Indonesian Annual Conference Series, Vol. 2, 2023
Halu Oleo International Conference on Economic and Business (IACS-HOICEB 2023)

Evaluating and Comparing Predictive Accuracy of Financial Distress Models in the Banking Sector: A Case Study of Indonesian Banking Entities (2019-2021)

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Abstract

This study aims to comprehensively evaluate and predict financial distress occurrences in the banking sector using four prominent models: Altman's Z-Score, Zmijewski's X-Score, Springate's S-Score, and Grover's G-Score. It endeavors to pinpoint the most accurate predictor among these models, focusing on their applicability in forecasting financial distress for banking entities listed on the Indonesia Stock Exchange from 2019 to 2021. Employing a descriptive research design with a quantitative descriptive approach, the study employs variables and measurements from the Altman, Zmijewski, Springate, and Grover models. Findings highlight the preeminence of the Zmijewski (X-Score) and Springate (S-Score) models, boasting a 100% accuracy rate in predicting and analyzing financial distress in the Indonesian banking industry. Conversely, the Altman (Z-Score) and Grover (G-Score) models exhibit a contrasting 0% accuracy rate across the study's sample. These results underscore the Zmijewski and Springate models' efficacy in predicting financial distress, emphasizing proactive anticipation by companies, regardless of their perceived financial stability. In summary, the originality of this study stems from its specific focus on evaluating and comparing these models within the Indonesian banking sector, its methodology, and the unique insights it offers regarding the efficacy of these models in predicting financial distress occurrences.

Keywords: *Accuracy Rate, Banking Industry, Financial Distress.*

INTRODUCTION

In the realm of business, the primary objective of every company is to achieve profitability, ensuring its continuous operation and sustained growth over the long term. In this pursuit, companies endeavor to navigate financial challenges and avoid difficulties that could jeopardize their existence. Financial distress characterizes a phase marked by deteriorating financial conditions within a company, which escalates the vulnerability to the risk of bankruptcy (Sari, 2018).

An analysis of a company's potential for bankruptcy holds immense significance for a multitude of stakeholders. The ramifications of a company's bankruptcy extend beyond its own affairs, impacting other interconnected parties as well. Consequently, the assessment of bankruptcy potential serves as a means of obtaining early warnings regarding the likelihood of such an outcome. Swift identification of these initial indicators of bankruptcy is of paramount importance for management, as it enables timely corrective actions to avert bankruptcy (Hanafi and Halim in Rahmah, 2018).

This aspect is equally applicable to the banking sector, which assumes a pivotal role within the regional economy. As Al-Arif (2011) as cited in Rahmah (2018) elucidates, banks function as financial intermediaries, amassing funds from individuals with surplus capital and allocating them to those in need. Indeed, every company, including banks, faces an array of operational risks that can lead to financial distress. The effective management of these risks is crucial to prevent companies from encountering financial difficulties. Consequently, the assessment of potential financial distress is a necessity for various stakeholders linked to the banking sector.

Indicators such as the ratio of non-performing loans (NPL) to total credit disbursements, which constitute a major revenue source, serve as early warning signals of potential bankruptcy threats in the banking industry.

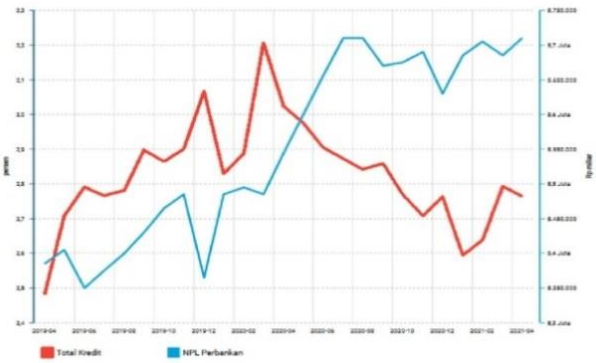

Figure 1. Non-Performing Loan (NPL) Trends in the Banking Sector (2019-2021)
Source: Financial Services Authority (2022)

Examining Non-Performing Loans (NPL) data provided by the Financial Services Authority reveals an escalating trend within the Indonesian banking industry since 2019. If this trend persists, it could potentially lead to financial difficulties and even bankruptcy.

The banking sector experienced a shift towards decline towards the close of 2019, evident in the upward trajectory of non-performing loans from 2.53% to 3.22% in 2021. Although this percentage remains below the critical threshold, cautionary measures must be taken by banking management to bolster financial performance and curtail the NPL percentage. Achieving this goal necessitates an evaluation of financial distress.

Several predictive models for "financial distress" have been developed, namely the Altman, Zmijewski, Springate, and Grover models. These models have demonstrated substantial accuracy in prior research. Zatira et al. (2022), in their study "Comparison of Altman, Zmijewski, Springate, Grover, and Foster Models in Predicting Bankruptcy of Indonesian Airlines During the Covid-19 Pandemic", identified the Zmijewski and Grover models as the most accurate, with an accuracy rate of 35%. The Springate model displayed an accuracy rate of 12.5%, while the Altman and Foster models achieved accuracy rates of 0%.

In contrast, Sri Fitri Wahyuni and Rubiyah (2021), in their study "Analysis of Financial Distress Using Altman Z-Score, Springate, Zmijewski, and Grover Methods in Plantation Sector Companies Listed on the Indonesia Stock Exchange", found the Altman model to be the most suitable and accurate for predicting financial distress among plantation sector companies listed on the Indonesia Stock Exchange.

Considering the variations in prior research and evaluating the strengths and weaknesses of each predictive model, this study aims to address disparities among financial distress prediction models, specifically the Altman, Zmijewski, Springate, and Grover models. Furthermore, the research seeks to gauge the accuracy levels of these models in predicting financial distress within the banking industry listed on the Indonesia Stock Exchange (BEI), with the ultimate objective of identifying the most suitable model for predicting bankruptcy.

The primary objective of this study is to analyze financial distress within the banking industry, utilizing the Altman (Z-Score), Zmijewski (X-Score), Springate (S-Score), and Grover (G-Score) models. The study focuses on the banking sector listed on the Indonesia Stock Exchange from 2019 to 2021, with the aim of pinpointing the most accurate model for analyzing financial distress during this period.

Signaling theory was initially introduced by Akerlof and Arrow and later expanded into an equilibrium theory by Spence. According to Ross (1977), as cited in Asmaradana and Satyawan (2022), signaling theory revolves around the conveyance of accurate information by management to the market, followed by the reception of feedback—whether positive or negative—regarding the valuation of the company.

In accordance with Statement of Financial Accounting Standards (SFAS No. 1), financial statements provide a structured representation of an entity's financial standing and performance. The objective of financial statements is to furnish data concerning the financial position, performance, and cash flows of an entity, serving a diverse range of users in making informed economic decisions. Furthermore, financial statements mirror the managerial responsibility for the utilization of entrusted resources (Indonesian Institute of Accountants, 2018).

Financial statement analysis, as defined by Kariyoto (2017), is a thoughtful process aimed at assessing the financial position and historical performance of a company. Its primary objective is to ascertain the most plausible estimates and predictions regarding the company's future condition and performance.

Financial distress denotes a situation where a company struggles to meet its obligations or current debts, compelling the company to implement corrective measures to surmount its economic challenges. This predicament can arise when a company sustains losses over a span of years, potentially culminating in bankruptcy (Kusumaningtyas, 2017).

Altman Model (Z-Score):

The Altman model, introduced in 1968, selects 22 financial ratios considered capable of predicting financial distress. Following a rigorous assessment of each ratio, Altman identified five financial ratios that could effectively predict financial distress (Altman, 1968). However, variable X5 was excluded due to its variability across companies of differing asset sizes. In this study, the Altman model is applied to Non-Manufacturing Companies and can be represented as follows:

Z" = 6.56X1 + 3.267X2 + 6.72X3 + 1.05X4

Here:

- Z" represents the Overall Index
- X1 denotes Working Capital/Total Assets
- X2 signifies Retained Earnings/Total Assets
- X3 represents Earnings Before Interest and Taxes/Total Assets
- X4 indicates Book Value of Equity/Book Value of Total Debt

The resulting Z" index value determines the company's state, whether distressed, in a grey area, or healthy. Threshold points for Z" values are categorized as:

- Z" value <1.1: distressed condition
- 1.1 < Z" < 2.6: grey area condition
- Z" value >2.6: healthy condition

Zmijewski Model (X-Score):

The prediction model devised by Zmijewski in 1983 emerged after two decades of replicated research. This model incorporates ratios that assess performance, leverage, and liquidity of the company (Zmijewski, 1984). The model's equation is:

X = -4.3 - 4.5X1 + 5.7X2 - 0.004X3

Here:

- X represents the Overall Index
- X1 corresponds to Return on Assets (ROA)
- X2 represents Leverage (Debt Ratio
- X3 signifies Liquidity (Current Ratio)

The model's cutoff point is set at 0. A value greater than 0 (X > 0) predicts financial distress, an X value equal to 0 (X = 0) indicates a grey area condition, and an X value less than 0 (X < 0) suggests no impending financial distress.

Springate Model (S-Score):

Conducted in 1978, Gordon L. V Springate's research employed the Multiple Discriminant Analysis (MDA) technique akin to Altman. This model, known as the Springate model, employs four financial ratios from a selection of 19 ratios gathered from various literature sources (Effendi, 2018). The model's equation is:

S = 1.03A + 3.07B + 0.66C + 0.4D

Here:

- S denotes the Overall Index
- A represents Working Capital/Total Assets
- B signifies Earnings Before Interest and Taxes/Total Assets
- Ccorresponds to Earnings Before Taxes/Current Liabilities
- D denotes Sales/Total Assets
- The S value categorizes the company's state as distressed or non-distressed (healthy). Threshold points for S values are:
  - S value <0.862: distressed condition
  - S value = 0.862: grey area condition
  - S value >0.862: healthy condition

Grover Model (G-Score):

Developed by Jeffrey S. Grover in 2001 as a revision and reassessment of the Altman Z-Score model (Rahmah, 2018), the Grover model's equation is:

G = 1.650X1 + 3.404X2 - 0.016X3 + 0.057

Here:

- G represents the Overall Index
- X1 signifies Working Capital/Total Assets
- X2 corresponds to Earnings Before Interest and Taxes/Total Assets
- X3 denotes Net Income/Total Assets (ROA)

The G value classifies the company's state as distressed, in a grey area, or non-distressed (healthy). Threshold points for G values are:

- G value <-0.02: distressed condition
- -0.02 < G value < 0.01: grey area condition
- G value >0.01: healthy condition

METHODS

In this study, a descriptive quantitative research approach was adopted. According to Sugiyono (2016), a descriptive quantitative approach involves utilizing statistical methods to analyze collected data by presenting them without the intent to generalize or draw universally applicable conclusions.

Quantitative data, comprising specific numerical values that can be subjected to mathematical operations, is employed in this study, following the definition by Juliandi et al. (2014). The analyzed data consist of financial statements from banking industry companies listed on the Indonesia Stock Exchange (IDX). Secondary data sourced from relevant documents and accessed through www.idx.co.id are used.

The population encompasses all entities within the research scope, i.e., banking industry companies listed on the Indonesia Stock Exchange, amounting to 106 companies. A non-probability sampling technique, specifically the purposive sampling technique, is employed. As delineated by Sugiyono (2016), purposive sampling involves selecting samples based on specific criteria, aiming to ensure data representativeness. The selected sample companies in this study are:

- Bank Jago Tbk.
- Bank Central Asia Tbk.
- Bank Negara Indonesia (Persero) Tbk.
- Bank Rakyat Indonesia (Persero) Tbk.
- Bank Tabungan Negara (Persero) Tbk.
- Bank Mandiri (Persero) Tbk.

The research employs quantitative analysis to analyze collected data. This involves calculating, analyzing, and classifying data using financial distress prediction models, including Altman Z-Score, Zmijewski X-Score, Springate S-Score, and Grover G-Score. The analysis process comprises several steps:

- Calculating financial ratios for each company and applying them to the prediction models using their respective formulas.
- Interpreting scores and classifying company conditions based on model-specific threshold points.
- Creating a comparison table of financial distress prediction results using the employed models.
- Calculating accuracy rates for each model and presenting the results in tables. The accuracy rate indicates each model's predictive precision and is calculated using the formula:

$$\text{Accuracy Rate} = \frac{(\text{Number of Correct Predictions})}{\text{Total Sample Size})} \text{ x } 100\%$$

- Drawing conclusions based on the outcomes of the five models and identifying the most accurate model for financial distress prediction.

Operational Definitions of Variables:

- Financial Distress: Refers to a company's weakened financial condition, indicated by factors such as reduced sales, losses, debt payment challenges, and other relevant indicators.
- Financial Distress Prediction Models:
  - Altman Model: A discriminant equation incorporating specific financial ratios to assess the likelihood of company bankruptcy. Ratios include working capital to total assets, retained earnings to total assets, earning before interest and taxes to total assets, and total equity to total debt.
  - Zmijewski Model: Developed by Zmijewski in 1983, this model employs ratios that measure company performance, leverage, and liquidity. The ratios were previously researched by Zmijewski.
  - Springate Model: Developed by Gordon L. V Springate in 1978, this model employs ratios similar to Altman's, using the Multiple Discriminant Analysis (MDA) technique. Ratios include working capital to total assets, retained earnings to total assets, earning before interest and taxes to total assets, earning before taxes to current liabilities, and sales to total assets.
  - Grover Model: Developed by Jeffrey S. Grover in 2001, this model is a modified version of the Altman Z-Score model, incorporating ratios such as working capital to total assets, retained earnings to total assets, earning before interest and taxes to total assets, and return on assets (ROA).

RESULTS AND DISCUSSION

The following tables present the outcomes of the Altman model (Z-Score) analysis for the banking industry companies listed on the Indonesia Stock Exchange (IDX) during the years 2019-2021:

Table 1. Results of Altman Model (Z-Score) Analysis

Company Code	Year	Z-Score	Classification
ARTO	2019	2,99	*Non distress*
	2020	3,1	*Non distress*
	2021	6,44	*Non distress*
BBCA	2019	2,26	*Grey Area*
	2020	2,02	*Grey Area*
	2021	1,94	*Grey Area*
BBNI	2019	1,9	*Grey Area*
	2020	1,49	*Grey Area*
	2021	1,28	*Grey Area*

BBRI	2019	1,72	*Grey Area*
	2020	1,51	*Grey Area*
	2021	1,87	*Grey Area*
BBTN	2019	1,92	*Grey Area*
	2020	1,26	*Grey Area*
	2021	2,35	*Grey Area*
BMRI	2019	1,96	*Grey Area*
	2020	1,65	*Grey Area*
	2021	1,89	*Grey Area*

Source: www.idx.co.id processed by the author (2023)

The subsequent tables showcase the results of the Zmijewski model (X-Score) analysis for the banking industry companies listed on the Indonesia Stock Exchange (IDX) during the years 2019-2021:

Table 2. Results of Zmijewski Model (X-Score) Analysis

Company Code	Year	X-Score	Classification
ARTO	2019	7,88	*Distress*
	2020	9,20	*Distress*
	2021	13,41	*Distress*
BBCA	2019	2,63	*Distress*
	2020	2,50	*Distress*
	2021	2,45	*Distress*
BBNI	2019	2,61	*Distress*
	2020	2,49	*Distress*
	2021	2,20	*Distress*
BBRI	2019	2,41	*Distress*
	2020	2,82	*Distress*
	2021	2,51	*Distress*
BBTN	2019	2,29	*Distress*
	2020	2,08	*Distress*
	2021	2,13	*Distress*
BMRI	2019	2,92	*Distress*
	2020	2,72	*Distress*
	2021	3,03	*Distress*

Source: www.idx.co.id processed by the author (2023)

The subsequent tables display the results of the Springate model (S-Score) analysis for the banking industry companies listed on the Indonesia Stock Exchange (IDX) during the years 2019-2021:

Table 3. Results of Springate Model (S-Score) Analysis

Company Code	Year	S-Score	Classification
ARTO	2019	0,08	*Distress*
	2020	0,05	*Distress*
	2021	0,70	*Distress*
BBCA	2019	0,38	*Distress*
	2020	0,33	*Distress*
	2021	0,32	*Distress*
BBNI	2019	0,36	*Distress*
	2020	0,25	*Distress*
	2021	0,24	*Distress*
BBRI	2019	0,37	*Distress*
	2020	0,33	*Distress*
	2021	0,37	*Distress*
BBTN	2019	0,36	*Distress*
	2020	0,27	*Distress*
	2021	0,23	*Distress*
BMRI	2019	0,39	*Distress*
	2020	0,31	*Distress*
	2021	0,37	*Distress*

Source: www.idx.co.id processed by the author (2023)

The ensuing tables elucidate the results of the Grover model (G-Score) analysis for the banking industry companies listed on the Indonesia Stock Exchange (IDX) during the years 2019-2021:

Table 4. Results of Grover Model (G-Score) Analysis

Company Code	Year	G-Score	Classification
ARTO	2019	0,48	*Non distress*
	2020	0,47	*Non distress*
	2021	1,14	*Non distress*
BBCA	2019	0,50	*Non distress*
	2020	0,44	*Non distress*
	2021	0,43	*Non distress*
BBNI	2019	0,51	*Non distress*
	2020	0,39	*Non distress*
	2021	0,36	*Non distress*
BBRI	2019	0,49	*Non distress*
	2020	0,40	*Non distress*
	2021	0,51	*Non distress*
BBTN	2019	0,51	*Non distress*
	2020	0,37	*Non distress*
	2021	0,36	*Non distress*
BMRI	2019	0,54	*Non distress*
	2020	0,45	*Non distress*
	2021	0,52	*Non distress*

Source: www.idx.co.id processed by the author (2023)

The Altman Z-Score model was applied to the banking industry listed on the Indonesia Stock Exchange (BEI) for the years 2019-2021. The following discussion presents an analysis of the results obtained from the Altman model (Z-Score) calculations.

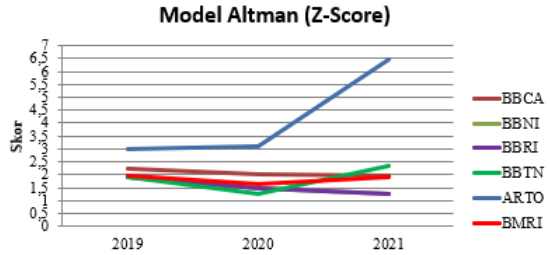

Figure 2. Results of Altman Model (Z-Score) Calculation

Source: Processed by the author (2023)

As depicted in Figure 2, the Z-Score values were calculated for each of the studied companies. Notably, PT Bank Jago Tbk (ARTO) exhibited a consistent increase in Z-Score values across the three years, starting from 2.99 in 2019 and reaching 6.44 in 2021. According to the Altman model criteria, a Z-Score exceeding the cutoff point of 2.6 suggests a non-distress classification. Consequently, PT Bank Jago Tbk (ARTO) was categorized as non-distressed for the entire period.

Contrastingly, the other five companies, including PT Bank Central Asia Tbk (BBCA), PT Bank Negara Indonesia Tbk (BBNI), PT Bank Rakyat Indonesia Tbk (BBRI), PT Bank Tabungan Negara Tbk (BBTN), and PT Bank Mandiri Tbk (BMRI), attained Z-Score values within the range of 1.1 to 2.6 during 2019-2021. These values correspond to the grey area, implying an indeterminate financial condition. Based on the Altman Z-Score model, none of the 18 analyzed companies were predicted to be in financial distress.

The results indicate that the Altman Z-Score model classified 0 out of 18 sample companies as facing financial distress, and the accuracy rate for this model was 0%. Consequently, the Altman Z-Score model exhibited limitations in predicting financial distress within the studied banking industry.

Figure 3 presents the results of the Zmijewski X-Score model calculations for the banking industry during the same period. Notably, PT Bank Jago Tbk (ARTO) consistently obtained high X-Score values, indicating a persistent state of financial distress over the three years.

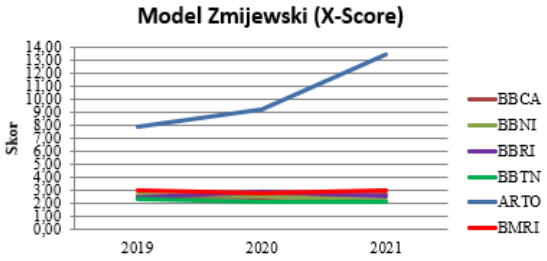

Figure 3. Results of Zmijewski Model (X-Score) Calculation

Source: Processed by the author (2023)

For the other five companies, their X-Score values consistently exceeded the threshold value of 2 set by the Zmijewski model. According to the model criteria, all these companies were deemed to be in financial distress during 2019-2021. The Zmijewski X-Score model predicted financial distress for 18 out of 18 sample companies, with an accuracy rate of 100%. This suggests the effectiveness of the Zmijewski X-Score model in identifying financial distress situations within the studied banking industry.

Figure 4 illustrates the results of the Springate S-Score model calculations for the same industry during the same period. Interestingly, PT Bank Jago Tbk (ARTO) exhibited the lowest S-Score values in 2019 and 2020, followed by a notable increase in 2021. However, even in 2021, the S-Score values remained above the model's threshold value of 0.862, indicating a non-distress state for this company throughout the period.

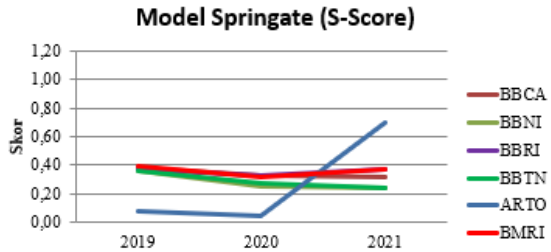

Figure 4. Results of Springate Model (S-Score) Calculation

Source: Processed by the author (2023)

Conversely, the other five companies consistently maintained S-Score values below 0.862, indicative of financial distress according to the Springate model. The Springate S-Score model accurately predicted financial distress for all 18 sample companies, resulting in an accuracy rate of 100%. These results reinforce the efficacy of the Springate S-Score model in identifying financial distress conditions in the studied industry.

Figure 5 portrays the results of the Grover G-Score model calculations for the same industry during

the same period. Remarkably, all six companies consistently achieved G-Score values above 0.01, suggesting that none of the studied companies were in a financial distress condition according to the Grover model.

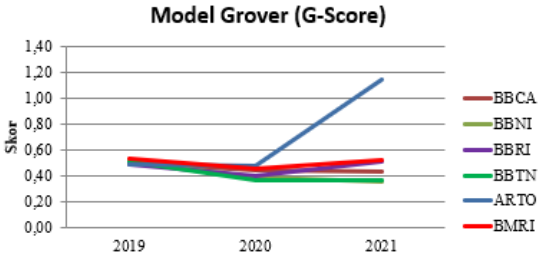

Figure 5. Results of Grover Model (G-Score) Calculation

Source: Processed by the author (2023)

The Grover G-Score model predicted financial distress for 0 out of 18 sample companies, yielding an accuracy rate of 0%. This indicates that the Grover G-Score model was not effective in identifying financial distress within the studied banking industry.

Table 5 provides a comprehensive overview of the accuracy levels of the four models—Altman Z-Score, Zmijewski X-Score, Springate S-Score, and Grover G-Score—in predicting financial distress. The Zmijewski X-Score and Springate S-Score models demonstrated the highest accuracy rates of 100%, effectively distinguishing financial distress situations. These results emphasize the significance of considering multiple models for accurate financial distress prediction.

Table 5. Table of Accuracy Calculation for Financial Distress Models

Accuracy Level	=	Prediction/ Total	=	Accuracy Result
Altman Model Z-Score	=	$\frac{0}{18}$ x100%	=	0%
Zmijewski Model X-Score	=	$\frac{18}{18}$ x100%	=	100%
Springate Model S-Score	=	$\frac{18}{18}$ x100%	=	100%
Grover Model G-Score	=	$\frac{0}{18}$ x100%	=	0%

Conversely, the Altman Z-Score and Grover G-Score models exhibited accuracy rates of 0%, implying limitations in their effectiveness for predicting financial distress within the studied industry. This underscores the importance of adopting more refined and accurate models for reliable predictions.

In conclusion, the comparison of the four models' accuracy levels highlights the superiority of the Zmijewski X-Score and Springate S-Score models in predicting financial distress. Researchers and practitioners should consider the strengths and limitations of various models to make informed decisions regarding financial distress assessment and management strategies.

CONCLUSION

Based on the comprehensive analysis of financial distress using the Altman Z-Score, Zmijewski X-Score, Springate S-Score, and Grover G-Score models on Banking industry companies listed on the Indonesia Stock Exchange, the following conclusions are drawn:

1. Altman Z-Score Model: The Altman Z-Score model predicted financial distress for none of the 18 sampled companies over the three-year period (2019-2021). This model exhibited limitations in effectively identifying financial distress, resulting in an accuracy rate of 0%.
2. Zmijewski X-Score Model: The Zmijewski X-Score model accurately predicted financial distress for all 18 sampled companies during the study period. With an accuracy rate of 100%, this model demonstrated its effectiveness in identifying companies facing financial distress.
3. Springate S-Score Model: Similar to the Zmijewski X-Score model, the Springate S-Score model also correctly predicted financial distress for all 18 sampled companies throughout the study period. Its accuracy rate of 100% underscores its capability in identifying financial distress situations.
4. Grover G-Score Model: The Grover G-Score model did not predict financial distress for any of the 18 sampled companies, resulting in an accuracy rate of 0%. This model's limitations were evident in its inability to effectively identify financial distress conditions.

In light of the research findings, several recommendations are provided for various stakeholders:

1. Companies in Non-Distress: Companies classified as non-distressed should focus on sustaining and enhancing their financial performance. Continuous efforts to improve operational efficiency, manage risk, and maintain healthy financial ratios can help prevent the onset of financial distress.
2. Companies in the Grey Area or Financial Distress: Entities categorized in the grey area or facing financial distress should prioritize rigorous evaluation of their financial health. Timely corrective measures, such as restructuring debt, optimizing cash flow, and strategic decision-making, are crucial to mitigate the risk of bankruptcy.
3. Financial Information Users: Investors and creditors should prioritize conducting thorough financial analyses, including assessments of financial distress, when making investment or lending decisions. A comprehensive understanding of a company's financial health and potential distress can guide informed choices.
4. Future Research Directions: For future researchers in the field of financial distress prediction, it is recommended to consider incorporating additional models beyond those studied in this research, such as the CAScore, Fulmer, Ohlson, Zavgen, Taffler, and more. Exploring the integration of external factors and macroeconomic indicators as research variables can enhance the accuracy and applicability of distress prediction models.

In conclusion, the research highlights the varying efficacy of different distress prediction models in the context of the Indonesian banking industry. While the Zmijewski X-Score and Springate S-Score models demonstrated high accuracy rates, the Altman Z-Score and Grover G-Score models exhibited limitations. By considering the conclusions and recommendations provided, stakeholders can make informed decisions to proactively manage financial distress and mitigate potential risks.

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