DATA ANALYTICS AND APPLIED MATHEMATICS
E-ISSN: 2773-4854
VOLUME 4, ISSUE 2, 2023, 25 – 32
DOI: https://doi.org/10.15282/daam.v4i2.9686

RESEARCH ARTICLE

Prediction bankruptcy for technology sector company using Altman's Z-score model

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ABSTRACT - The financial performance of a company is essential as it is due to external users such as creditors, investors, and customers making the best decision after investigating the company's sustainability. This study aims to forecast the economic health and feasibility of the five technology companies in Malaysia using Altman's Z-score model, which was chosen using the simple random sampling method by analyzing balance sheets and income statements. Findings show that the technology sector in Malaysia performed poorly in 2021, with 3 companies are in distress zone, while two companies are in the grey zones, indicating this model can be utilized as initial test for company future performances. Although this does not imply that the enterprises have bad financial stability, one should exercise caution and be aware of the risks while investing.

ARTICLE HISTORY
Received : 23/01/2023
Revised : 18/02/2023
Accepted : 25/03/2023
Published : 30/09/2023

KEYWORDS
Bankruptcy
Financial performance
Forecast
Altman's Z-Score

1. INTRODUCTION

Bankruptcy is a legal system in which an individual or company is facing difficulty to repay outstanding debts. Excessive debt will result in payment default and personal bankruptcy filing [1-2]. Bankruptcy filing is a legal course undertaken by the company to discharge its debt obligations. Therefore, the erosion in the credit evaluation process exists due to the increase in the number of personal bankruptcies [3]. Due to the large default debts from prior clients, this issue has caused the bank to become more cautious by tightening the lending procedure in loan approval. Recently, the number of bankruptcies worldwide has increased because of the financial crisis since the pandemic of Covid-19. In Malaysia, a total of 10,317 people has been declared bankrupt and 1,246 businesses have been closed down during the movement control order (MCO) period between March 2020 and July 2020 [4]. As the number of bankruptcies increases, the company stakeholders such as investors, customers, and creditors are more aware to the financial performance of the company. According to the [5], a debtor who is unable to pay debts totaling at least RM100,000 is subject to being declared bankrupt as a result of an Adjudication Order issued by the High Court against him. Insolvency allows a person or business to start over by wiping off debts that are just unaffordable and allowing creditors a chance to get some sort of payback based on the assets that may be liquidated by the person or firm. Therefore, there are various models to predict the chance of one's company going bankrupt in the next two years such as Altman's Z-score and the Zmijewski model so that the company will be more alert and take proper action for the problems.

Since Altman's Z-score was released as one of the bankruptcy prediction models in 1968, the field has been saturated with several more bankruptcy prediction models. It refers to both the growing body of research and the diversity of models employed in predicting business failure. In general, Altman's Z-score, which is a statistical variant of the standard z-score, is based on five financial ratios that may be computed using information from an organization's annual report. It determines if a business has a high likelihood of going bankrupt by looking at factors including profitability, leverage, liquidity, solvency, and activity. Professor Edward Altman developed the Altman's Z-score algorithm, which measures the probability of a corporation filing for bankruptcy, in 1967. It was then published in 1968 [6], Altman has consistently updated his Z-score throughout time. Altman examined 86 struggling businesses from the year 1969 to 1975, 110 from the year 1976 to 1995, and lastly 120 from the year 1996 to 1999. He discovered that the Z-score had an accuracy range of 82% to 94%. Altman's Z-score Plus, which he released in 2012, is a modified version that can be used to evaluate all the businesses from every sector. Altman's Z-score Plus is a tool for assessing business credit risk. A trustworthy method for estimating credit risk is Altman's Z-score. [7] stated that the firm's bankruptcy may be predicted using Altman's model as a predictor and maybe as proof in the future. As a result of their understanding that a mathematical model is an abstraction of reality, they think that more data, as well as economic indicators, may be required to predict the outcome of the company's future operational activities and its financial position performance.

As the digital era is currently find its way to the global economy, the technology sector deserved much attention, in particular in the during, and post pandemic environment. Information and communications technology (ICT) have made it possible for industrial and service businesses worldwide to boost labor productivity and revenue growth during the Fourth Industrial Revolution (IR 4.0). In developing, rising, and developed economies throughout the world, ICT investments, and diffusions have significantly boosted productivity growth as well as enhanced organizational effectiveness and efficiency. In light of this recent development, Malaysia's technology-based companies, particularly

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those listed on Bursa Malaysia, are required to work toward the achievement of Vision 2050, which aims to turn Malaysia into a smart community with sustained national economic growth. However, this sector is also vulnerable to disruption such as the pandemic, as technology is by nature a very vibrant, and fast-moving business entity. The disruption on the uncertainties that is caused by the pandemic may hinder progress and result in vulnerable positions among the companies in this sector.

This study will select five technology sector companies in Malaysia to investigate the risk of one's company getting bankruptcy and the financial health of the company. We will focus on the financial performance of 5 technology companies in Malaysia as well as forecast the bankruptcy of the companies, as shown in Table 1. The reason why we focus on these 5 technology companies is that they are used in all areas of life. For instance, we use mobile, TV, computer, and transportation in daily life. In this study, we would like to have a deeper understanding of Altman's Z-score model for predicting the risk of companies going bankrupt and predicting the financial health and viability of Technology sector companies in Malaysia.

Table 1. Background of the five technology companies

No.	Company Name	Description
1.	Company A	The Company A provides various services such as designs, supplies, installs, and integrations of IT infrastructures, teleconferencing, LANs, interactive media management systems, radio and television news automation, telecommunication systems, and other relevant electronic systems through its subsidiaries.
2.	Company B	Company B whose subsidiaries offer modern and world-class high precision mold fabrication, magnetic coils for hard disc drives, and services to assist our clients in accelerating crucial advancement in their sectors.
3.	Company C	Company C is one of the few global automotive-LED producers that provides a comprehensive variety of color spectrum and brightness intensity for both interior and exterior applications. Examples of interior applications are instrument clusters, infotainment systems, climate control, switches, and ambient lighting while headlamps, tail lamps, rear combination lighting, brake light central, and license plate lamps are from exterior applications.
4.	Company D	Company D is a company that offers enterprise data management (EDM) services. Backup, storage, recovery, and restoration are among the services provided. In addition, the firm offers value-added services such as installation, configuration, and implementation of EDM infrastructure technology solutions.
5.	Company E	Company E is a provider of information technology solutions specializing in the design, development, deployment, and support of application and system solutions for the financial services industry, stockbroking, and investment banks. Application Solutions, Maintenance Services, and Application Services Provider are the three divisions of the company.

2. METHODOLOGY

Altman's Z-score model depends on five key financial ratios. When determining a company's financial stability and insolvency risk, increases the model's accuracy. The following is how Altman's Z-score formula is expressed:

$$Zeta, \zeta = 1.2A + 1.4B + 3.3C + 0.6D + 1.0E$$

where ζ = Altman's Z-score

$$A = \frac{Working\ Capital}{Total\ Assets}$$

$$B = \frac{Retained\ Earnings}{Total\ Assets}$$

$$C = \frac{Earnings\ Before\ Interest\ and\ Tax}{Total\ Assets}$$

$$D = \frac{Market\ Value\ of\ Equity}{Total\ Liabilities}$$

$$E = \frac{Total\ Sales}{Total\ Assets}$$

After obtaining the value of Zeta(ζ), we indicate the likelihood of one business heading for bankruptcy. The risk that a firm will go bankrupt often increases with the Z-score. A company gaining a z-score below 1.8 means that the company is in the distress zone and the probability of the company getting bankrupt is quite high. A Z-score, which is between 1.8 to 3.0 indicates that the company is in the grey zone and there is a moderate chance that a company will go bankrupt. A score between 3.0 and 4.0, on the other hand, implies that the business is not likely to go bankrupt, as shown in Figure 1.

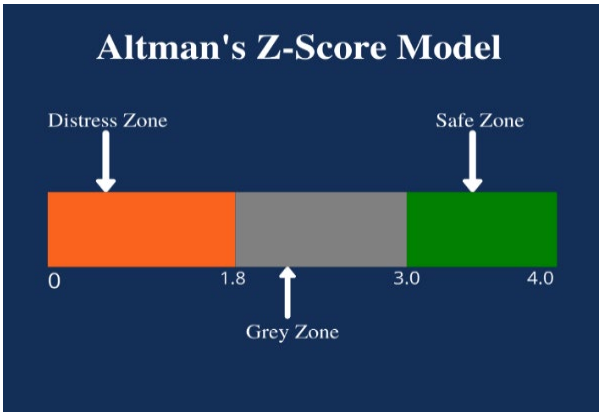

Figure 1. Altman's Z-Score model [8]

Based on a company's financial performance, investors can use Altman's Z-score to decide whether to buy or sell its shares. Investors should think about purchasing a business's stock if its Z-score is closer to 3, indicating that the company is unlikely to file for bankruptcy over the next two years. Consequently, if a company's Z-score is closer to 1.8, investors would choose to sell the company's shares to avoid losing money because the figure denotes a higher probability of bankruptcy. Table 2 below shows the important financial measures that are used to calculate the Zeta value:

Table 2. Key financial ratios

Formula	Description
$A = \frac{Working\ Capital}{Total\ Assets}$	Working capital is the difference between a company's current assets and current liabilities. The amount of working capital of a company has an impact on its short-term financial stability. A business that has positive working capital may pay its short-term debts while still having money left over for investments and expansion. On the other hand, negative working capital implies that the company would find it difficult to meet its short-term financial commitments.
$B = \frac{Retained\ Earnings}{Total\ Assets}$	The ratio of retained earnings to total assets indicates how much earnings a corporation has left over after it has been making profits or losses. Low retained earnings to total assets ratio indicate that a company is paying expenses with borrowed money rather than its cash reserves and will make a company's chances of failure higher. On the other hand, high retained profits to total assets ratio indicates that a company uses its retained earnings to pay for capital expenditures. It demonstrates that the firm has become profitable over time and no longer requires financing.
$C = \frac{Earnings\ Before\ Interest\ and\ Tax}{Total\ Assets}$	A company's profitability can be gauged by earnings before interest and taxes (EBIT). It has to do with a business's ability to generate profits solely from its operations. This ratio reveals a company's ability to increase sufficient revenue to maintain profitability, support ongoing operations, and pay off debt.
$D = \frac{Market\ Value\ of\ Equity}{Total\ Liabilities}$	By multiplying the number of outstanding shares and the current stock market price, we can calculate the market capitalization which is also called the market value of a company's equity. When a company files for bankruptcy before the value of its obligations surpasses the value of its assets on the balance sheet, the market value of its equity/total liabilities ratio reveals how much its market value will drop. Investors might perceive a high market value of equity to total liabilities ratio as high investor confidence in the company's financial strength.

Table 2. (cont.)

Formula	Description
$\boldsymbol{E = \frac{Total\ Sales}{Total\ Assets}}$	The ratio of total sales to total assets shows how effectively management uses assets to generate money in comparison to competitors. A high sales-to-total-assets ratio means that the company's management only has to invest a modest amount of money to bring in revenue. On the other hand, a low sales-to-total-assets ratio indicates that management will have to spend more money and time to increase sales, which would lower the company's profitability.

To interpret the financial health of technology sector companies in Malaysia, a total of five technology sector companies which are Company A, Company B, Company C, Company D, and Company E are selected. We used a simple random sampling method to select these five companies to avoid bias in the data.

3. RESULTS AND DISCUSSION

These five technology sector companies in Malaysia are searched on the website of Bursa Malaysia. By referring to the annual reports of the technology sector companies in 2021, we collect the working capital, total assets, retained earnings, earnings before interest and tax, the market value of equity, total liabilities, and sales of each company. Thus, we used this information to carry out the analysis for the prediction of bankruptcy of each company by using Altman's Z-score model.

Company A

Table 3 represents the financial ratios of Company A in 2021. By getting the financial measures in Table 3, we can calculate Altman's Z-score model to determine the financial health of Company A by calculating the Zeta value.

Table 3. Data of financial ratios of Company A in 2021

Company Name	Working Capital (RM)	Total Assets (RM)	Retained Earnings (RM)	Earnings before Interest and Tax (RM)	Market Value of Equity (RM)	Total Liabilities (RM)	Sales (RM)
Company A	45,090,135	337,667,382	9,877,669	7,956,226	13,091,220	276,243,328	16,516,644

$$\begin{aligned}\zeta A &= 1.2A + 1.4B + 3.3C + 0.6D + 1.0E \\ &= 1.2\left(\frac{45{,}090{,}135}{337{,}667{,}382}\right) + 1.4\left(\frac{9{,}877{,}669}{337{,}667{,}382}\right) + 3.3\left(\frac{-7{,}956{,}226}{337{,}667{,}382}\right) + 0.6\left(\frac{13{,}019{,}220}{276{,}243{,}328}\right) + 1.0\left(\frac{16{,}516{,}644}{337{,}667{,}382}\right) \\ &= 0.2006\end{aligned}$$

The Altman's Z-score of Company A is 0.2006. Since the value is less than 1.8, so it falls in the distress zone. This indicates that the financial performance of this company is low and has a high probability of bankruptcy in near future.

Company B

Table 4 shows the business measures of Company B in 2021. By getting the business measures in Table 4, we can gain the value of Zeta, which is using Altman's Z-score formula to determine the financial health of Company B.

Table 4. Data of business measures of Company B in 2021

Company Name	Working Capital (RM)	Total Assets (RM)	Retained Earnings (RM)	Earnings before Interest and Tax (RM)	Market Value of Equity (RM)	Total Liabilities (RM)	Sales (RM)
Company B	657,000	50,852,910	-23,850,85	-1,458,216	28,348,946	7,024,530	10,649,985

$$\begin{aligned}\zeta B &= 1.2A + 1.4B + 3.3C + 0.6D + 1.0E \\ &= 1.2\left(\frac{657{,}000}{50{,}852{,}910}\right) + 1.4\left(\frac{-23{,}850{,}585}{50{,}852{,}910}\right) + 3.3\left(\frac{-1{,}458{,}216}{50{,}852{,}910}\right) + 0.6\left(\frac{28{,}348{,}946}{7{,}024{,}530}\right) + 1.0\left(\frac{10{,}649{,}985}{50{,}852{,}910}\right) \\ &= 1.8951\end{aligned}$$

The Altman's Z-score of Company B is 1.8951. Since the value is between 1.8 and 3, so it falls in the grey zone. This indicates that the financial performance of this company is moderate and has a medium chance of going bankrupt.

Company C

Table 5 represents the monetary ratios of Company C that collect from Bursa Malaysia. By getting the monetary ratios in Table 5, we can determine Altman's Z-score to interpret the financial health of Company C in 2021.

Table 5. Data of monetary ratios of Company C in 2021

Company Name	Working Capital (RM)	Total Assets (RM)	Retained Earnings (RM)	Earnings before Interest and Tax (RM)	Market Value of Equity (RM)	Total Liabilities (RM)	Sales (RM)
Company C	443,235,000	1,290,441,000	73,971,000	138,102,000	104,868,065	476,464,000	846,545,000

$$\begin{aligned}\zeta C &= 1.2A + 1.4B + 3.3C + 0.6D + 1.0E \\ &= 1.2\left(\frac{443,235,000}{1,290,441,000}\right) + 1.4\left(\frac{73,971,000}{1,290,441,000}\right) + 3.3\left(\frac{138,102,000}{1,290,441,000}\right) + 0.6\left(\frac{104,868,065}{476,464,000}\right) + 1.0\left(\frac{846,545,000}{1,290,441,000}\right) \\ &= 1.6337\end{aligned}$$

The Zeta value of Company C is 1.6337. Since the value is less than 1.8, so it falls in the distress zone. This indicates that the financial performance of this company is low, and it has a high probability of bankruptcy in near future.

Company D

Table 6 shows the data of financial ratios of Company D in 2021. By getting the financial measures in Table 6, we can gain the value of Zeta using Altman's Z-score formula to determine the financial health of Company D and predict the probability of this company for getting bankrupt.

Table 6. Data of financial ratios of Company D in 2021

Company Name	Working Capital (RM)	Total Assets (RM)	Retained Earnings (RM)	Earnings before Interest and Tax (RM)	Market Value of Equity (RM)	Total Liabilities (RM)	Sales (RM)
Company D	104,409,000	370,771,000	57,328,658	4,162,673	18,750,000	128,377,000	265,495,000

$$\begin{aligned}\zeta D &= 1.2A + 1.4B + 3.3C + 0.6D + 1.0E \\ &= 1.2\left(\frac{104,409,000}{370,771,000}\right) + 1.4\left(\frac{57,328,658}{370,771,000}\right) + 3.3\left(\frac{4,162,673}{370,771,000}\right) + 0.6\left(\frac{18,750,000}{128,377,000}\right) + 1.0\left(\frac{265,495,000}{370,771,000}\right) \\ &= 1.3951\end{aligned}$$

The Altman's Z-score of Company D is 1.3951. Since the value is less than 1.8, so it falls in the distress zone. This indicates that the business performance of this company is low, and it has a high probability of bankruptcy in near future.

Company E

Table 7 represents the data of financial measures of Company E in the year 2021. By getting the financial measures in Table 7, we can calculate Altman's Z-score to determine the financial health of Company E.

Table 7. Data of financial measures of Company E in 2021

Company Name	Working Capital (RM)	Total Assets (RM)	Retained Earnings (RM)	Earnings before Interest and Tax (RM)	Market Value of Equity (RM)	Total Liabilities (RM)	Sales (RM)
Company E	49,231,269	110,300,000	19,948,479	20,609,000	8,390,675.63	8,930,000	37,312,442

$$\begin{aligned}\zeta E &= 1.2A + 1.4B + 3.3C + 0.6D + 1.0E \\ &= 1.2\left(\frac{49,431,269}{110,300,000}\right) + 1.4\left(\frac{19,948,479}{110,300,000}\right) + 3.3\left(\frac{20,609,000}{110,300,000}\right) + 0.6\left(\frac{8,390,675.63}{8,630,000}\right) + 1.0\left(\frac{237,312,442}{110,300,000}\right) \\ &= 2.3292\end{aligned}$$

The Altman's Z-score of Company E is 2.3292. Since the value is between 1.8 and 3, so it falls in the grey zone. This indicates that the financial performance of this company is moderate, and it has a medium chance of going bankrupt.

Table 8 shows Altman's Z-score and the state of financial distress of Company A, Company B, Company C, Company D, and Company E.

Table 8. The table above summarizes the results of the technology sector companies

Company Name	Altman's Z-score	Zone
Company A	0.2006	Distress zone
Company B	1.8951	Grey zone
Company C	1.6337	Distress zone
Company D	1.3951	Distress zone
Company E	2.3292	Grey zone

$= \zeta A + \zeta B + \zeta C + \zeta D + \zeta E$

$= \frac{0.2006+1.8951+1.6337+1.3951+2.3292}{5}$

= 1.4907 (Distress zone)

Altman's Z-score will influence investors' decisions to trade the company's stock based on its financial stability. This is because investors may think about buying the company's shares if a company's Z-score is near 3 since there is little chance that it will fail within the next two years. Based from Table 8, we substituted the Altman's Z-score of each company to calculate the average zeta of the technology sector in Malaysia. After that, we obtained that there is an average zeta value of 1.4907 which lay in the distress zone. Thus, the Zeta value indicates that the overall financial health of technology sector companies in Malaysia is low during the year 2021. Investors may need to think more carefully before selling the company's shares to safeguard their investment because the score suggests a high risk of the firm going bankrupt.

4. CONCLUSIONS

There is a risk for a business to face financial ruin due to some uncertainties such as the pandemic Covid-19. During and after the pandemic period, many companies struggled financially and chose to shut down the company. On the other hand, no indication can clarify whether a business is likely to go bankrupt. Therefore, some mathematical method is created to predict the bankruptcy risk of a business. This study utilized the Altman's Z-score to further investigate the prediction of bankruptcy for the technology sector in Malaysia. We randomly select Company A, Company B, Company C, Company D, and Company E to investigate their performances during the pandemic era. The findings showed that Company A, Company C, and Company D are in the distress zone and have a Zeta score of less than 1.8. When referring to Figure 1, these finding show that these companies have a higher possibility of filing for bankruptcy in the coming 2 years. Whereas, the Company B and Company E have an Altman's Z-score that is in the grey zone, between 1.8 to 3.0. This indicates that the two companies have a slight chance that they will file for bankruptcy shortly. We also calculate the average Z-score of the technology sector, the data shows that generally, the technology sector in Malaysia has a poor performance in 2021. Although this does not imply that the enterprises have bad financial stability, one should exercise caution and be aware of the risks while investing.

ACKNOWLEDGEMENTS

Gratitude goes to Universiti Utara Malaysia, the School of Quantitative Sciences and the respondents for their support in this study.

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