firm may be divided into two parts: either non-capital risk, mainly because of the uncertainty of a firm's markets and capital, or financial risk, mainly due to the induction of fixed-cost securities into the firm's capital structure [30]. The variability of EPS produced by the use of financial leverage is called financial risk [31]. As stated by Arthur J. Keown et al., the added variability in earnings available to common stockholders and the additional chance of insolvency borne by the common stockholders is caused by the use of financial leverage [36]. Thus, in a narrow sense, the financial risk is equivalent to capital structure risk.

However, in a broad sense, financial risk is uncertainties associated with any form of financing, including credit risk, business risk, investment risk, and operational risk [26]. Financial risk can also be defined as the variation in cash flows, financial results, and firm value due to the influence of various factors, such as interest rate, exchange rate, commodity price, stock price, and so on [6]. These factors are associated with the economic environment in which all corporate entities operate. The purpose of this study is not to examine financial risk considering all those factors rather examine the financial risk exposure associated with the firm financing policy. Hence, the narrow view of financial risk is applied with a slight modification. Two additional components are included in financial risk in addition to capital structure risk, which is liquidity risk (short term solvency) and bankruptcy risk (long-term stability risk) that are related to firm financing decisions. Thus in this study, financial risk includes three components:

- (i) Capital structure risk associated with the use of financial leverage;
- (ii) Liquidity risk associated with the ability to repay short-term debts by utilizing current assets; and
- (iii) Long-term stability risk affiliated with the use of permanent capital to acquire noncurrent assets / fixed assets.

2.2. Measurement

Selected three components of financial risk are measured using different financial and statistical tools. The elements of financial risk and their measurement methods are shown in figure 1.

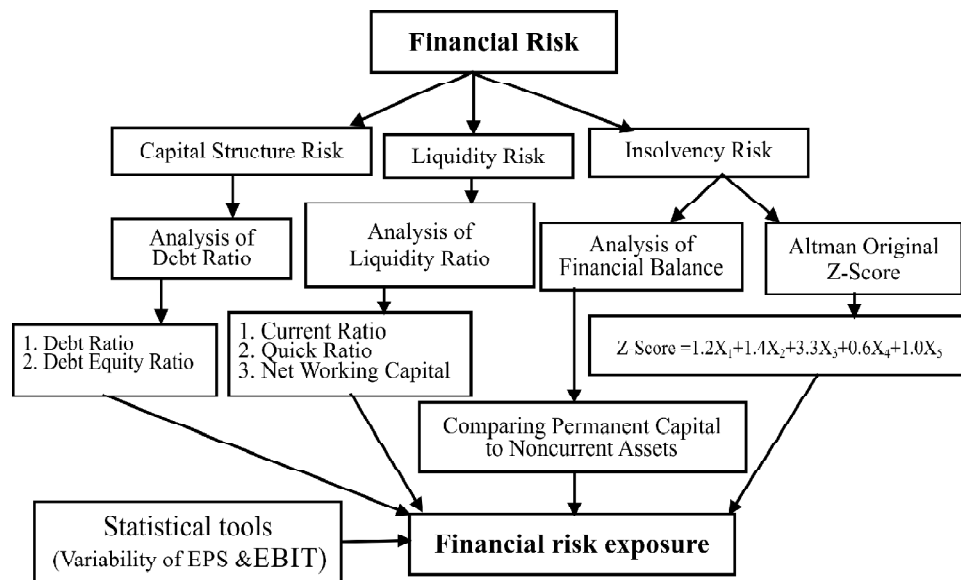


Figure 1: Components of financial risk and their measurement

Source: Developed by the researchers

2.2.1. Financial Tools

Despite some limitations, we have used accounting ratios as the best available option to achieve our purpose. The positive and negative effects of leverage increase with the symmetry of debt in a company. With higher leverage, the risk exposure of lenders raises similar to shareholders. So we can use debt-assets (DA) and debt-equity (DE) ratios to understand and assess capital structure risk.

The DA ratio is a measure of a company's assets that are financed by debt, rather than equity. This ratio implies a company's ability to repay its

debts out of its assets. This ratio also denotes the proportion of other people's money to the total claims on the company's assets. The higher the ratio, the higher is the risk of the lenders [18].

The DE ratio takes into account the financial structure, broadly divided into equity and total outside liabilities [5]. It is the total of current liabilities and long-term debts to the owner's equity. The DE ratio is an attempt to show, in another form, the proportion of lenders claim to ownership claim [18]. Financial risk is usually estimated using the extent to which debt financing is used corresponding to equity [14]. The higher the DE ratio, the higher the financial risk associated with the use of debt capital. In theoretical studies, the optimal (standard) value of this ratio is 1: 3, and in this situation, a company can get the advantages of debt capital (mainly tax shield) without exerting an unnecessary risk of financial distress [6]. However, in the present business world, a company should look for its optimal value recognizing its characteristics and unique situation.

The second element of financial risk analysis is related to the liquidity of a company. The company bears high liquidity risk when it persistently strives to meet its short-term commitments. Liquidity ratios are useful measures to determine the level of liquidity risk of a company. The current and quick ratios assess the short-term ability of a company to pay its currently aging debts and meet unforeseen needs for cash [2]. Short term lenders such as bankers and suppliers are especially interested in assessing liquidity risk in this way [38]. The most commonly used ratio to appraise corporate debt exposure in the balance sheet is the current ratio. This association between current assets and current liabilities exhibits the protection of lenders in case of default. The greater the current ratio, the greater is the safety of the lenders. From the lender's point of view, a higher ratio would surely provide a cushion against severe reductions of value in case of business failure. However, an extremely high current ratio signals the failure of corporate management in utilizing current assets efficiently. At the same time, the company does not rightly use its current borrowing power. A very common rule of thumb implies that a current ratio of 2:1 is about right for most companies [18].

The second liquidity ratio is a quick ratio, which is a measure of a company's ability to pay its short-term obligations using its most liquid assets without damaging short term liquidity. So it is the most conservative and suitable method of estimating the true liquidity position of a company as the numerator of this ratio excludes all the least liquid current assets such as inventory and prepaid expenses from the total current assets. The commonly accepted standard for this ratio is 1:1, which suggests that the

company can repay its currently maturing debt with its most liquid current assets without relying on the least liquid assets. The interpretation of the quick ratio is similar to the current ratio. A higher value means lower liquidity risk. However, it may be a signal of wasteful and unproductive use of liquid assets.

Over and above the liquidity ratios, the absolute amount of net working capital can be used to estimate the liquidity risk of a company. Networking capital is a commonly used measure of liquidity though the basic purpose of working capital management is to manage the required working capital at the right time, at the right cost, and from the right source to achieve a trade-off between liquidity and profitability [22, 23]. In the context of short term financial management, the risk is the possibility that a company will be incapable of paying its bill as they come due. Moreover, a company that cannot pay its bill as they come due is called technically insolvent. It is generally assumed that the greater the company's networking capital, the more liquid the company and therefore, the lower its risk of becoming technically insolvent [27]. Conversely, a higher level of net working capital is connected to a higher cost of capital. So after the optimal point, a further increase in net working capital becomes ineffective.

A company keeps the financial balance when its noncurrent assets are financed by long-term sources of funds and short-term assets by short-term sources of funds. Otherwise, the company reduces its financial balance, which may lead to financial instability and difficulties in long-term solvency. Consequently, the company may become bankrupt. Two established rules can be used to analyze the financial balance of a company. According to the first rule, noncurrent assets should be financed by equity capital. Only in this situation, the financial balance is maintained. It is known as conservatism policy. The second rule is less restrictive and according to it, noncurrent assets may be financed by permanent capital including equity and long-term debt. If at least, the second rule is maintained, the company keeps the financial balance and its insolvency risk is very low. Otherwise, the risk of potential distress is significant.

Ratio analysis has some limitations and naturally, the study could bear those limitations. But, to check the limitations of pursuing different strategies by the companies under different sectors, we have presented the results separating them (companies) sector-wise.

2.2.2. Altman Original Z-score

This study uses Altman's Z-score along with financial ratios to assess the insolvency risk, the third component of financial risk to cross-check the

results. Edward I. Altman, a financial economist at the graduate school of business at New York University, developed a model for predicting the likelihood that a company would go bankrupt. This model uses five financial ratios that combine in a specific way to produce a single number, called the Z-score. The model also gives the guidelines for financial health zone (Supplementary Table 1).

Altman's original Z-score is as follows:

$$Z = 1.2X_1 + 1.4X_2 + 3.3X_3 + 0.6X_4 + 1.0X_5 \quad (1)$$

Where:

Z = Overall index of corporate financial health, X₁ = Working Capital/Total Assets, X₂ = Retained Earnings/Total Assets, X₃ = Earnings before Interest and Tax/Total Assets, X₄ = Market Value of Equity/Total Liabilities, X₅ = Sales/Total Assets.

It is a general measure of corporate financial health and the most influential model of failure prediction. Based on Multiple Discriminate Analysis, the model predicts a company's financial health based on a discriminate function to the company [3]. But Grice and Ingram state that the z-score analysis does not incorporate pre-bankruptcy non-financial events that may result in bankruptcy (i.e. union problems, lawsuits, etc.) [16]

2.2.3. Statistical Measures

We have accepted that the risk produced by financial leverage is a financial risk for this study. It may be interpreted as the increased relative variability of EPS (DFV) from its expected value in response to a relative variability of EBIT (IFV) from its expected value considering both favorable and unfavorable outcomes due to the uncertainty inherent in financing operations of the company [35]. So from that point of view, we have used the following relative measures to calculate the financial risk holistically:

- (i) The ratio of the Coefficient of Variation of DFV (EPS) to IFV, which is EBIT

$$\begin{aligned} \text{FLR} &= \frac{\text{Coefficient of variation of EPS}}{\text{Coefficient of variation of EBIT}} \\ &= \frac{\sigma(\text{EPS})/E(\text{EPS})}{\sigma(\text{EBIT})/E(\text{EBIT})} \end{aligned}$$

- (ii) The ratio of Mean Absolute Deviation to the expected value of DFV (EPS) and IFV (EBIT)

$$\begin{aligned}
 \text{FLR} &= \frac{\text{Mean Absolute Deviation of } EPS / E(EPS)}{\text{Mean Absolute Deviation of } EBIT / E(EBIT)} \\
 &= \frac{E(|EPS_j - E(EPS)|) / E(EPS)}{E(|EBIT_j - E(EBIT)|) / E(EBIT)}
 \end{aligned}$$

3. EMPIRICAL METHODS AND RESULTS

3.1. Data

According to the DSE database, there are twelve manufacturing sectors in Bangladesh Capital Market containing one hundred and seventy-five companies as on December 31, 2017. This list has been used as the sampling frame for the present study. Fifty percent or six sectors out of the twelve industrial sectors have been selected using the simple random sampling technique and a study period of seventeen years ranging from 2001 to 2017 has been fixed considering enough to generalize the results of the study. So, the companies which were enlisted on DSE under selected industrial sectors in or before 2001 have been included in the sample (Supplementary Table 2). The number of such companies is forty-nine. All these companies except one have been selected for the study and hence the sample size is forty-eight (Supplementary Table 3). We have excluded one company because of the non-availability of annual reports for the whole study period.

3.2. Measurement Methods

At the outset of the discussion of empirical results, we have presented sector-wise corporate financing to have a clear idea about the capital structure of the listed manufacturing companies on DSE. Next, we have used debt ratios along with ROE to know the level of capital structure risk and its relationship with financial performance. After that, we have measured liquidity risk with the help of liquidity ratios and the amount of net working capital. At this stage, we have also compared permanent capital with noncurrent assets to test the long term stability risk. Then, we have calculated Z-scores of the companies to examine their financial health and insolvency risk. Finally, we have employed relative statistical measures to get the overall view of financial risk exposure. As every industrial sector has some unique characteristics and companies belong to different sectors should not be compared, all the results have been depicted sector-wise.

3.3. Empirical Results

3.3.1. Mode of Corporate Financing

This section covers the mode of financing of the selected companies that includes the analysis of changes in the value of total assets, equity and debt capital of the selected companies over the period of study (Table1).

Table 1
Assets, equity and debt capital of companies under different industrial sectors (Amount of taka in million)

Sector	Total Assets			Equity Capital			Debt Capital		
	2001	2017	Change (Times)	2001	2017	Change (Times)	2001	2017	Change (Times)
Cement	5,600	24,503	4.38	2,603	9,687	3.72	2,997	14,796	4.94
Engineering	7,156	44,161	6.17	4,442	18,302	4.12	2,714	25,858	9.53
Fuel & Power	15,624	153,814	9.84	2,166	14,872	6.87	13,458	138,941	10.32
Jute	722	2,425	3.00	155	546	3.52	567	1879	3.31
Pharm. & Chem.	17,274	174,454	10.10	9,470	113,420	11.98	7,804	60,933	7.81
Tannery	4,214	24,495	5.81	1,465	8,250	5.63	2,751	16,261	5.91

In absolute terms, the amount of total assets, equity and debt were fluctuating from year to year with upward trends in all the three sample companies of the cement sector. The amount of total assets had a fluctuating trend until 2007 thereafter an upward trend was observed except in 2014. This situation suggests that the cement companies are growing in terms of the higher value of assets and through realizing the amount of invested capital despite rapidly changing market scenario and competitive conditions. A similar situation was observed in the case of both equity and debt capital of the sector. With the passes of time, the equity base of the selected companies has been increasing gradually. Moreover, the fluctuation in the value of debt capital was more noticeable than that of assets and equity capital over the period of study. Thus, the increase in debt capital (4.94 times) was somewhat more pronounced than the equity capital (3.72 times) over the period of study.

There was a fluctuating but rising trend in the absolute amount of equity capital as well as the debt capital of the engineering sector during the whole period of study. But in the case of total assets, there was an uninterrupted upward trend throughout the period of review. The value of total assets was 6.17 times in 2017 in comparison to 2001. This is an indication of positive growth in terms of the higher value of assets in the engineering sector. A

bit different situation was observed in the case of debt capital where an increasing trend was noticed throughout the period except in 2009 and 2010. In these two years, there was a downward trend in the value of debt capital and that might be the result of Bangladesh capital market boom during that time and the market was mostly equity-focused and there were very few debt securities available. The growth rate of equity capital was much higher (9.83 times) than that of debt capital (4.12 times). So, the selected companies under the engineering sector have achieved a strong equity base as time passes.

In the fuel and power sector, the amount of total assets had a fluctuating trend until 2008 thereafter an upward trend was set in. The amount of equity had a fluctuating trend till 2004 thereafter an increasing trend was set in and continued till 2017. But during 2001 - 2009, there had been a fluctuating trend in the value of debt capital in comparison to the value of total assets and equity capital and thereafter, an upward trend was noticed and continued till the end of the study period. Thus, the growth in equity capital (6.87 times) was less marked than that of debt capital (10.32) over the period of study.

There was also an upward trend in total assets and debt capital of the jute sector throughout the period except in 2003. The value of total assets was 3 times in 2017 in comparison to 2001 that suggests jute goods manufacturing companies are also growing in terms of the higher value of assets. But the growth rate is lower than the other sectors. The amount of equity capital was Tk. 155 million in 2001 and it increased to Tk. 546 million (3.52 times) in 2017 with a fluctuating trend during the whole period of study. It is a sign of an unstable financial policy. An increase in equity capital was more noticeable than the increase in debt capital over the period of study. The reason could be a lack of trustworthiness and creditworthiness of the sector to the providers of debt capital.

There was an increasing trend in all three elements (debt, equity, and assets) of pharmaceuticals and the chemical sector during the period of study. The only exceptional year is 2010 when a decrease was observed in the value of debt capital. However, this deviation is indicative, and possibly the reason behind it is the stock market boom. The pharmaceuticals and chemicals companies had a high growth rate (10.1) in terms of the value of assets and realizing new investment projects to cope up with the huge demand for drugs in the home and abroad. Similar scenarios were observed in the case of equity and debt capital. The growth rate of equity (11.98) is the highest among the six selected manufacturing sectors. So, it can be said that the pharmaceuticals sector has achieved the faith of the investors and

thus the equity base of the selected companies has been increasing gradually. Moreover, a similar upward trend was noticed in the value of debt capital except for a minor deviation in 2010. However, the increase in equity capital (11.98 times) was more pronounced than the increase in debt capital (7.81 times) over the period of study.

The tannery companies were also growing in terms of the higher value of assets and realizing investment projects in spite of volatile as well as unstable market conditions. An identical situation was also observed in the case of equity capital. An upward trend was noticed in the value of debt capital except for a minor deviation in 2005. In 2001, the value of debt was Tk. 2,751 million that reached to Tk. 16,261 million (5.91 times) in 2017. The growth rates of the above stated three items were the same indicating stable financial policy of the companies.

3.3.2. Capital Structure Risk

The first and foremost element of financial risk is capital structure risk. Exposure to this risk has been measured and explained (Table 2 and 3) sector-wise here.

Table 2
Debt ratios and ROEs of cement, engineering and fuel & power sectors during the study period

Year	Cement Sector			Engineering Sector			Fuel and Power		
	DA Ratio	DE Ratio	ROE	DA Ratio	DE Ratio	ROE	DA Ratio	DE Ratio	ROE
2001	0.54	1.15	22.29	0.62	1.64	10.90	0.86	6.21	15.37
2002	0.55	1.20	7.70	0.64	1.79	10.89	0.87	6.75	13.18
2003	0.61	1.59	-2.23	0.64	1.74	12.02	0.87	6.47	10.16
2004	0.61	1.59	-2.19	0.66	1.96	8.61	0.88	7.60	9.73
2005	0.63	1.67	6.67	0.67	2.04	9.37	0.86	6.29	9.91
2006	0.56	1.29	19.31	0.66	1.95	9.25	0.88	7.68	14.84
2007	0.57	1.31	20.00	0.67	2.06	7.74	0.91	10.37	14.92
2008	0.57	1.34	13.00	0.63	1.74	11.37	0.90	8.60	18.80
2009	0.47	0.88	18.03	0.56	1.28	16.57	0.87	6.74	26.46
2010	0.46	0.84	16.77	0.36	0.56	26.29	0.88	7.18	26.83
2011	0.50	0.98	12.34	0.40	0.66	13.06	0.89	8.50	25.86
2012	0.48	0.93	17.92	0.30	0.42	4.87	0.90	9.41	26.79
2013	0.45	0.83	17.36	0.31	0.45	4.76	0.89	7.94	29.99
2014	0.49	0.96	14.27	0.33	0.50	5.13	0.89	7.84	24.81
2015	0.53	1.12	18.12	0.35	0.55	4.06	0.88	7.45	22.45
2016	0.57	1.32	19.97	0.37	0.60	4.77	0.89	7.98	21.10
2017	0.60	1.53	18.08	0.41	0.71	5.67	0.90	9.34	20.33

Cement sector: It is evident from Table 2 that both the values of DE and DA ratios were fluctuating during the period of review. The DE ratio was higher than 1 in 11 out of 17 years of study and in the remaining 6 years, the ratio was near to 1 indicating considerable financial risk due to the high use of debt in the capital structure of the listed cement companies in Bangladesh. As stated earlier the DE ratio was higher than 1 during 2001-2008, which suggests that the capital structure was highly geared with significant financial risk. However, this financial risk was not so risky to stop working. DA ratio gives us almost similar results. From 2001 to 2008, the DA ratio was more than 0.5, which suggests more than half of the assets of those companies were financed through debt capital. So, there was a financial risk in the cement sector though the risk was within the tolerable level. Moreover, the financial risk situation was improved to some extent in the second half of the study as the DA ratios were below 0.5 from 2009 to 2014.

Engineering sector: Both the values of the DE and DA ratios were fluctuating during the period of review. The highest value of the DE ratio was 2.06 in 2007 as against the lowest DE ratio of 0.42 in 2012 with a fluctuating trend throughout the period. The DE ratios were much higher than 1 till 2009 indicating significant financial risk due to the overuse of debt in the capital structure of the selected companies. Thereafter, the ratios were much below 1, which suggests an insignificant financial risk and there was still scope for using more debt in their capital structures to maximize the benefits of financial leverage. As stated earlier the DE ratio was higher than 1 during 2001-2009, which means that the capital structure was highly geared with substantial financial risk. Though this financial risk was not so unsafe to stop working, financial management could think of reducing the use of debt. Since 2010, their capital structures were low geared as the DE ratios were very low. DA ratio gives us almost similar results as it was more than 0.5 during 2001-2009. This situation demonstrates that the major portion of the assets of those companies was financed through debt capital instead of equity capital. So, there was a financial risk but the risk was at an acceptable level. Moreover, the financial risk situation has improved to a great extent during the remaining years of study as the ratios were below 0.5. Though the key motive for using debt in the capital structure is to have a positive effect on ROE, the financial management of the selected engineering companies could not fully materialize the benefits of financial leverage to maximize financial performance. But in 2007, the financial leverage was the highest as against the lowest ROE. Contrarily, the leverage was nearly at the lowest level against the highest ROE in 2010. Again during 2012-2015, the ROE was lower along with lower financial leverage. So, there

was no conclusive evidence in support of the financial norm that the more the financial leverage, the more the ROE. There might be some other factors that could have contributed to such deviation from the financial norm.

Fuel and power sector: Both the values of DE and DA ratios were fluctuating during the period of review. The highest value of the DE ratio was 10.37 in 2007 and the lowest DE ratio was 6.21 in 2001 with a fluctuating trend throughout the period. The DE ratio was much higher than the standard norm 1 throughout the period of the study indicating remarkable financial risk due to excessive use of debt in the capital structure of the companies under the fuel and power sector. Their capital structures were highly geared which denotes high financial risk.

DA ratio gives us almost similar results. During the whole period of study, the DA ratios were more than 0.5, which suggests the major part of assets of power and fuel companies was financed through debt capital instead of equity capital. Thus, the companies had high financial risk and there was no sign of improvement of their financial risk situation till the concluding year of study.

While examining each company thoroughly, we have found that the average values of DE and DA ratios of the selected companies are affected by the values of DE and DA ratios of **POL**. The values of DE of POL during the period of study were ranging from 11 to 26 and DA was near to 0.90 all along. Moreover, being a capital intensive sector, it could be a reason for the excessive use of debt.

Though the primary motive for using debt in the capital structure is to have a positive effect of financial leverage on ROE, which is not evident here. The highest ROE was not found in 2007 when the financial leverage was at the highest level. Again, the rate was not at the minimum level in 2001 when the financial leverage was at the lowest level. Thus, an irregular change was observed. So, it is difficult to conclude regarding the mode of the relationship between ROE and financial leverage.

Jute sector: It is evident from table 3, the highest value of the DE ratio was 5.04 in 2006 and the lowest value of the DE ratio was 1.46 in 2008 with a fluctuating trend throughout the period. The DE ratio was much higher than the standard norm of 1 during the whole period of the study indicating significant financial risk (Capital structure) due to excessive use of debt in the capital structure of the listed jute companies. The capital structures of the companies were highly geared and there was no sign of improvement till the concluding year of the study and as such the financial risk is a great concern for the jute sector as a whole. Initiatives should be taken by the

Table 3
Debt ratios and ROEs of jute, pharmaceuticals and chemicals, and tannery sectors during the study period

Year	Jute Sector			Pharm. and Chem. Sector			Tannery Sector		
	DA Ratio	DE Ratio	ROE	DA Ratio	DE Ratio	ROE	DA Ratio	DE Ratio	ROE
2001	0.78	3.65	-5.09	0.45	0.82	13.11	0.66	2.15	16.67
2002	0.74	2.88	-16.05	0.44	0.79	12.64	0.66	2.14	20.20
2003	0.77	3.30	-8.14	0.46	0.86	12.02	0.65	2.16	19.78
2004	0.82	4.57	-10.96	0.45	0.83	14.15	0.66	2.35	13.25
2005	0.82	4.64	3.70	0.43	0.76	14.29	0.66	2.25	15.03
2006	0.83	5.04	9.26	0.43	0.75	12.36	0.66	2.50	18.83
2007	0.61	1.55	1.78	0.44	0.78	12.94	0.68	2.73	25.26
2008	0.59	1.46	-0.36	0.42	0.73	14.77	0.68	2.42	27.57
2009	0.61	1.54	-0.18	0.43	0.77	15.82	0.62	1.92	24.84
2010	0.62	1.63	1.49	0.34	0.53	13.00	0.56	2.02	29.02
2011	0.65	1.85	1.49	0.38	0.61	13.53	0.59	1.56	19.83
2012	0.67	2.07	-0.80	0.37	0.58	12.51	0.60	2.08	19.44
2013	0.73	2.70	-17.87	0.37	0.59	12.99	0.43	1.11	19.35
2014	0.72	2.52	-11.59	0.35	0.54	14.14	0.42	1.18	14.93
2015	0.73	2.71	-5.07	0.37	0.59	16.15	0.45	1.28	13.92
2016	0.77	3.35	-11.48	0.34	0.51	17.51	0.47	1.41	16.18
2017	0.77	3.44	-9.59	0.35	0.54	14.77	0.52	1.56	14.22

management to change the financing policy to avoid the risk of insolvency and financial instability and to make the companies safe from the pressure of loan providers.

DA ratio gives us an almost similar result as the DE ratio (> 0.5). Thus the major part of the assets of the selected jute companies was financed through debt capital instead of equity capital, which is a clear sign of high dependence on debt capital. So, there was a significant financial risk and the risk was at an undesirable level. Financial management should pay special attention to high dependence on debt capital and reduce the same to an acceptable level to improve the situation.

Though there was volatility in ROE, interestingly the highest ROE was observed in 2006 when financial leverage was also at the highest level. It is consistent with the prime motive of using debt capital to have a positive effect of financial leverage on ROE. But the impact of financial leverage was not the same during the whole period. So, it is difficult to draw any

conclusion about the relationship between ROE and the effect of financial leverage in the companies under the jute sector in Bangladesh.

Pharmaceuticals and chemical sectors: The highest value of the DE ratio was 0.86 in 2003 and the lowest DE ratio was 0.53 in 2010 with a moderate fluctuating trend throughout the period. The DE ratio was below 1 throughout the period indicating insignificant financial risk due to less use of debt in the capital structure of DSE listed pharmaceuticals and chemical companies in Bangladesh. This situation also suggests that the companies had the opportunity to use more debt capital in their capital structures to increase their ROE. Moreover, since 2010 the mean DE ratio was below 0.6 which was much lower than the standard norm of 1. So, the financial management of the companies may rethink to revise their financing policy.

DA ratio gives us almost similar results. During the whole period of study, the DA ratios were less than 0.5, which suggests more than half of their asset was financed through equity capital. So, there was a very lower level of financial risk. Moreover, the financial risk situation had improved to some extent in the second half of the study as the DA ratios were below 0.4 from 2010 to 2017. In this situation, management could pay attention to enhance upside business potentials using debt capital.

The lowest ROE was observed in 2003 when the level of financial leverage was at the highest level. But in 2010, the highest ROE was not witnessed when the level of financial leverage was at the lowest level. There were irregular fluctuations of ROE with the changes in the capital structure. So, a mixed effect of financial leverage on ROE was observed in the pharmaceuticals and chemical companies during the period of review.

Tannery sector: The highest value of the DE ratio was 2.73 in 2007 and the lowest DE ratio was 1.11 in 2013 with a fluctuating trend throughout the period. The DE ratios were higher than 1 in all the years of the study indicating more financial risk than the acceptable level due to excessive use of debt in the capital structure of DSE listed tannery companies. The level of financial risk until 2012 was a matter of great concern. The DE ratio had come down near to standard norm 1 in 2013 and continued until 2016. So, the level of financial risk had stood at an acceptable point. These changes indicate that the management of those tannery companies had decided to use more equity capital than debt capital in their capital structure during the last part of the study period to avoid the risk of insolvency and instability, and to make their companies safe from the pressure of loan providers.

DA ratio gives us almost similar results. DA ratios were more than 0.5 in the initial 12 out of 17 years of study, which suggests more than 50 percent of corporate assets were financed through debt capital. So, there was a significant financial risk. However, the financial risk situation had improved to some extent in the concluding years of the study as the DA ratios were below 0.5 from 2013 to 2016.

Irregular ups and downs in ROE were observed together with the changes in capital structure over the period of review. Neither the highest nor the lowest ROE was observed in 2007 when the use of debt was at the highest level. Again, more than average ROE was observed in 2013 when the financial leverage was at the lowest level. So, it is difficult to draw any specific conclusion regarding the effect of financial leverage on ROE of the selected companies under the tannery sector.

3.3.3. Liquidity and Solvency Risk

The next element of financial risk analysis is liquidity risk. The absolute amount of average net working capital and the relative values of current and liquid assets with current liabilities (both current and quick ratios) for the selected sectors are presented in Tables 4 and 5.

Cement sector: During 2003-2006, the amount of net working capital was negative and in relative terms, the current ratios were below 1 and the quick ratio was below 0.4 as against the rule of thumb of 2 and 1 respectively, which suggest the selected cement companies had high financial risk (Liquidity risk) during that period. Moreover, the ratio of permanent capital and noncurrent assets was below 1 which means a part of the noncurrent assets was financed by short term debts. But, the permanent portion of noncurrent assets should be financed by permanent capital according to the financial norm. Thus, the financial risk management was somewhat disorganized because of high liquidity risk, poor financial planning, aggressive financing of noncurrent assets with short term funds, and substantial risk of insolvency. But, this situation proved gradually from 2007. Both the current and quick ratios were near to the standard norms of 2 and 1 respectively. As the companies could finance their total amount of noncurrent assets with permanent capital and the absolute amount of net working capital was positive, the financial management scenario of the cement sector was improved significantly during the second half of the study period. This improvement indicates that the financial health of the cement sector as a whole improved significantly and became stable during the second half of the study period.

Table 4
Liquidity ratios, NWC and PC/NCA of cement, engineering and fuel & power sectors during the study period

Year	Cement Sector				Engineering Sector				Fuel and Power			
	NWC	CR	QR	PC/NCA	NWC	CR	QR	PC/NCA	NWC	CR	QR	PC/NCA
2001	669.46	1.36	0.67	1.22	1579.53	1.45	0.66	1.73	466.72	1.04	0.84	1.25
2002	433.96	1.21	0.53	1.13	1550.72	1.42	0.64	1.74	577.03	1.04	0.88	1.30
2003	-681.02	0.78	0.26	0.88	1696.90	1.45	0.69	1.79	750.66	1.05	0.85	1.38
2004	-831.34	0.74	0.27	0.84	1866.98	1.43	0.66	1.90	627.11	1.04	0.84	1.32
2005	-721.16	0.82	0.30	0.86	2004.26	1.39	0.57	1.95	825.88	1.05	0.78	1.41
2006	-403.33	0.88	0.39	0.92	2222.84	1.40	0.65	1.95	1134.07	1.06	0.88	1.60
2007	108.80	1.02	0.46	1.02	2225.93	1.36	0.64	1.88	1508.89	1.05	0.83	1.81
2008	932.08	1.20	0.45	1.19	2525.35	1.36	0.68	1.63	1789.63	1.07	0.90	1.99
2009	2233.07	1.51	0.75	1.38	3372.53	1.55	0.75	1.80	2572.14	1.10	0.87	2.40
2010	2997.33	1.58	0.78	1.44	7953.70	2.45	1.44	2.49	3217.18	1.09	0.86	2.43
2011	2782.21	1.43	0.76	1.35	7808.21	2.10	1.12	2.11	4281.66	1.08	0.90	2.69
2012	4061.99	1.58	0.95	1.52	8004.37	2.02	0.89	1.48	4901.05	1.07	0.93	2.58
2013	5428.13	1.73	1.12	1.66	9644.30	2.28	1.20	1.58	6578.45	1.09	0.90	2.94
2014	4771.28	1.58	1.05	1.59	7866.97	2.01	0.95	1.40	7413.48	1.09	0.95	2.85
2015	4016.96	1.43	0.89	1.48	6726.15	1.76	0.83	1.31	7957.99	1.09	0.90	2.70
2016	3077.83	1.27	0.79	1.34	7712.48	1.78	0.85	1.36	8663.44	1.08	0.98	2.51
2017	1514.46	1.12	0.78	1.15	8693.17	1.67	0.78	1.39	9751.63	1.07	0.98	2.57

Table 5
Liquidity ratios, NWC and PC/NCA of jute, pharmaceuticals and chemicals, and tannery sectors during the study period

Year	Jute Sector				Pharm. and Chem. Sector				Tannery Sector			
	NWC	CR	QR	PC/NCA	NWC	CR	QR	PC/NCA	NWC	CR	QR	PC/NCA
2001	227.00	1.91	0.37	1.93	1231.06	1.21	0.37	1.12	933.56	1.41	0.37	1.93
2002	198.04	1.75	0.30	1.61	1277.84	1.19	0.38	1.12	1032.92	1.42	0.34	2.07
2003	215.28	1.86	0.25	1.69	2151.47	1.33	0.38	1.17	1189.83	1.45	0.36	2.23
2004	390.76	3.18	0.55	2.22	3343.78	1.47	0.50	1.24	1075.63	1.36	0.25	2.01
2005	398.38	3.12	0.73	2.25	4016.99	1.45	0.60	1.25	1124.99	1.38	0.32	2.08
2006	376.60	2.44	0.30	2.06	4559.64	1.44	0.60	1.25	1161.14	1.34	0.40	2.06
2007	-66.41	0.91	0.30	0.91	4261.22	1.36	0.59	1.20	1145.13	1.24	0.30	1.98
2008	-79.41	0.90	0.31	0.90	3746.30	1.24	0.53	1.14	1256.28	1.24	0.32	1.92
2009	-81.99	0.91	0.23	0.90	8787.05	1.61	0.82	1.28	1449.10	1.27	0.30	1.91
2010	-85.65	0.91	0.28	0.89	9968.10	1.65	0.82	1.26	1850.03	1.31	0.28	2.12
2011	-78.64	0.93	0.26	0.90	9749.39	1.44	0.75	1.22	2377.48	1.32	0.31	1.73
2012	-97.14	0.92	0.20	0.88	13242.29	1.56	0.83	1.27	2914.09	1.37	0.26	1.80
2013	-177.93	0.86	0.20	0.77	11947.15	1.41	0.77	1.21	3625.86	1.41	0.29	1.97
2014	-245.21	0.83	0.27	0.74	15332.40	1.52	0.87	1.25	4065.35	1.37	0.27	1.97
2015	102.00	1.09	0.31	1.11	32673.45	1.92	1.06	1.45	3619.63	1.30	0.28	1.77
2016	-63.68	0.95	0.23	0.94	44906.39	2.38	1.40	1.60	3989.37	1.31	0.34	1.76
2017	-121.35	0.92	0.24	0.89	52714.78	2.28	1.41	1.66	3831.15	1.26	0.32	1.65

Engineering sector: In absolute terms, the amount of net working capital was positive during the whole period of study. But in relative terms, the current ratios and the quick ratios were below the rule of thumb of 2 and 1 respectively till 2009, which indicates the selected engineering companies had financial risk (Liquidity risk) to some extent during that period. From 2010 to 2017, the state of affairs had improved remarkably like the current and the quick ratios were near to the standard norms 2 and 1 respectively. So, there was hardly any liquidity related financial risk and at the same time, there was no surplus liquidity during that period.

Moreover, the ratio of permanent capital and noncurrent assets was above 1 throughout the period of study which means the total noncurrent assets were financed by permanent capital following the standard financial norm. So, the selected companies were able to maintain financial balance during the period of review. Since 2009, the financial management of the engineering sector seems to be more organized and sound.

Fuel and power sector: During the period of study, the amount of net working capital was positive in absolute terms. But in relative terms, the current ratios were near to 1.1 and the quick ratios were near to 1 as against the rule of thumb of 2 and 1 respectively, which indicates the fuel and power companies had insignificant Liquidity risk during the period of review. Low current ratios were due to different nature (a huge amount in receivables and less amount in inventory) of this sector. Moreover, the fuel and power companies were able to finance their noncurrent assets through permanent capital during the first half of the study period. But after 2009 the ratio was more than two times of standard norm which was an indication of following the conservatism principle for financing assets.

As net working capital is positive and the quick ratios are at an almost optimal level, the liquidity related financial risk of the companies was at an acceptable level despite the lower current ratio. Moreover, as financial balance was maintained, there was hardly any long-term insolvency problem in the selected companies under the fuel and power sector of Bangladesh.

Jute sector: To discuss the liquidity related financial risk and financial balance of the companies under the jute sector, the analyzed period can be divided into two parts: the first one 2001-2006 and the second part 2007-2017. During the first part of the study period, the net working capital was positive in absolute terms but in relative terms, the current ratio was between 1.75 and 3.18, and the quick ratio was between 0.2 and 0.73. So, there was insignificant liquidity related to financial risk during that period. But the profitability was of very low due to excess liquidity and no or low

profitable investment of the idle fund in 2004 and 2005 which is an indication of inefficient working capital management.

But in the second part of the study period, the net working capital was negative (except in 2015), the current and quick ratios were below 1 and 0.35 respectively. Hence, the liquidity related financial risk situation deteriorated sharply.

The ratio of permanent capital to noncurrent assets was above 1 during the first part of the study period. So, the financial balance was maintained and there was no risk of long term insolvency. But an opposite scenario was observed in the second part when the ratio was below 1 suggesting a portion of noncurrent assets was financed by short term liabilities. As a result, the financial balance was in a weak position and the companies were exposed to the risk of long term insolvency. In recent years the liquidity risk position and financial balance of the jute sector as a whole was not good and needed to be improved.

Pharmaceuticals and chemicals sector: In absolute terms, the amount of net working capital was positive throughout the period under review. But the current and quick ratios were below the standard norms. The average values of current and quick ratios were below 1.5 and 0.6 respectively from 2001 to 2008, indicating a significant level of liquidity related financial risk in the companies under this sector. But since 2009 the situation was improved gradually and at the end of the period both the ratios reached near to the standard norms. Hence, the risk was at an acceptable level during 2009-2017.

The ratio of permanent capital and noncurrent assets was all along above 1 in the whole period of review that suggests the selected companies were following the standard rule of financing noncurrent assets. As a result, there was hardly any risk of long term insolvency leading to bankruptcy.

Tannery sector: The amount of net working capital was positive with an upward trend during the period of study. But the current ratios were below 1.5 and the quick ratios were at or below 0.4 as against the rule of thumb of 2 and 1 respectively, which suggests the selected tannery companies had Liquidity risk during the period of review. However, this risk was near to the acceptable level. Moreover, the ratio of permanent capital and noncurrent assets was above 1 which means no part of the noncurrent assets was financed by short term liabilities and hence there was hardly any risk of long term insolvency leading to liquidation. So, the financial risk situation in the selected companies of the tannery sector was not a matter of great concern. Nevertheless, the situation needs to be improved gradually by making this sector more investment-friendly.

3.3.4. Insolvency Risk

In this stage of analysis, we will present the Z score of the selected companies for examining their financial health and also for predicting the likelihood of bankruptcy.

Table 6
Average Z-Scores of companies under cement sector

<i>The Z-score of the selected companies</i>					
<i>Year</i>	<i>ACL</i>	<i>CCL</i>	<i>HCL</i>	<i>MCL</i>	<i>Mean</i>
2013	1.28	3.90	6.97	2.42	3.64
2014	1.15	2.97	7.44	2.06	3.41
2015	1.34	2.46	7.62	2.27	3.42
2016	1.04	2.18	6.72	1.82	2.94
2017	0.80	2.00	6.14	1.85	2.70
Mean	1.12	2.70	6.98	2.09	3.22
Std.	0.21	0.76	0.59	0.26	0.39

<i>Ranking based on average Z- score</i>				
<i>Company</i>	<i>Average Z-score</i>	<i>Rank</i>	<i>Risk zone</i>	<i>Comment</i>
ACL	1.12	4	Distress	In financial distress Risk
CCL	2.70	2	Safe	Could go either way
HCL	6.98	1	Safe	Not in financial distress Risk
MCL	2.09	3	Gray	Could go either way

Cement sector: The calculated Z-scores of the selected cement manufacturing companies are shown in table 6. If we examine the values, HCL showed very consistent performance during the whole period of study. The average value of the Z-score of the company stands at 6.98. So, it can be concluded that HCL has sound financial health and no possibility of financial distress shortly. CCL and MCL have an average Z-score of 2.70 and 2.09 respectively and as such the companies fall in the gray area that indicates, there was a low probability that the firms would face financial distress. But, the average Z-score of ACL is very low (1.12) and below 1.80. None of the observed years' Z-score is above 1.80. So, the company was on the verge of financial distress and the financial condition of the company appeared to be a matter of great concern for the stakeholders particularly stockholders. The industry average Z-score during the period 2013 to 2017 is 3.22 which is higher than 2.99. So, it can safely be said that the cement industry as a whole was financially sound during the last five years of

study and the sample companies had an insignificant risk of insolvency except ACL, which had a significant risk of bankruptcy.

Engineering sector: It is observed from Table 7 that 11 out of 16 companies are consistently good performers. The average Z-scores of all companies is more than 2.99. So, it can be concluded that engineering companies have sound financial health and no possibility of financial distress shortly. Out of these eleven companies, RFL has the best financial health with the highest Z-score (6.53) and also low standard deviation (0.55). The average values of the Z-scores of three companies (AAL, BTA, and NPL) is in between 1.8 and 3. Hence, these companies fall in the gray area that indicates there is less probability that the companies would face financial distress very soon. But, the average Z-scores of the remaining two companies is below 1.8. None of the observed years' (except KQL in 2017) Z-score is above 1.80. So, the companies are at high financial distress risk and their financial condition is a matter of great concern for the stakeholders particularly stockholders. APL is in the worst vulnerable condition with negative Z-scores in all the years. During the period 2013 to 2017, the industry average Z-score is 3.77, which is higher than 2.99. So, it can safely be said that most of the companies under the engineering sector are financially sound and they have a very low risk of insolvency. The potential

Table 8
Average Z-Scores of companies under the fuel and power sector

<i>The Z-score of the selected companies</i>						
<i>Year</i>	<i>BWEL</i>	<i>CVOPRL</i>	<i>ELL</i>	<i>LBL</i>	<i>POL</i>	<i>Mean</i>
2013	2.44	33.14	3.42	8.93	2.26	10.04
2014	1.86	11.28	4.51	10.10	2.17	5.99
2015	1.68	9.99	1.59	10.69	1.93	5.18
2016	0.72	19.51	12.82	7.65	1.55	8.45
2017	2.49	14.70	7.84	7.77	1.33	6.83
Mean	1.83	17.72	6.04	9.03	1.85	7.29
Std.	0.72	9.37	4.42	1.36	0.40	1.96
<i>Company</i>						
<i>Ranking based on average Z- score</i>						
	<i>Average Z-score</i>	<i>Rank</i>	<i>Risk Zone</i>	<i>Comment</i>		
BWEL	2.49	4	Gray	Could go either way		
CVOPRL	17.72	1	Safe	Not in financial distress Risk		
ELL	6.04	3	Safe	Not in financial distress Risk		
LBL	9.03	2	Safe	Not in financial distress Risk		
POL	1.85	5	Gray	Could go either way		

investors should consider the Z- score of a publicly-traded company before making any investment decision.

Fuel and Power: Table 8 shows the calculated Z-scores of the selected companies in this sector. CVO, LBL, and ELL have very sound financial health. The average values of Z-scores of the companies stand at 17.72, 9.03 and 6.04 respectively. So, these three companies have no threat of financial distress immediately. The remaining two companies, BWEL and POL, have an average Z-score of 1.85 and 1.83 respectively. The two values lie between 1.81 and 2.99 and as such the companies fall in the gray area which indicates that these two companies have a low probability of financial distress. Besides, none of the observed years' Z-score of any selected company in this sector is below 1.80. So, it can safely be said that the fuel and power sector as a whole is financially sound with a very low risk of insolvency.

Table 9
Average Z-Scores of companies under the jute sector

<i>The Z-score of the selected companies</i>				
<i>Year</i>	<i>JSL</i>	<i>NJML</i>	<i>SAIL</i>	<i>Mean</i>
2013	1.50	-0.96	1.54	0.69
2014	0.13	2.06	1.31	1.17
2015	1.06	2.07	1.53	1.55
2016	2.48	2.12	1.39	2.00
2017	2.58	2.75	1.46	2.26
Mean	1.55	1.61	1.45	1.53
Std.	1.02	1.46	0.10	0.63
<i>Ranking based on average Z- score</i>				
<i>Company</i>	<i>Average Z-score</i>	<i>Rank</i>	<i>Risk zone</i>	<i>Comment</i>
JSL	1.55	2	Distress	In financial distress Risk
NJML	1.61	1	Distress	In financial distress Risk
SAIL	1.45	3	Distress	In financial distress Risk

Jute sector: The average Z-scores of all the three companies are below 1.8 (Table 9). So, the companies are at the point of financial distress, and the financial condition of all the three companies has been a matter of great concern for the stakeholders particularly stockholders. So, it can be concluded that the financial health of Bangladesh jute sector is unsound, and there is a risk of financial distress.

Table 10
Average Z-Scores of companies under the pharmaceuticals and chemicals sector

The Z-score of the selected companies

Year	ACI	APL	BSL	BPL	GSK	KCL	KCI	LIL	OIL	PAL	RBL	RL.	SPL	TISL	IBL	Mem
2013	1.95	2.55	2.10	2.75	6.55	5.11	3.11	1.45	1.85	20.76	6.43	4.19	11.53	6.06	-0.33	5.07
2014	2.67	2.36	1.84	3.06	7.28	5.78	3.60	1.27	1.95	8.29	7.33	5.98	19.91	5.78	0.29	5.16
2015	3.83	2.60	1.56	3.69	7.32	1.57	3.91	0.76	2.15	6.88	8.43	8.08	28.25	5.49	1.50	5.73
2016	3.32	2.58	1.47	2.05	6.78	2.13	4.43	0.77	2.93	9.61	7.21	8.05	29.04	5.95	1.65	5.87
2017	2.58	2.41	1.03	2.24	5.61	2.03	6.36	0.79	2.81	10.19	7.73	10.0	30.07	6.45	3.37	6.24
Mean	2.87	2.50	1.60	2.75	6.71	3.32	4.28	1.01	2.34	11.14	7.43	7.26	23.76	5.94	1.30	5.61
Std.	0.72	0.11	0.41	0.66	0.69	1.96	1.26	0.33	0.50	5.52	0.73	2.23	7.94	0.35	1.43	0.50
Rank	9	11	13	10	5	8	7	15	12	2	3	4	1	6	14	
zone	GZ	GZ	DZ	GZ	SZ	SZ	SZ	DZ	GZ	SZ	SZ	SZ	SZ	SZ	DZ	

Pharmaceuticals and chemicals sector: The calculated Z-scores are shown in table 10. If we examine the values we find that 8 out of 15 companies have shown very consistent performance in financial health. The average values of the Z-score of the companies are higher than 2.99 and none of the observed year scores have gone below this level. So, it can be concluded that the companies under the pharmaceuticals and chemical sector have sound financial health and there is no risk of financial distress shortly. Based on mean Z-scores, out of these 8 companies, the best financial health is maintained by SPL. But its variation in different years' Z-scores is very high (7.94). The average values of the Z-score of four companies, namely ACI, APL, BPL, and OIL are between 1.8 and 3. Hence, the companies fall in the gray area that indicates less risk of financial distress soon. But, the average value of the Z-scores of the remaining two companies, namely BSL, LIL and IBL, is below 1.80. None of the observed years' Z-score is above 1.80. So, the companies are at high risk of financial distress and the financial conditions of those two companies are a matter of great concern for the stakeholders particularly for stockholders. LIL is in the most vulnerable condition having an average Z-score of 1.01. The industry average of Z-score during the period 2013 to 2017 was 5.61 which is higher than 2.99. So, it can safely be said that most of the companies under the

Table 11
Average Z-Scores of companies under the tannery sector

<i>The Z-score of the selected companies</i>						
<i>Year</i>	<i>AFWL</i>	<i>ATL</i>	<i>BSL</i>	<i>LFWL</i>	<i>SLCL</i>	<i>Mean</i>
2013	2.34	6.76	5.94	2.68	7.53	5.65
2014	1.99	7.19	7.53	2.46	6.97	5.83
2015	1.65	5.13	8.35	2.39	4.69	5.04
2016	1.50	3.71	6.40	2.16	3.50	4.06
2017	1.57	2.38	5.81	3.12	6.46	4.47
Mean	1.81	5.04	6.81	2.56	5.83	5.01
Std.	0.35	2.02	1.10	0.36	1.68	0.76
<i>Ranking based on average Z- score</i>						
<i>Company</i>	<i>Average Z-score</i>	<i>Rank</i>	<i>Risk zone</i>	<i>Comment</i>		
APWL	1.81	5	Gray	Could go either way		
ATL	5.04	3	Safe	Not in financial distress Risk		
BSL	6.81	1	Safe	Not in financial distress Risk		
LFWL	2.56	4	Gray	Could go either way		
SLL	5.83	2	Safe	Not in financial distress Risk		

pharmaceuticals and chemicals industry are financially sound with an insignificant risk of insolvency. Potential investors should consider this factor before making any investment decision.

Tannery sector: If we examine the values of Z-scores in table 11, we find that three companies-BSL, SLCL, and ATL have shown very consistent financial health over the period. The average values of the Z-score of the companies are higher than 2.99. So, it can be concluded that these companies have sound financial health and no possibility of financial distress soon. Among these three companies, BSL has the highest sound financial health and its mean and standard deviation of Z-score are 6.81 and 1.10 respectively. The average values of the Z-score of the remaining two companies are above 1.80 but below 3. Hence, the companies fell in the gray area that indicates, there is a low probability that the firm would face financial distress in the near future. None of the companies' Z-score is below 1.80. So, the financial health of the companies of the tannery sector is very sound and none of them would face financial distress within a short time.

3.3.5. Statistical Measures of Financial Risk

At the final stage of analysis, we are presenting the statistical measures of financial leverage risk using two relative formulas only. We have ignored absolute measures for our interpretation because the sizes of the selected companies are different. Table 12 shows the results and ranks of the companies under all the selected sectors. Companies with negative values have not been taken into consideration for comparison purposes because the negative value of relative measure might give the ridiculous result.

According to both the measures the most and the least risky companies in the cement sector are ACL and HCL respectively. This result is consistent with the result of financial tools and Z-score.

Under the engineering sector, both the relative measures are giving the same result that BTA and APL are the riskiest and the least risky companies respectively. If we compare this result with that of the Z-score, it may be considered irrational. The reasons might be a different length of the period, total and partial view, different sources of inputs, etc.

Both the relative measures are giving the same result for the fuel and power sector, POL and BWEL are the least risky and the riskiest firms respectively. This result is also not consistent with the z-score because of the reasons mentioned above.

Table 12
 Ranking of companies under different sectors based on financial leverage risk measured by statistical tools

Company	Sector	CV	Rank	MAD	Rank	Company	Sector	CV	Rank	MAD	Rank
ACL	Cement	4.10	4	3.56	4	POL	Fuel & Power	0.41	1	0.39	1
CCL	Cement	1.83	2	1.54	2	JSL	Jute	3.56	1	3.99	1
HCL	Cement	1.57	1	1.38	1	NJML	Jute	-51	NA	-70	NA
MCL	Cement	3.64	3	3.48	3	SAIL	Jute	25.75	3	24.05	3
AAL	Engineering	0.70	3	0.58	3	ACI	Pharm. & chem.	0.83	8	0.89	8
AGL	Engineering	3.34	13	3.19	13	APL	Pharm. & chem.	0.75	6	0.73	7
ABL	Engineering	0.91	5	0.87	5	BSL	Pharm. & chem.	1.99	14	2.72	14
APL	Engineering	0.10	1	0.11	1	BPL	Pharm. & chem.	0.42	3	0.31	2
BTA	Engineering	46.06	16	40.44	16	GSK	Pharm. & chem.	1.02	9	1.04	10
BAC	Engineering	13.36	14	11.83	14	KCL	Pharm. & chem.	0.36	2	0.44	3
BLL	Engineering	2.30	12	2.09	12	KCI	Pharm. & chem.	0.78	7	0.70	6
ECL	Engineering	1.56	11	1.39	11	LIL	Pharm. & chem.	1.64	11	1.75	12
KQL	Engineering	27.05	15	23.86	15	OIL	Pharm. & chem.	5.59	15	5.43	15
MJS	Engineering	1.35	9	1.34	9	PAL	Pharm. & chem.	1.98	13	2.06	13
NPL	Engineering	1.19	8	1.18	8	RBL	Pharm. & chem.	1.03	10	1.02	9
NTL	Engineering	1.16	7	1.11	7	RL	Pharm. & chem.	0.32	1	0.30	1
QDL	Engineering	0.88	4	0.80	4	SPL	Pharm. & chem.	0.53	4	0.60	4
RFL	Engineering	0.98	6	0.94	6	TISL	Pharm. & chem.	0.54	5	0.65	5
RJL	Engineering	1.36	10	1.37	10	IBL	Pharm. & chem.	1.83	12	1.52	11
SBL	Engineering	0.38	2	0.42	2	APWL	Tannery	1.61	2	1.43	2
BWEL	Fuel & Power	4.53	5	4.39	5	ATL	Tannery	3.44	4	2.94	4
CVOPRL	Fuel & Power	2.29	4	2.32	4	BSL	Tannery	1.06	1	1.06	1
ELL	Fuel & Power	1.02	3	1.02	3	LFWL	Tannery	1.95	3	1.62	3
LBL	Fuel & Power	1.00	2	1.00	2	SLL	Tannery	-26	NA	-33	N

SAIL and JSL are the riskiest and the least risky firms respectively. This result is in agreement with the result of the Z-score.

OIL and RL are the riskiest and the least risky companies respectively among the selected companies under the pharmaceuticals and chemicals sector. This result is most consistent with the Z-score.

Both the relative measures suggest that the riskiest and the least risky companies of the tannery sector are ATL and BSL respectively.

3.3.6. Summary of Discussion

After a detailed discussion on each element of the financial risk of all the selected sectors separately, we have strived to compare among the sectors regarding the financial risk exposure in this section. Though every individual industrial sector has its characteristics, the comparison of financial risk exposure may be helpful for potential investors to make an informed judgment.

Positive growth was observed in the selected manufacturing sectors during the period of study. The highest and the lowest growth rates of all three items - total assets, debt and equity capital, were witnessed in the Pharmaceuticals & chemical and the Jute sectors respectively. There was uniformity in the growth rate in all the three areas of all the sectors except engineering. The growth rate of debt capital in the engineering sector was much lower in comparison to total assets and equity. Based on the growth rate, it can be said that the Pharmaceuticals & chemical sector is the most potential sector among all the selected manufacturing sectors in Bangladesh.

A similar scenario was also observed in the case of capital structure risk. The capital structure risk is insignificant in the pharmaceuticals & chemical sector having lower debt ratios while this risk is at an alarming level in the jute sector because of the higher debt ratio. However, this risk is at an acceptable level in the remaining four sectors. A positive relationship between ROE and financial leverage was observed in the jute sector while the relationship was negative in the cement sector. It showed mixed results in the other four sectors.

From the viewpoint of liquidity related to financial risk, the engineering sector was in a better position. The liquidity risk was insignificant in the engineering sector since the net working capital was positive and liquidity ratios were near to the standard norms. Like capital structure risk, the jute sector was in a vulnerable position with significant liquidity risk because of lower current and quick ratios. Net working capital was negative in 10

out of 17 years of study. The liquidity risk position of other sectors was at an acceptable level.

As the average Z-score was very low (below 1.8) and financial balance was not maintained, again the jute sector was at high risk of financial distress. The financial health of the remaining five sectors was good enough, keeping them free from any risk of financial distress soon. However, among these five sectors, the fuel and power sector was in a better position with a comparatively higher average value of Z-score.

If we consider relative methods of statistical tools for measuring overall financial risk exposure and attempt to arrange the selected sectors in ascending order, the arrangement will be engineering, pharmaceuticals & chemicals, tannery, cement, fuel & power, and jute.

The overall financial risk exposure of the selected manufacturing sectors was on average at an acceptable level except for the jute sector.

4. CONCLUSION

Measuring and managing risk exposure is the most essential component of corporate risk management strategy. Financial risk usually refers to the probability that a company's cash flow will exhibit insufficient to meet its obligations and as such thorough knowledge of financial risk exposure is essential for debt providers to avoid default risk. Without understanding rudimentary risk exposures of a company, it is rather challenging to examine whether the company is modifying its exposures in a way that fits with the theory. A rational investor should conduct a due diligence review of corporate financial risk exposure switching patterns overtime before investing in corporate bonds and stocks as well.

The intention of this study was to measure and evaluate three components of financial risk, viz. capital structure risk, liquidity risk, and insolvency risk of 48 sample companies out of 91 DSE listed manufacturing companies in six industrial sectors. We have used financial tools, statistical tools, and Z-score to measure different components of financial risk. The empirical results have shown that all the sample companies are using financial leverage and hence they are exposed to financial risk. But in most cases, the exposure to financial risk is within the acceptable or threshold level with a few exceptions.

Conversely, the use of financial leverage is very low or nonexistent in some cases, although their return on investment is higher than the market interest rate and as such, they had ample opportunity to use more debt in their capital structure to get the advantages of trading on equity. This

situation also affirms the absence of sound corporate financial planning. While assembling data from financial statements, we observed that most of the companies had a very low level of long term debt (cheaper source of finance) rather than short term debt (costly source of finance) in their capital structure, which exhibit unwise use of short term debt instead of long term debt.

We have also examined empirically the financial health and insolvency risk of the sample companies using the Z-score. The results have indicated that 9 out of 48 companies (1 out of 4 cement, 2 out of 16 engineering, 3 out of 15 pharmaceuticals & chemical, and 3 out of 3 jute companies respectively) have the potential risk of financial distress. The management should take a prudent financial decision to revise the situation, and the general investors should be cautious while investing in stocks of these companies.

The sector-wise analysis of results has revealed that the overall financial risk exposure of the selected manufacturing sectors is within acceptable level except for the jute sector. The financial risk exposure ranking of the sample sectors from low to high based on statistical results are engineering, pharmaceuticals & chemicals, tannery, cement, fuel & power, and jute in that order. Hence, special attention should be given to the jute sector to manage its high financial risk exposure for more accelerated development of this sector.

This study has provided a better understanding and a deep insight into financial risk exposure of publicly traded manufacturing companies in Bangladesh. The findings have also provided clues to the sample companies to revisit their debt policies. Debt restructuring is essential for some companies to bring financial risk exposure down to an acceptable level and for some companies to receive advantages of financial leverage. DSE listed companies rely much on short term debt and the reason could be the complexities of having sufficient long term debt and the absence of a vibrant corporate bond market due to poor participation of institutional and retail investors. This could be a significant policy implication for finance managers because they can utilize long term debt to design an optimal capital structure for maximizing shareholders' wealth through maximizing firm value. The findings of financial health would be useful for creating awareness among the present and the potential investors of the Bangladesh capital market.

We have proposed a new measuring approach to financial risk exposure in this paper. We have developed an integrated approach combining financial tools, statistical tools, and Z-score to assess the financial risk exposure of the sample companies. The combination of three tools to achieve a single objective is hardly ever found in related literature. This method

could be a useful tool to evaluate financial risk exposure in the developing country context where the derivative market is yet to develop. So, it is a groundbreaking research of its kind and it will certainly contribute to academic literature.

Besides, the Bangladesh stock market is defined as underdeveloped and highly speculative with weak regulatory mechanisms and it is passing through a period of extreme volatility, uncertainty, and grave crisis caused by the aftereffect of the major stock market crash in 2010-2011. This study could encourage revising corporate financial policy decisions and also contribute immensely towards a sound, efficient, and vibrant capital market for developing country context, particularly for Bangladesh.

We have found some negative values of CV while calculating financial risk. So, we have ranked the companies based on positive values of CV only keeping aside the companies with negative CV. Another constraint is that accounting year and presentation of financial statements of different companies are not uniform.

LIST OF ABBREVIATIONS

CR	Current Ratio
CV	Coefficient of Variation
DFV	Dependent Financial Variable
DA	Debt Assets
DE	Debt Equity
DSE	Dhaka Stock Exchange
DZ	Distress Zone
EPS	Earnings per Share
EBIT	Earnings before Interest and Tax
FLR	Financial Leverage Risk
GDP	Gross Domestic Product
GZ	Gray Zone
IFV	Independent Financial Variable
MAD	Mean Absolute Deviation
NCA	Noncurrent Assets
NWC	Net Working Capital
PC	Permanent Capital
QR	Quick Ratio

ROE Return on Equity

SZ Safe Zone

N.B All the acronyms of names of sample companies have been given in the sample list to avoid complexity.

Declarations

Availability of data and material: Please contact authors for data requests.

Funding: This research received no external funding.

REFERENCES

- Almansour, B. Y. (2015). Empirical Model for Predicting Financial Failure. *American Journal of Economics, Finance, and Management*, 1(3), 113-124.
- Alam, S. M. R., & Hossain, S. Z. (2004). Management of Working Finance: A Study on the Shipbuilding Industry in Bangladesh. *Management Accountant-Calcutta (Kolkata)*, 39(2), 111-117.
- Altman, E. I. (1968). Financial Ratios, Discriminant Analysis and the Prediction of Corporate Bankruptcy. *The Journal of Finance*, 23(4), 589-609.
- Bartram, S. M., Brown, G. W., & Fehle, F. R. (2009). International Evidence on Financial Derivatives Usage. *Financial management*, 38(1), 185-206.
- Bhattacharya, H. (2007). *Total Management by Ratios: An Analytic Approach to Management Control and Stock Market Valuations*. SAGE Publications India.
- Błach, J. (2010). Financial Risk Identification Based on the Balance Sheet Information. *Managing and Modelling of Financial Risks*, 10-19.
- Bodie, Z., Kane, A., & Marcus, A. J. (2000). *Ready Notes to Accompany Essentials of Investments*. Irwin/McGraw-Hill.
- Boehlje, M. & Gray A.(2003). *Risk, Economic Value Added, and Capital Structure*. West Lafayette, IN: Department of Agricultural Economics, Purdue University.
- Cebenoyan, A. S., & Strahan, P. E. (2004). Risk Management, Capital Structure, and Lending at Banks. *Journal of Banking & Finance*, 28(1), 19-43.
- Collier, P. M. (2009). *Fundamentals of Risk Management for Accountants and Managers Tools and Techniques* (1st ed.). Oxford: Elsevier Ltd.
- Debasish, S. S. (2008). Foreign Exchange Risk Management Practices-A Study in Indian Scenario. *BRAC University Journal*, 5(2), 81-91.
- Dey, R., Hossain, S., & Rezaee, Z. (2018). Financial Risk Disclosure and Financial Attributes among Publicly Traded Manufacturing Companies: Evidence from Bangladesh. *Journal of Risk and Financial Management*, 11(3), 50.
- Dey, R., Hossain, S., & Rahman, R. (2018). Effect of Corporate Financial Leverage on Financial Performance: A Study on Publicly Traded Manufacturing Companies in Bangladesh. *Asian Social Science*14(12), 124-133.
- Fabozzi, F. J., & Peterson, P. P. (2003). *Financial Management and Analysis* (2nd ed.). Hoboken: John Wiley & Sons, Inc.

- Frank, M. Z., & Goyal, V. K. (2009). Capital Structure Decisions: Which Factors Are Reliably Important?. *Financial management*, 38(1), 1-37.
- Grice, J. S., & Ingram, R. W. (2001). Tests of the Generalizability of Altman's Bankruptcy Prediction Model. *Journal of Business Research*, 54(1), 53-61.
- Guerard Jr., J. B. (2005). *Corporate Financial Policy and R& D Management* (2nd ed.). Hoboken: John Wiley & Sons, Inc.
- Helfert, E. A., & Helfert, E. A. (2001). *Financial Analysis: Tools and Techniques: A Guide for Managers* (pp. 221-296). New York: McGraw-Hill.
- Hill, N. C., & Stone, B. K. (1980). Accounting Betas, Systematic Operating Risk, and Financial Leverage: A Risk-Composition Approach to the Determinants of Systematic Risk. *Journal of Financial and Quantitative Analysis*, 15(3), 595-637.
- Horne, V., & Wachowicz, J. (2008). *Fundamentals of Financial Management*. Essex: Pearson Education Limited.
- Hossain, S. Z. (2017). Bangladesh Stock Market Bubble Burst: The Transgression of Economic Factors. *Research Bulletin*, 43(1), 51-63.
- Hossain, S. Z., & Akon, M. H. R. (1997). Financing of Working Capital: Case Study of Bangladesh Textile Mills Corporation. *Journal of Financial Management & Analysis*, 10(2), 37.
- Islam, M. R., & Hossain, S. Z. (2019). Conceptual mapping of shared value creation by the private commercial banks in Bangladesh. *Asian Journal of Sustainability and Social Responsibility*, 4(1), 3.
- Jorge, M. J. D. S., & Augusto, M. A. G. (2011). Financial Risk Exposures and Risk Management: Evidence From European Nonfinancial Firms. *RAM. Revista de Administração Mackenzie*, 12(5), 65-97.
- Kou, G., Chao, X., Peng, Y., Alsaadi, F. E., & Herrera-Viedma, E. (2019). Machine Learning Methods for Systemic Risk Analysis in Financial Sectors. *Technological and Economic Development of Economy*, 1-27.
- Kou, G., Peng, Y., & Wang, G. (2014). Evaluation of clustering algorithms for financial risk analysis using MCDM methods. *Information Sciences*, 275, 1-12.
- Lawrence J. Gitman and Chad J. Zutter. (2009). *Principles of Managerial Finance*. New York: Pearson Prentice Hall.
- Loudon, G. F. (2004). Financial Risk Exposures in the Airline Industry: Evidence from Australia and New Zealand. *Australian Journal of Management*, 29(2), 295-316.
- Moazzem, K. G., & Rahman, M. T. (2012). *Stabilizing the Capital Market of Bangladesh: Addressing the Structural, Institutional and Operational Issues* (No. 95). Centre for Policy Dialogue (CPD).
- Odit, M. P., & Chittoo, H. B. (2008). Does Financial Leverage Influence Investment Decisions? The Case of Mauritian Firms. *Journal of Business Case Studies*, 4(9), 49-60.
- Pandey, I. M., (1995). *Financial Management*. New Delhi: Vikas Publishing House Pvt. Ltd.
- Petersen, H. (1964). Risk and the Capital Structure of the Firm. *The Journal of Finance*, 19(1), 120-121.

- Rahman, M. T., Hossain, S. Z., & Habibullah, M. (2017). Stock Market Crash in Bangladesh: The Moneymaking Psychology of Domestic Investors. *American Journal of Theoretical and Applied Business*, 3(3), 43-53.
- Ross, S. A., Westerfield, R., & Jordan, B. D. (2008). *Fundamentals of corporate finance*. Tata McGraw-Hill Education.
- Sinha, S. (2013). Financing Leverage Analysis: A Conceptual Framework. *IOSR Journal of Business and Management*, 7(3), 64-91.
- Titman, S., Keown, A. J., & Martin, J. D. (2011). *Financial management: Principles and applications* (Vol. 11). Boston: Prentice-Hall.
- Vaughan, E. J., & Vaughan, T. (2007). *Fundamentals of Risk and Insurance*. John Wiley & Sons.
- Weygandt, J. J., Kimmel, P. D., & Kieso, D. E. (2015). *Financial & Managerial Accounting*. John Wiley & Sons.