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PREDICTION OF THE ACCURACY LEVEL OF FINANCIAL DISTRESS IN TRANSPORTATION AND LOGISTICS SECTOR COMPANIES ON THE INDONESIA STOCK EXCHANGE

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Abstract

Financial distress is a financial difficulty characterized by reduced and even negative profits. This research analyzes the accuracy of the modified Altman Z-Score, Springate, Zmijewski, and Grover models in forecasting financial distress in transportation and logistics companies in Indonesia. This quantitative descriptive method research uses a population of all transportation and logistics companies listed on the Indonesia Stock Exchange for 2018-2022. The sample size was 23 companies, which were taken using the purposive sampling method. For data collection, the process is to analyze all records and data related to the research owned by the company selected as the object of research. The analysis compares the calculated prediction results with the actual conditions of the sample companies in 2022. The results of this study show that the Zmijewski method is the method with the highest level of accuracy in predicting financial distress in the transportation and logistics sector, followed by the Grover method, the Springate method, and the modified Altman Z-score method.

Keywords: Financial Distress; prediction model; Altman Z-Score modification; Springate; Zmijewski; Grover.

INTRODUCTION

Bankruptcy is a problem in a company that arises due to a problem that is not solved. Darsono and Ashari (2005) state that there are generally two causes of bankruptcy: internal and external. External factors include raw material difficulties because suppliers cannot supply the raw materials used in production. Meanwhile, from the company's financial side, there are internal factors such as negative company debt and working capital that make the company unable to survive—the onset of bankruptcy due to financial difficulties or financial distress.

Plat and Platt (2002) argue that financial distress is a period of decline in the company's financial condition that occurs before the company goes bankrupt or is liquidated. Financial distress can be detected according to the company's inability to pay its maturing obligations. Whitaker (1999) said that a firm can be considered in financial distress when it has negative net income for several years. Management must be aware of financial distress because it can plunge the company into bankruptcy. Bankruptcy costs caused by the cost of selling assets below market prices by force, liquidity costs, and costs of damage to fixed assets while waiting to be sold will arise if the company goes bankrupt (Sjahrial, 2008: 202).

According to data obtained from the databooks.katadata.co.id website, the growth of the transportation and logistics sector in 2018 was 7.05%; in 2019, it was 6.38%; in 2020, it was -15.05%; in 2021, it was 3.24%, and in 2022 it was 5.01%. The imposition of restrictions on social activities to break the chain of spreading the coronavirus has paralyzed the transportation sector in the first year of

the COVID-19 pandemic. Community mobility dropped dramatically, so the industry experienced negative growth in 2020.

There are many ways to predict a company's financial distress. However, in this study, four methods were taken, including the modified Altman Z-Score (Altman, E. I., 1968), Springate (Spingate, 1978), Zmijewski (Zmijewski, 1984), and Grover (Grover, 2001). The reason for choosing four different methods is because each method has advantages and disadvantages. The Altman method is widely used because of its high accuracy, but other research results argue that two methods are the Springate and Zmijewski methods.

From the previous description, this research aims to analyze the accuracy of the modified Altman Z-Score, Springate, Zmijewski, and Grover models in forecasting financial distress in transportation and logistics companies in Indonesia.

LITERATURE REVIEW

According to Brahmana (2007) through Hidayat (2014), if a company has a negative performance on several indicators, such as operating profit, net profit, and a book value of equity, and the company conducts a merger, it can be assumed that the company is experiencing financial difficulties. Another phenomenon, according to Hanifah (2013) through Hidayat (2013), is that the corporation will encounter liquidity difficulties, reflected in the reduced ability to meet financial obligations to creditors. Not all companies that experience financial distress will experience bankruptcy. All rely on the capabilities of company management to overcome the existing problems.

Hery (2017) argues that financial distress is when a company faces difficulties fulfilling its obligations or its revenue does not cover the costs of experiencing losses. Aghajani and Jouzbarkand (2012) say that financial distress is a situation where a company or a person is in a weak financial position. Anggarini and Ardiyanto (2010) state that companies facing financial distress will experience several symptoms. These symptoms include sharing failure to repay overdue debt to creditors and being unable to pay debts on time, or in other words, the amount of liabilities it has exceeds the amount of assets, which in short is called an *insolvable* condition.

Research conducted by Aprilia Ariqoh, Zivana & Yuniningsih, Yuniningsih (2022) shows that liquidity positively influences financial distress; leverage hurts financial distress, and operating cash flow does not influence financial distress. The effect of liquidity on financial distress cannot be moderated by company size, But firm size can moderate the impact of debt on financial desperation. In predicting the economic distress in this study proxied by the Altman Z-Score model, this indirectly shows that the Altman Z-Score model is an accurate model for predicting financial distress.

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Modified Altman Model Financial Distress Prediction Model (Z"-*Score*)

To make his prediction model applicable to all companies, such as manufacturing, non-manufacturing, and bond-issuing companies in developing countries, Altman modified his model by making various adjustments. In this latest model, Altman eliminates different asset sizes. The modification of the Atman model can be seen in the equation below:

$$Z" = 6.56X1 + 3.26X2 + 6.72X3 + 1.05X4$$

Description:

Z" = bankruptcy index

X_1 = working capital / total assets (measures liquidity ratio)

X_2 = retained earnings / total assets (measures profitability ratio)

X_3 = earnings before interest and taxes / total assets (measures profitability ratio)

X_4 = book value of equity/book value of total debt (measuring the company's ability to know the amount of company capital used to bear the burden of debt in the long term)

Healthy and bankrupt companies are classified into:

- Z" < 1.23: bankrupt company.
- 1.23 < Z" < 2.9: belongs to the *gray area* (it cannot be determined whether the company is healthy or bankrupt).
- Z" > 2.9: includes companies that are not bankrupt.

Financial Distress Prediction Model Springate Prediction Model

Springate developed a model that predicted the likelihood of financial distress in 1978 following the Altman model's steps, which uses the stepwise multiple discriminant analysis. The model flow selects 4 out of 9 common financial ratios that distinguish healthy and unhealthy companies. Springate tested his model and found an accuracy rate of 92.5% using 40 companies. The equation of this model is expressed as:

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

Description:

S = bankruptcy index

A = working capital / total assets (measures liquidity ratio)

B = earnings before interest and taxes / total assets (measures profitability ratio)

C = earnings before taxes / current liabilities (measures liquidity ratio)

D = sales / total assets (measures the ability to use assets to generate sales)

Based on the Springate model, if S> 0.862, then the company is in good health. Meanwhile, if S < 0.862, then the company has the potential to go bankrupt.

Zmijewski Financial Distress Prediction Model

The corporate bankruptcy predictor model developed by Zmijewski in 1984 uses the validity of additional financial ratios as a predictive tool. The financial ratios used include ratio analysis that measures a company's performance, leverage, and liquidity. The formula for this prediction method is:

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

Description:

X_1= Profitability *(Return on Asset (ROA))* Net income / Total assets

X_2 = *leverage* (*debt ratio*) Total debt / Total equity

X_3 = liquidity (*current ratio*) Current assets / Current debt

The company is predicted to experience financial difficulties in the future if the value of $X \geq 0$ and the opposite if $X < 0$.

Financial Distress Prediction Model Grover Prediction Model

In this model, Grover expanded his research by assessing and redesigning the Altman Z-Score model. Grover uses the sample and methods used by Altman by adding thirteen new financial ratios. These ratios are fluent ratio, quick ratio, total return on assets, inventory turnover, ROA, ROE, financial leverage index, fixed assets/total equity, gross profit margin, and working capital *turnover*. The thirteen ratios are then analyzed using *stepwise analysis*, producing three influential variables.

By using *Canonical Discriminant Function Coefficients, the* equation of the Grover model, namely (Pahlevi, 2011):

$$Score = 1.650X1 + 3.404X2 + 0.016ROA + 0.057$$

Description:

X_1 = *working capital / total assets* (measures liquidity ratio)

X_2 = *earnings before interest and taxes / total assets* (estimates profitability ratio)

ROA = *net income / total assets* (measures profitability ratio)

If the score of a company $\leq$ -0.020, then the company is declared bankrupt. However, if a company's score is > - 0.020, then the company is declared healthy.

METHOD

This research is the descriptive quantitative type by comparing the predicted calculation results with the actual conditions of the sample companies in 2022 to get a financial distress calculation method with the highest accuracy level. The research population is all transportation and logistics companies registered on the Indonesia Stock Exchange from 2018-2022. The number of research samples was 23 companies taken using the purposive sampling method. The data collection method is carried out by analyzing all records and data related to research owned by the company selected as the object of study.

The analysis compares the calculated prediction results with the actual conditions of the sample companies in 2022.

RESULTS AND DISCUSSION

This research uses secondary data collected from the financial reports of each company published on their website. Samples in this research were 23 companies that had been selected from 36 transportation and logistics companies in Indonesia. The objects chosen as the sample of this study are transportation and logistics companies that publish financial reports for 2018-2022.

Accuracy Results Models

Prediction This test is used to test how accurately each method predicts financial distress in transportation and logistics companies. After testing, the prediction results of each technique will be compared with the actual condition of the company in 2022.

Altman Z-Score Method

Weighted Accuracy and Error Rate

To get the level of accuracy by comparing the number of correct estimates/predictions and the number of samples. Meanwhile, the weighted error rate is gauged by comparing the number of incorrect forecasts to the number of pieces. From this table, it can be seen the accuracy and error rate of the Altman Z-Score model:

Table 1. Accuracy and Error Rate of Altman Z-Score Model

	Total sample	**Correct prediction**	**Wrong prediction**	**Type of error**	
Distress	8	6	2	Type I	25%
Non Distress	15	7	8	Type II	53.33%
Total	23	13	10		
Accuracy Level		**55.52%**	**Weighted Error Rate**	**44.48%**	

Source: Secondary Data Processed, 2023

According to Table 1, the Altman Z-Score model can predict 13 samples out of 23 pieces correctly. The Altman Z-Score model did not successfully predict the other ten samples correctly. From these data, the accuracy rate of the Altman Z-Score model in predicting financial distress in transportation and logistics companies was found to be 55.52%, and the weighted error rate was 44.48% with two types of errors, which will be explained below.

Error Type I & II

An error is classified when the sample company, in its natural condition, experiences financial distress. However, it is forecast to be in the gray area or will not experience economic pain. An error will be classified into type II error when the sample company in its natural condition is in distress or a gray area but is forecast to experience financial pain.

Based on the results of data processing that has been done, the Altman Z-Score model predicts that 8 companies will experience financial distress. However, only 6 of the 8 companies are predicted correctly. As many as 2 other companies are expected to be in the gray area and even in non-distress conditions. Based on this data, the Altman Z-Score method's type I error rate is 25%. The Altman Z-Score model predicts that 15 companies will not experience financial distress or be in the gray area. However, from these calculations, only 7 companies were correctly expected, while the other 8 were not. So, the Altman Z-Score method's error rate with type II is 53.33%.

Springate Method

Weighted Accuracy and Error Rate

The accuracy rate is counted by equating the number of correct predictions and samples. Meanwhile, the weight error rate is measured by comparing the number of incorrect forecastings with the number of samples. The rate of accuracy and error rate in the Springate model can be seen in the table and explanation below:

Table 2. Accuracy and Error Rate of Springate Model

	Total sample	**Correct prediction**	**Wrong prediction**	**Type of error**	
Distress	12	10	2	Type I	16.67%
Non Distress	11	4	7	Type II	63.64%
Total	23	13	10		
Accuracy Level		**60.87%**	**Weighted Error Rate**	**39.13%**	

Source: Secondary Data Processed, 2023

According to Table 2, the Springate model can predict 14 samples out of a total of 23 samples correctly. The Springate model did not successfully predict the other nine samples correctly. From these data, the accuracy rate of the Springate model in predicting financial distress in transportation and logistics companies was found to be 60.87%, and the weighted error rate was 39.13% with two types of errors, which will be explained later.

Type Error I & II

According to the data processing results, the Springate model predicts 12 companies will experience financial distress, with ten samples predicted correctly. As many as 2 other companies are predicted to be in non-distress conditions. Based on this data, the Springate method's type I error rate is 16.67%. The Springate model predicts that 11 companies will not experience financial distress.

However, it turns out that only 4 companies were successfully predicted correctly, while 7 other companies were not. Based on this data, the type II error rate for the Springate method is 63.64%.

Zmijewski Method

Weighted Accuracy and Error Rate

The rate of error and accuracy of the Zmijewski model can be seen in the table and explanation below:

Table 3. Accuracy and Error Rate of the Zmijewski Model

	Total sample	**Correct prediction**	**Wrong prediction**	**Type of error**	
Distress	7	5	2	Type I	28.57%
Non Distress	16	14	2	Type II	12.5%
Total	23	13	10		
Accuracy Level		**82.61%**	**Weighted Error Rate**	**17.39%**	

Source: Secondary Data Processed, 2023

According to Table 3, it can be seen that the Zmijewski model can predict 19 samples out of a total of 23 samples correctly. The Springate model did not successfully predict the other 4 samples correctly. From these data, the Zmijewski model in predicting financial distress in transportation and logistics companies obtained an accuracy rate of 82.61%, and the weighted error rate is 17.39% with two types of errors, which will be explained later.

Type Error I & II

According to the results of data processing that has been carried out, the Zmijewski model predicts 7 companies will experience financial distress, with 5 samples predicted correctly. As many as 2 other companies are predicted to be in non-distress conditions. Based on this data, the Zmijewski method's type I error rate is 28.57%. The Zmijewski model predicts 16 companies will not experience financial distress, but it turns out that only 14 companies were successfully predicted correctly, while the other 2 companies were not. Based on this data, the type II error rate of the springate method is 12.5%.

Grover Method

Weighted Accuracy and Error Rate

The table below shows the accuracy and error rate of the Grover model:

Table 4. Accuracy and Error Rate of Grover Model

	Total sample	**Correct prediction**	**Wrong prediction**	**Type of error**	
Distress	8	5	3	Type I	37.5%
Non Distress	15	12	3	Type II	20%
Total	23	13	10		

Accuracy Level	**73.91%**	**Weighted Error Rate**	**29.09%**

Source: Secondary Data Processed, 2023

According to Table 4, it can be seen that Grover's model can correctly predict 17 samples out of a total of 23 samples. The Grover model did not successfully predict the other 6 samples correctly. From these data, the accuracy rate of the Grover model in predicting financial distress in transportation and logistics companies is obtained at 73.91%, and the weighted error rate is 29.09% with 2 types of errors, which will be explained later.

Type Error I & II

According to the results processing results, the Grover model predicts 8 companies will experience financial distress, with 5 samples predicted correctly. As many as 3 other companies are predicted to be in non-distress conditions. Therefore, the type I error rate in the Grover method is 37.5%. The Grover model predicts that 15 companies will not experience financial distress, but it turns out that only 12 companies were successfully predicted correctly, while the other 3 companies were not. Based on this data, the type II error rate of the springate method is obtained at 20%.

Discussion

The most accurate model can be defined by looking at two indicators, na: theuracy rate and the error rate. The accuracy rate is determined by comparing the number of correct predictions and the number of samples. Meanwhile, the error rate of each method is divided into two types, namely Error Type I and II. After measuring the accuracy and error rates, here is a comparison of the data processing results of each method:

Table 5. Comparison of Accuracy and Error Levels of Each Prediction Model

Rating	Methods	Accuracy Level	Weighted Error Rate	Type I Error	Type II Error
1	Zmijewski	82.61%	17.39%	28.57%	12.5%
2	Grover	73.91%	26.09%	37.5%	20%
3	Springate	60.87%	39.13%	16.67%	63.64%
4	Altman Modification	55.52%	44.48%	25%	53.33%

Source: Secondary Data Processed, 2023

The table above shows that the Zmijewski model has the highest value, so it can be said that the accuracy is also the most accurate in predicting the financial difficulties of transportation and logistics companies for the 2018-2022 period in Indonesia with an accuracy level of 82.61%.

Therefore, based on the data obtained, if these four models are ranked, the Zmijewski model is the best among the other four models. Because the Zmijewski model has an accuracy rate of 82.61%

and a weighted error rate of 17.39%, these results explain that the Zmijewski model can predict financial distress with accuracy and minimal errors compared to the other four models. The Grover model occupies the second rank, the third rank is the Springate model, and the fourth rank is the Altman Z-Score model.

All of these ratios are ratios that represent the company's equity and net income. It is one of the reasons for the high accuracy of the Zmijewski model. Another thing we can see in the Zmijewski model is that the Zmijewski model emphasizes debt to forecast the financial distress of a company. Two of the three model ratios are influenced by debt because of the choice of financial ratios that were utilized in constructing the financial distress model for this investigation: net income, total liabilities, and short-term debt. The model will predict that the company will have financial difficulties with more outstanding debt. It also shows that companies in financial distress have problems with leverage (TLTA) and liquidity (CACL).

This research is in accordance result with Febriana (2021), which examines the prediction of financial distress using the same three models as this research (Altman Z-Score, Zmijewski, and Springate models) in foreign exchange and non-foreign exchange Islamic banks in Indonesia for the 2015-2018 period. His research states that the methods with the highest level of accuracy are owned by the Altman Z-Score and Zmijewski models with an accuracy rate of 100%. The Springate method is concluded to have an accuracy rate of 67%.

This research result is also consistent with Sari & Yulianto (2018), who examined financial distress prediction using Springate and Zmijewski models at real estate companies and real estate at the Stock Exchange. Indonesian securities for the period 2013-2015. Stage. His research shows that the method with the highest accuracy belongs to the Zmijewski model, with an accuracy rate of 100%, while the Springate method has an accuracy rate of 66.66%.

The results of this research are similar to those of Listyarini (2020), who conducted a study to predict financial distress using Altman, Springate, and Zmijewski models in manufacturing companies in Indonesia in the period 2011-2014. His research shows that the method with the highest accuracy is the Zmijewski model, with a 100% accuracy rate; the Springate model, with an 89.29% accuracy rate; and the Altman model, with a 75% accuracy rate.

CONCLUSION

This research shows differences in the accuracy of each model in predicting financial distress in transportation and logistics companies in Indonesia. Based on the analysis results, the most accurate model is the Zmijewski model in forecasting the financial distress of transportation and logistics companies in Indonesia listed on the stock exchange in 2018-2022. This conclusion is reached because the model has the highest accuracy and the lowest error rate. Then, the Grover, Springate, and modified Altman Z-Score methods were followed.

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