Optimization Of Bankruptcy Risk Through The Altman And Grover Models: A Comparative Study

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Abstrak

Mengoptimalkan risiko kebangkrutan menjadi suatu hal yang sangat penting dalam upaya menjaga stabilitas keuangan perusahaan. Untuk menghindari kebangkrutan, perlu adanya analisis yang dapat memprediksi potensi kebangkrutan dari suatu perusahaan. Dalam penelitian ini, penulis menggunakan dua model analisis prediksi kebangkrutan, yaitu model Altman (Z-Score) dan model Grover (G-Score). Penelitian ini menggunakan data sekunder, yang mengambil lima perusahaan teknologi, yaitu Samsung, Apple, Asus, Xiaomi dan Lenovo, selama periode 2013 - 2022. Penelitian ini bertujuan untuk membandingkan hasil analisis dari kedua metode tersebut dan menentukan metode mana yang paling akurat dalam memprediksi kebangkrutan. Berdasarkan hasil perhitungan dengan menggunakan Model Altman telah dihasilkan bahwa perusahaan yang diteliti lebih banyak dalam kategori "Grey Area", sedangkan perhitungan menggunakan Model Grover bahwa perusahaan yang diteliti lebih banyak dalam kategori "sehat". Serta Model Altman memiliki tingkat akurasi perhitungan potensi kebangkrutan paling tinggi yaitu 38% dibandingkan dengan model Grover yang memiliki tingkat akurasi sebesar 14%. Penelitian ini menyatakan bahwa model Altman lebih akurat dalam memprediksi potensi kebangkrutan daripada model Grover.

Kata Kunci: Altman, Financial Distress ,Grover, Kebangkrutan, Risiko

Abstract

Optimizing the risk of bankruptcy is very important in efforts to maintain the company's financial stability. To avoid bankruptcy, it is necessary to have an analysis that can predict the potential bankruptcy of a company. In this research, the author uses two bankruptcy prediction analysis models, namely the Altman model (Z-Score) and the Grover model (G-Score). This research uses data from Samsung, Apple, Asus, Xiaomi and Lenovo, during the period 2013 - 2022. This research aims to compare the analysis results of the two models and determine which method is the most accurate in predict bankruptcy. Based on the results of calculations using the Altman Model, it was found that more of the companies studied were in the "Gray Area" category, while calculations using the Grover Model showed that more of the companies studied were in the "healthy" category. And the Altman model has the highest level of accuracy in calculating potential bankruptcy, namely 38% compared to the Grover model which has an accuracy level of 14 %. This research states that the Altman model is more accurate in predicting potential bankruptcy rather than the Grover model.

Keywords: Altman, Bankruptcy, Financial Distress, Grover , Risk

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INTRODUCTION

Corporate bankruptcy is a condition where a company cannot fulfill its financial obligations to creditors or shareholders. Company bankruptcy can be caused by various factors, such as global economic conditions, internal company problems, level of competition, and product innovation. To measure the risk of corporate bankruptcy, it can use the Altman (Z-Score), Grover (G-Score), Springate (S-Score) and Zmjiewski (X-Score) models, which use certain financial ratios, as well as other methods and models to measure the company's financial condition as an early warning in company bankruptcy.

Risk Optimization is a process of finding the level of bankruptcy risk that best fits the company's goals and capabilities (Secioktaviany & Asrori, 2016) . Bankruptcy risk refers to the possibility that a company will be unable to meet its financial obligations, which can have serious impacts on the company's operations and reputation (Kristiyanti, 2018) . Optimizing the risk of bankruptcy is very important in efforts to maintain the company's financial stability. Bankruptcy risk optimization is not only about avoiding risks completely, but also about managing risks in a smart and strategic way. Not only focuses on identifying potential risks, but also on efforts to minimize their negative impacts. This involves the use of a variety of financial instruments, careful credit analysis, and efficient liquidity management. In addition, it is important to understand that optimizing bankruptcy risk is not only the responsibility of the finance department, but also involves the entire company management.

Bankruptcy risk is the possibility that a company cannot fulfill its financial or operational obligations, so it must stop its activities or carry out debt restructuring (Br Sitanggang & Sion Silaban, 2021). Bankruptcy risk is influenced by various factors, such as financial performance, capital structure, business strategy, market environment, and earnings management (Mahardika & Setyawan, 2022) . To optimize bankruptcy risk, a company must analyze these factors and determine an acceptable level of risk (Sari, 2018). Companies must also monitor bankruptcy risk periodically and take preventive or corrective action if necessary (Isnaini et al., 2022)

Altman Model (Z- Score)

The Altman Model (Z-Score) is a prediction model developed by an American researcher, namely Edward I. Altman, known as Z-Score Analysis. Z-Score analysis is an analytical model used to predict the possibility of *financial distress* in the future . Altman used some discriminant analysis in which he combined information from five financial ratios into a single weighted index to develop a bankruptcy prediction model, which has become known as the "Z" model (or Z-score)

Initially, the Altman Z-Score analysis model was intended for analyzing manufacturing companies only. However, from time to time developments are carried out so that this model is not only used for manufacturing companies, but also for non-manufacturing companies. There are three types of Altman Z-Score analysis models currently used, the first model is for predicting public manufacturing companies, the second model is a private manufacturing company model, and the third is a non-manufacturing private company model.

This research uses the Original Z-Score analysis model. This model was developed in 1968 and is used to predict bankruptcy in manufacturing companies that have gone public. Following are the results of the formulation:

$$Z\text{-Score} = 1.2\,X1 + 1.4\,X2 + 3.3\,X3 + 0.6\,X4 + 0.999$$

Description :

Z = Overall Index

X1 = Working Capital / Total Assets

X2 = Retained Earnings / Total Assets

X3 = Earnings Before Interest and Taxes / Total Assets

X4 = Book Value of Equity / Total Liabilities

X5 = Sales / Total Assets

The Classification of healthy or bankrupt companies according to the Altman model of cut-off values/criteria, namely :

1. If the value of Z-Score > 2.99 = Safe/not bankrupt (the company is in a healthy state so it is unlikely that bankruptcy will occur)
2. If the value of 1.81 < Z-Score < 2.99= Gray Area (enter into categories whose predictions change, cannot be ascertained whether in good health or bankruptcy)
3. If the value of Z-Score < 1.81 = Financial Distress (high risk of bankruptcy)

The ratio that differentiates the Altman model (Z-Score) from other models (such as Grover, Springate, Zmijewski), is the use of the Book Value of Equity to Total Liabilities ratio (Wahyuni & Rubiyah, 2021). Which is, book value functions to see the price per share of the total equity owned by the company. Later, the book value per share (BVPS) is calculated to determine the price to book value (PBV), which is used to show the value of the company's assets that shareholders will receive if the company is liquidated, whether the company's shares are traded above or below the market price. Meanwhile, total liabilities consist of the company's total short-term and long-term liabilities.

Model Grover (G-Score)

A model developed by Grover G. Gordon in 1975. This model uses four financial ratios, namely cash flow to total debt, total debt to total assets, earnings before interest and tax to interest expense, and sales to total assets. This method produces a G-score which indicates the possibility of the company experiencing bankruptcy (Munawarah & Hayati, 2019) .

Grover's Model Equation :

$$\text{G-Score} = 1.650\ X1 + 3.404\ X2 - 0.016\ X3 + 0.057$$

Description :

X1 = Working Capital / Total Assets
X2 = Earnings Before Interest and Taxes / Total Assets
X3 = Net Income / Total Assets

The Classification of healthy or bankrupt companies according to the Grover model of cut-off values/criteria, namely :

1. If Score G < -0.02 = the company is predicted to experiencing bankruptcy or be unhealthy
2. If Score G > 0.01 = the company is predicted as not experiencing bankruptcy or be healthy

This research uses the Altman (Z-Score) and Grover (G-Score) models to predict the risk of company bankruptcy. These two models are very popular because they can provide useful information for investors, creditors, management and other stakeholders, about the company's financial condition and its potential for bankruptcy (Lutfiyyah & Bhilawa, 2021) . The Altman (Z-Score) and Grover (G-Score) models are also easy to calculate and interpret because they only require data available in the company's financial statements. However, these two methods also have limitations, namely that these two models only consider financial factors in predicting bankruptcy, so they may not be able to capture non-financial factors that also have an influence, such as macroeconomic factors, competition, regulations, technology, innovation, tastes. consumers and others. Therefore, it is necessary to carry out a more comprehensive and holistic analysis to assess company performance and risks.

In previous research, many studies have been conducted on the Altman Z-Score and Grover (G-Score) models. However, there are differences in the results shown by previous research. In research conducted by Adfanin , et al (2023) which used the Altman (Z-Score), Springate (S-Score) and Zmjiewski (X-Score) models on conventional taxi companies for the period of 2019-2021. The research results show that by using the Altman Model (Z-Score), the

results state that PT. Express Transindo Utama Tbk (TAXI) is predicted to be in the potential bankruptcy category and PT. Blue Bird Tbk (BIRD) is predicted to be in the category with no potential for bankruptcy . Meanwhile, the results of calculations using the Springate (S-Score) model stated that many of the companies studied were in the "potentially bankrupt" category. Furthermore, calculations using the Zmjiewski (X-Score) model stated that many of the companies studied were in the "no potential for bankruptcy" category.

Then next, there was research conducted by Saputra, et al (2021) which used the Altman Z-Score, Springate, Zmijweski, Foster, and Grover Model at the company PT. Bank Mandiri Tbk for the period of 2016-2019. Calculation results using the Altman Z-Score Model, PT. Bank Mandiri Tbk for the period of 2016-2019, shows that this company is in a gray area, so it is categorized as a company that is experiencing financial difficulties. Meanwhile, based on the results of calculations using the Springate Model and the Zmijewski model, it shows that PT. Bank Mandiri Tbk for the 2016-2019 period is in a healthy financial condition and has no financial problems. Calculations using the Foster and Grover Model state that PT. Bank Mandiri Tbk in the period of 2016 – 2019 was included in the non-bankrupt category.

Meanwhile, research conducted by Oktaviani & Yanti (2022) used four models bankruptcy predictions, namely Altman, Springate, Zmijewski and Grover at the company PT. Matahari Department Store Tbk for the period of 2016-202. From the results of this research, it states that all four models using this model produce the same predictions , namely PT. Matahari Department Store Tbk is widely predicted to be in the category of not having the potential to go bankrupt. Only in 2020, PT. Matahari Department Store Tbk is predicted to be in the Potential Bankruptcy category.

Based on previous research, there is a population gap, namely a gap in the aspect of population coverage when taking research data, where previous research used different companies and periods. So the limited and different number of objects studied will influence the research results.

Due to inconsistencies in the results of previous research and several of the research results mentioned previously, it only discusses the calculation of bankruptcy predictions using various models, but it is not yet known whether the prediction models used are accurate enough or not. Therefore, there is still a need for further research regarding the accuracy of models for predicting bankruptcy .

So the aim of this research is to provide early warning to companies about the company's condition through financial reports using the Altman (Z-score) and Grover (G-Score) bankruptcy prediction models . This research also aims to compare the analysis results of the two models and determine which model is the most accurate in predicting bankruptcy.

METHODOLOGY

The quantitative approach is the research method used to answer the objectives of this research. This research uses secondary data, which takes five technology companies, namely Samsung, Apple, Asus, Xiaomi and Lenovo. Secondary data used is in the form of annual financial reports, The period of 2013-2022, obtained from various official sources. Asus and Xiaomi companies use data from the the period of 2017 – 2022, due to not getting the financial report.

The data is then processed using the Altman (Z-score) and Grover (G-score) models. After getting the value from each model, it is then categorized according to the cut off value of each model. Each model has a cut-off value to be able to categorize or group the analysis results as to whether they are included in a healthy company, gray area (for the Altman model), or included in the category of potential bankruptcy (financial distress). Then, calculate the level of accuracy for each bankruptcy prediction model to assess which

bankruptcy prediction model is the best prediction between the two bankruptcy prediction models.

RESULTS AND DISCUSSION

Altman Model (Z-Score)

Table 1. Prediction Results using the Altman Model (Z-Score)

Company	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Samsung	S	S	S	GA	GA	GA	GA	GA	GA	S
ASUS	-	-	-	-	GA	GA	GA	GA	GA	GA
XIAOMI	-	-	-	-	GA	FD	GA	GA	GA	GA
APPLE	GA	GA	GA	GA	GA	GA	GA	GA	GA	GA
LENOVO	GA	FD	FD	S	S	FD	FD	GA	GA	GA

Description: S = Safe; GA = Gray Area; FD=Financial Distress
Source: Data processed (2024)

The table above shows the condition of five companies using the Altman Z-Score model, from the period 2013 - 2022. Altman Z-Score is a financial measure used to determine whether a company is experiencing bankruptcy. The higher the Altman Z-Score value, the lower the risk of bankruptcy. Conversely, the lower the Altman Z-Score value, the higher the risk of bankruptcy .

Based on the table, that among the five companies, only SAMSUNG is predicted to be in the "Safe" category for three consecutive years, even in 2022 only Samsung is predicted to be in the "Safe" category. Meanwhile, Lenovo and Xiaomi were predicted to be in the "Financial Distress" category. But Lenovo has an interesting company condition, having been predicted to be in the "Safe" and "Financial Distress " categories for two consecutive years. Two other companies, namely ASUS and APPLE, where ASUS is predicted to be in the "Gray Area" category for 6 consecutive years, as well as APPLE is predicted to be in the "Gray Area" category for 10 consecutive years. Where this condition is an uncertain and risky condition, this must be a concern for the company. The companies Samsung, Asus and Apple were never predicted to be in the "Financial Distress" category based on the results of calculations using the Altman model (Z-Score).

Grover Model (G-Score)

Table 2. Prediction Results using the Grover Model (G-Score)

Company	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Samsung	H	H	H	H	H	H	H	H	H	H
ASUS	-	-	-	-	H	H	H	H	H	H
XIAOMI	-	-	-	-	H	UH	H	H	H	H
APPLE	H	H	H	H	H	H	H	H	H	H
LENOVO	UH	UH	UH	H	H	UH	UH	H	H	H

Description: H= Healthy; UH= Unhealthy
Source: Data processed (2024)

Table 2 above shows the condition of five technology companies based on calculations using the Grover model (G-Score), from the 2013 period - 2022. The Grover Score (G-Score) is a measure that measures a company's performance in several aspects, such as sales growth, profitability, efficiency, liquidity and solvency. A positive score value indicates good performance, while a negative score value indicates poor performance. Grover's value (G-Score) fluctuates around 0, which indicates that they are in an uncertain and risky financial condition. The higher the G-Score value, the lower the risk of bankruptcy. Conversely, the lower the Grover G-Score, the higher the risk of bankruptcy .

Based on Table 2, only two companies are predicted to be in the "unhealthy" category, namely XIAOMI and LENOVO. Meanwhile, three other companies, namely Samsung, Apple and Asus, are predicted to be in the "healthy" or "no potential for bankruptcy" category. And based on calculations using the Grover model , that APPLE has the highest grover value (G-Score) among the five the company studied, which means that APPLE has good financial performance. On the other hand, LENOVO has the lowest Grover value (G-Score) , which indicates that LENOVO has unhealthy or risky financial performance. Meanwhile, SAMSUNG, XIAOMI, and ASUS, has Grover value (G-Score) that fluctuate around 0, which indicates that they are in an uncertain and risky financial condition.

Uncertainty in a company's financial condition can occur due to various factors, such as internal and external factors of the company. Internal company factors that can cause bankruptcy include inefficient management which will result in continuous losses which ultimately cause the company to be unable to pay its obligations; Imbalance in the capital owned and the amount of debt owned; and fraud committed by company management can result in bankruptcy.

Meanwhile, external factors that can cause bankruptcy come from factors that are directly related to the company, including customers, suppliers, debtors, creditors, competitors or the government. Meanwhile, external factors that are not directly related to the company include macro economic conditions and global competition factors.

Test of Accuracy

This test aims to determine the level of accuracy of which model is most accurate in predicting bankruptcy in this study. Accuracy level analysis is calculated based on the correct number in analyzing bankruptcy divided by the number of samples (Oliviana & Pandin, 2023) . The following are the results obtained from the Altman (Z-Score) and Grover (G -Score) models after calculating according to the cut off point of each model:

Table 3. Comparison of Bankruptcy Models (Financial Distress)

Model	Comparison Results			Total Sample
	Financial Distress	Gray	Not Bankrupt/Safe	
Altman Z-Score	16	12	14	42
Grover G-Score	6	0	36	42

Source: Data processed (2024)

Based on the level of accuracy of each model, it is calculated using the following formula:

$$\text{Accuracy Level} = \frac{\text{The number of predictions is correct}}{\text{Number of samples}} x 100\%$$

Table 4 . Level of Accuracy

Model	Number of Correct Predictions (Those experiencing Financial Distress	Number of Samples	Level of accuracy
Altman Z-Score	16	42	38%
Grover G-Score	6	42	14%

Source: Data processed (2024)

Based on the calculations in Table 4, it can be seen that the m model Altman Z -Score has the greatest level of accuracy in predicting and analyzing bankruptcy in this study . The size model accuracy level Altman (Z -Score) is 38 %, with this high level of accuracy, it means that the method Altman Z -Score is able to predict bankruptcy very well. Furthermore, the Grover model (G -Score) has an accuracy level of 14 % of the total research sample. With an accuracy level of 14%, the Grover model (G-Score) shows performance that is not yet accurate in predicting bankruptcy in this study .

The results of the accuracy level analysis above are in line with the research of Safitri and Arifin (2023), where the research results show that the Altman model is the most accurate prediction model with a percentage of 81%. Apart from that, research conducted by Wahyuni and Rubiyah (2021) shows that the most appropriate and accurate model in predicting financial distress conditions is the Altman model (Z-Score) with the highest accuracy level of 76%. And supported by the results of research conducted by Wahyuni EDT and Seriska (2022), which states that the Altman Z-Score model has the highest level of accuracy of 73.91 % .

This means, Altman's Z- Score can be used as a tool for evaluating the company's financial performance and as a financial predictor. But that doesn't mean that Altman's Z-Score is the best model among the other models. This is because each company has different characteristics, as well as financial management, such as financing decisions, investment decisions, dividend decisions, capital budgeting, capital structure, and so on. Where these decisions are influenced by many factors, such as the company's risk appetite and economic conditions.

CONCLUSIONS

Based on the research results, using the Altman Model (Z-Score) it was found that the companies studied were more in the "Gray Area" category, while calculations using the Grover Model (G-Score) showed that the companies studied were more in the "healthy" category. Using the Altman (Z-Score) model, the Samsung company has the highest score among the five companies. Meanwhile, using the Grover Model (G-Score), Apple has the highest score among the five companies.

The Altman model (Z-Score) has the highest level of accuracy in calculating potential bankruptcy, compared to the Grover model (G-Score). In this research, the Altman model (Z-Score) is the most effective model used to predict potential bankruptcy. The Altman model (Z-score) and the Grover model (G-Score) have their respective strengths and weaknesses. Altman model (Z- score) and Grover (G-Score) uses different financial ratios, different weights, and different threshold values in calculating bankruptcy scores. Therefore, the bankruptcy prediction results from the two models can vary depending on the financial condition of the company being analyzed**.** The researcher realized that this research still has many limitations, namely the analysis model used in the comparison is still relatively few, by comparing two models and the determination of the research population and sample is not optimal.

The researcher is aware that the results of this research are not yet fully feasible as a measuring tool for predicting company bankruptcy. However, through the Altman and

Grover models, companies can consider analyzing and knowing the company's financial condition as an early warning system. For further research, it is recommended to use other models and methods to analyze bankruptcy as a comparison, because there is no perfect model, and there is no model that accommodates the actual situation faced by the company.

In general, the task of bankruptcy prediction is to predict whether the company will go bankrupt or not. To accurately conduct the prediction, have to use algorithms to train the datasets, such as the financial data from the firm's financial statements, or also called the Multivariant Discriminant Analysis (MDA) model, such as Altman and Grover. Through the process of dataset, can obtain a classifier with good classification accuracy, which can be used to do the bankruptcy prediction. For future trend in bankruptcy prediction using deep leaning techniques, such as Convolutional Neural Network (CNN). One particular trend is the diversification of data sources. Former bankruptcy prediction papers would usually use numerical data, such as financial statement data, accounting data. Now using CNN, the textual data, like news or public report even some comments from experts, are used to do the prediction (Qu et al., 2019).

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