

Comparison analysis of Altman's and Foster's Z-score model in predicting bankruptcy: evidence from Indonesian automotive and component industries

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Abstract

The purpose of this study is to determine differences in bankruptcy predictions of the Altman and Foster models. The sampling technique used is purposive sampling with an observation period of 2016-2018 with 12 company samples per year. The analysis technique uses the Altman and Foster method with the paired two-sample t-test as a hypothesis test tool. Based on the results of the Altman and Foster Z-Score model of automotive and component industries in 2016-2018 it can be concluded that the financial model of Altman and Foster can predict bankruptcy. Furthermore, the hypothesis testing found that there is no differences in the results of the Altman and Foster bankruptcy prediction.

Keywords

comparison analysis; Altman's model; Foster's model; bankruptcy prediction

INTRODUCTION

Since Indonesia has become the largest market for automotive industry in Asia (Nurhidayat, 2021), it is not surprising that the industry has attracted large amount of investment (Kemeterian Perindustrian, 2021). For example, Kementerian Perindustrian (2021) published that four-wheel or more has attracted IDR 99,16 trillion, while the two and three wheel industry has the investment value IDR 10,5 trillion.

However, as an investor, before decide to invest in a certain project, some consideration and analysis should be conducted to ensure that the investment decision may become the successful one. Among several analysis, the likelihood of bankruptcy is one of the most important analysis that should be carried out (Lyndares and Zhdanov, 2013).

In this study, the likelihood of the company's bankruptcy was measured by analyzing the company's financial statements in previous years using the Multiple Discriminant Z-Score Analysis tool, particularly the one that developed by Altman and Foster. Z-Score is a form of financial analysis that uses financial ratios

that are combined into a mathematical equation. The ratios used represent the overall financial ratios.

There are several researchers who conclude that the accuracy results from Altman and Foster are different. As in the research of Lili and Trisnadi (2014), that of the five bankruptcy analysis methods such as Altman, Springat, Zmijewski, Foster and Grover, Zmijewski, Foster and Grove model have a higher level of accuracy in predicting bankruptcy. However, according to Kosasih (2010), there is no difference between the results of the analysis of the bankruptcy of the Altman and Foster models.

These difference results motivate us to compare the Altman and Foster models. Particularly, our study attempt to conduct the comparison analysis for Altman's and Foster's Z-score model in predicting bankruptcy on the automotive and component industry on the Indonesia Stock Exchange (IDX). The data as shown in Table 1 shoes that there are several loss phenomena that occur in automotive and component industry which are indicated by the EBIT (Operating Profit), Total Assets, and ROI data from 12 automotive and component companies listed on the Indonesia Stock Exchange.

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Table 1.
EBIT, total asset, and ROI of automotive and
component industry on BEI during 2016 - 2018

Emiten Code	EBIT			Total Asset			Retrun on Investment (ROI)		
	2016	2017	2018	2016	2017	2018	2016	2017	2018
ASII	22.253.000	29.137.000	34.995.000	261.855.000	295.830.000	344.711.000	8%	10%	10%
AUTO	648.907	711.936	861.563	14.612.274	14.762.309	15.889.648	4%	5%	5%
BOLT	159.541	131.970	102.841	1.188.799	1.206.090	1.312.377	13%	11%	8%
BRAM	418.170	461.811	389.926	3.988.823	4.127.276	4.265.196	10%	11%	9%
GDYR	34.586	-3.605	14.795	1.520.305	1.677.643	1.813.375	2%	0%	1%
GJTL	825.947	106.824	-85.585	18.697.779	18.191.176	19.711.478	4%	1%	0%
IMAS	-247.735	154.166	253.260	25.633.342	31.440.444	40.955.996	-1%	0%	1%
INDS	60.140	160.341	147.983	2.477.273	2.434.617	2.482.338	2%	7%	6%
LPIN	-86.192	195.150	35.133	477.838	268.116	301.596	-18%	73%	12%
MASA	-111.856	-97.920	-345.971	8.187.165	8.885.731	9.257.972	-1%	-1%	-4%
PRAS	3.970	4.006	8.160	1.596.467	1.542.244	1.635.543	0%	0%	0%
SMSM	658.208	720.638	828.281	2.254.740	2.443.341	2.801.203	29%	29%	30%

Note. From www.idx.co.id, processed data.

Table 1 also shows that the operating profit is smaller than the total assets owned. In fact, there are 66% of companies that have a very small ROI or return on investment with a value below 5%. According to the Decree of the Minister of Finance No.740/KMK/1989, if the ROI value is less than 5%, it is included in the company with an unhealthy condition, if the ROI value is between 5% to 8% then it is included in the company with an unhealthy condition, but if the ROI value is between 8% to 12%, it is included in the company in a healthy condition. This shows that the automotive and components industry are currently estimated to be less efficient in utilizing their assets.

LITERATURE REVIEW AND HYPOTHESES DEVELOPMENT

Bankruptcy

Bankruptcy is a condition when a company or organization cannot pay its obligations. Bankruptcy is also usually caused by financial difficulties which can be seen as a

long continuum, ranging from the lightest to the most severe. This is in line with the explanation of bankruptcy according to Toto (2011), namely: "Bankruptcy is a condition where the company is no longer able to pay off its obligations. This condition usually does not just appear in the company, there are early indications of the company which can usually be recognized earlier if the financial statements are analyzed more carefully in a certain way. Financial ratios can be used as an indication of bankruptcy in the company.

Bankruptcy prediction

Hanafi (2014) suggests that there are several indicators used to predict bankruptcy. First, external indicator, refers to indicator which can be taken from financial markets, information, from related parties. Second, internal indicator, refers to indicator that can be taken from the company's cash flow, company strategy, financial statements. This analysis wants to see the strength of the company relative to its competitors.

Table 2.
Samples of study

No	Company	No	Company
1	Astra International Tbk	7	Indomobil Sukses International Tbk
2	Astra Otoparts Tbk	8	Indospring Tbk
3	Garuda Metalindo Tbk	9	Multi Prima Sejahtera Tbk
4	Indo Kordsa Tbk	10	Multistrada Arah Sarana Tbk
5	Goodyear Indonesia Tbk	11	Prima Alloy Steel Universal Tbk
6	Gajah Tunggal Tbk	12	Selamat Sempurna Tbk

Altman Z-score model and Foster Z-score model and the hypothesis development

According to Choiruddin (2016), in 1993, Altman developed a model for closed manufacturing companies. The X_4 variable in this function uses the book value of the stockholder's equity because it does not have a market value of equity. So we get the equation:

$$Z = 0,717X_1 + 0,847X_2 + 3,107X_3 + 0,420X_4 + 0,998X_5$$

where:

- Z = Bankruptcy Index
- X_1 = Working Capital / Total Asset
- X_2 = Retained Earnings / Total Asset
- X_3 = Earnings Before Interest and Taxes / Total Asset
- X_4 = Book Value of Equity / Book Value of Total Debt
- X_5 = Sales / Total Asset

The Z value is the overall index of the Multiple Discriminant Analysis function. According to Altman, there are cut off figures for the Z value that can explain whether the company will fail or not, in the future and Altman divides it into three categories, namely: 1) if the Z value 1.23, it is a bankrupt company; 2) if the value is 1.23 Z 2.90 then it is included in the grey area (cannot be determined whether the company is healthy or bankrupt); 3) if the Z value 2.90 then it is a company that is not bankrupt.

Foster then tried to apply the same sample of companies to be analyzed with Multivariate Models, namely:

$$Z\text{-Score} = aX + bY$$

where:

- X = E/OR
- Y = TIE

The first ratio explains how much operating costs are compared to income, while the second ratio shows how much operating profit is compared to the interest to be paid. By using the same data as Univariate Models, the discriminant equation is obtained, namely:

$$Z\text{-Score} = -3,366X + 0,657Y$$

This equation is then used to rank the Z values for all companies taken as samples. After that, a "Cut-off Point" is sought to separate the bankrupt and non-bankrupt companies. In this case, Foster uses a "Cut-off Point" Z = 0.640, so that a company that has Z 0.640 is included in the group of bankrupt companies, whereas if Z 0.640 is included in the group of companies that are not bankrupt. This study is considered successful because of the 10 companies there is 1 company that is wrong in grouping (Husnan, 2002).

Previous studies which investigates the the accuracy of some bankruptcy analysis show mixed results. There are several researchers who conclude that the accuracy

Table 3.
Altman bankruptcy prediction in the period of 2016 – 2018

No	Company	2016		2017		2018	
		Z-Score	Prediction	Z-Score	Prediction	Z-Score	Prediction
1	Astra International Tbk	2,495	Grey Area	1,561	Grey Area	1,572	Grey Area
2	Astra Otoparts Tbk	1,605	Grey Area	1,692	Grey Area	1,844	Grey Area
3	Garuda Metalindo Tbk	4,860	Not bankrupt	3,628	Not bankrupt	3,097	Not bankrupt
4	Indo Kordsa Tbk	2,268	Grey Area	2,639	Grey Area	2,549	Grey Area
5	Goodyear Indonesia Tbk	2,223	Grey Area	1,887	Grey Area	1,832	Grey Area
6	Gajah Tunggal Tbk	1,300	Grey Area	1,181	Bankrupt	1,116	Bankrupt
7	Indomobil Sukses International Tbk	1,287	Grey Area	0,840	Bankrupt	1,058	Bankrupt
8	Indospring Tbk	1,640	Grey Area	2,657	Grey Area	3,753	Not bankrupt
9	Multi Prima Sejahtera Tbk	-0,349	Bankrupt	4,978	Not bankrupt	3,045	Not bankrupt
10	Multistrada Arah Sarana Tbk	0,713	Bankrupt	0,696	Bankrupt	1,003	Bankrupt
11	Prima Alloy Steel Universal Tbk	0,318	Bankrupt	0,354	Bankrupt	0,387	Bankrupt
12	Selamat Sempurna Tbk	6,444	Not Bankrupt	7,787	Not Bankrupt	8,380	Not bankrupt

Note. From processed data.

results from Altman and Foster are different. As in the research of Lili and Trisnadi (2014), that of the five bankruptcy analysis methods such as Altman, Springat, Zmijewski, Foster and Grover, Zmijewski, Foster and Grove model have a higher level of accuracy in predicting bankruptcy. However, according to Kosasih (2010), there is no difference between the results of the analysis of the bankruptcy of the Altman and Foster models. In this study, we predict that Altman's and Foster's model has no difference in predicting bankruptcy.

H1: Altman's and Foster's model has no difference in predicting bankruptcy

METHODS

This type of research is quantitative because the research data is in the form of numbers (Sugiono, 2013). The quantitative method in question is a case study on the automotive and component industry on the Indonesia Stock Exchange. The object of research in this study is the financial report data of the automotive and component industry on the Indonesia Stock Exchange from 2016 to 2018.

Table 4.
Foster's bankruptcy prediction in the period of 2016 – 2018

No	Company	2016		2017		2018	
		Z-Score	Prediction	Z-Score	Prediction	Z-Score	Prediction
1	Astra International Tbk	8,524	Not Bankrupt	9,542	Not Bankrupt	7,547	Not Bankrupt
2	Astra Otoparts Tbk	3,607	Not Bankrupt	6,286	Not Bankrupt	10,095	Not Bankrupt
3	Garuda Metalindo Tbk	8,278	Not Bankrupt	3,806	Not Bankrupt	2,445	Not Bankrupt
4	Indo Kordsa Tbk	8,037	Not bankrupt	8,821	Not bankrupt	8,681	Not bankrupt
5	Goodyear Indonesia Tbk	2,198	Not Bankrupt	-0,103	Bankrupt	0,796	Not Bankrupt
6	Gajah Tunggal Tbk	0,973	Not Bankrupt	0,289	Bankrupt	0,130	Bankrupt
7	Indomobil Sukses International Tbk	0,085	Bankrupt	0,394	Bankrupt	0,390	Bankrupt
8	Indospring Tbk	1,437	Not Bankrupt	13,720	Not Bankrupt	23,889	Not Bankrupt
9	Multi Prima Sejahtera Tbk	1,279	Not Bankrupt	15,765	Not Bankrupt	1117,987	Not Bankrupt
10	Multistrada Arah Sarana Tbk	-0,293	Bankrupt	-0,169	Bankrupt	-0,707	Bankrupt
11	Prima Alloy Steel Universal Tbk	0,108	Bankrupt	0,109	Bankrupt	0,109	Bankrupt
12	Selamat Sempurna Tbk	28,199	Not Bankrupt	49,413	Not Bankrupt	55,574	Not Bankrupt

Note. From processed data.

Population and sample

As presented in Table 2, the population in this study is 12 companies in automotive and component industry on the Indonesia Stock Exchange 2016-2018. This study uses a purposive sampling technique which is a sampling technique with certain considerations. This sample is more suitable for qualitative research, or research that does not generalize (Sugiyono, 2013:122). The sample in this study is to use criteria related to the research background, as

follows: 1) have a regular annual financial report of the company in 2016-2018; 2) publish the company's annual financial statements that have been approved by the company and published as an Annual Report book every year, especially in 2016-2018.

From these criteria, researchers determine 12 samples of companies in the Automotive Sub-Sector and components on the Indonesia Stock Exchange to be studied, which are as follows in the Table 2.

Table 5.
The comparison of Altman and Foster bankruptcy prediction in the period of 2016 – 2018

No	Company	2016		2017		2018	
		Altman	Foster	Altman	Foster	Altman	Foster
1	Astra International Tbk	Grey Area	Not bankrupt	Grey Area	Not bankrupt	Grey Area	Not bankrupt
2	Astra Otoparts Tbk	Grey Area	Not bankrupt	Grey Area	Not bankrupt	Grey Area	Not bankrupt
3	Garuda Metalindo Tbk	Not bankrupt	Not bankrupt	Not bankrupt	Not bankrupt	Not bankrupt	Not bankrupt
4	Indo Kordsa Tbk	Grey Area	Not bankrupt	Grey Area	Not Bankrupt	Grey Area	Not Bankrupt
5	Goodyear Indonesia Tbk	Grey Area	Not bankrupt	Grey Area	Bankrupt	Grey Area	Not bankrupt
6	Gajah Tunggal Tbk	Grey Area	Not bankrupt	Bankrupt	Bankrupt	Bankrupt	Bankrupt
7	Indomobil Sukses International Tbk	Gray Area	Bankrupt	Bankrupt	Bankrupt	Bankrupt	Bankrupt
8	Indospring Tbk	Grey Area	Not bankrupt	Grey Area	Not Bankrupt	Not Bankrupt	Not Bankrupt
9	Multi Prima Sejahtera Tbk	Bankrupt	Not bankrupt	Not bankrupt	Not bankrupt	Not bankrupt	Not bankrupt
10	Multistrada Arah Sarana Tbk	Bankrupt	Bankrupt	Bankrupt	Bankrupt	Bankrupt	Bankrupt
11	Prima Alloy Steel Universal Tbk	Bankrupt	Bankrupt	Bankrupt	Bankrupt	Bankrupt	Bankrupt
12	Selamat Sempurna Tbk	Not bankrupt	Not bankrupt	Not bankrupt	Not bankrupt	Not bankrupt	Not bankrupt

Note. From processed data.

Data collection

In this study the data collection methods used are documentation and literature study. According to Sugiyono (2013) a document is a record of events that have passed. Documents can be in the form of writing, drawings, or monumental works of someone. Meanwhile, according to Arikunto (2006) the documentation method, which is looking for data about things or variables in the form of notes, transcripts, books, newspapers, magazines, inscriptions, minutes of meetings, agenda, and so on. Meanwhile, the literature study is employed to get information that is relevant to the topic or problem that will be or is being studied. This information can be obtained from scientific books, research reports, scientific essays, theses and dissertations,

regulations, statutes, encyclopedias, and other written and electronic sources.

Data analysis

This study used data analysis methods using two models of analysis, namely Altman and Foster Z-score. The formula for Altman Z-score is presented below:

$$Z = 0,717X_1 + 0,847X_2 + 3,107X_3 + 0,420X_4 + 0,998X_5$$

where:

X_1 = Working Capital to Total Asset

X_2 = Retained Earnings to Total Asset

X_3 = Earnings Before Interest and Taxes to Total Asset

X_4 = Book Value of Equity to Book Value of Total Debt

Table 6.
Normality test results of Altman's dan Foster's z-score data (calculated periodically)

	Kolmogorov-Smirnov ^a			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Altman 2016	,244	12	,047	,877	12	,081
Foster 2016	,255	12	,030	,673	12	,000
Altman 2017	,219	12	,117	,847	12	,034
Foster 2017	,255	12	,030	,675	12	,000
Altman 2018	,217	12	,125	,772	12	,005
Foster 2018	,475	12	,000	,362	12	,000

Lilliefors Significance Correction

Note. From processed data.

X_5 = Sales to Total Asset

The formula for Foster Z-Score is presented as follows:

$$Z\text{-Score} = -3,366X + 0,657Y$$

where:

X = Transportation expense to Operating revenue

Y = EBIT to Interest expense

Hypotheses testing

To test the hypotheses, we used paired sample t-test. For decision making use the level of significance (5%) and the basis are: 1). if the probability (Asymg.Sig) 0.05 then H_0 is accepted, meaning there is no difference; and 2) if the probability (Asymg.Sig) 0.05 then H_0 is rejected, meaning that there is a difference.

To calculate the similarity of two sample group means, we used these procedures: 1) to carry out the test, the normality test of the data is first carried out to determine whether the data type is parametric or non-parametric statistics (Sugiono, 2013). Testing the normality of the data using the Kolmogorov-Smirnov (K-S); 2) after the normality test is carried out, the data is processed using a paired two-sample difference test with the following conditions: a) if the data is normally distributed, the t-test (Paired sample t-test) is used; b) if the data is not normally distributed, the Wilcoxon

signed rank test (non-parametric test) is used.

RESULTS AND DISCUSSION

Bankruptcy estimation using Altman Z-Score

From table 3 it can be seen that in 2016 there were 3 companies that went bankrupt, 2 companies that were not bankrupt, and 7 companies entered the Gray Area. In 2017, a total of 4 companies went bankrupt, 3 companies did not go bankrupt, and 5 companies entered the Gary area. In 2018 there were 4 companies that went bankrupt, then there were 4 companies that did not go bankrupt, and those that were included in the gary area category were 4 companies.

Companies that are predicted to go bankrupt in 2016 to 2017 are Multistrada Arah Sarana Tbk with a Z-Score of 0.713 in 2016, 0.696 in 2017, 1.003 in 2018 and Prima Alloy Steel Universal Tbk with a Z-Score of 0.318 in 2016, 0.354 in 2017, 0.387 in 2018 Tbk with a Z-Score of 6,444 in 2016, 7,787 in 2017, then 8,380 in 2018.

Bankruptcy estimation using Foster Z-Score

From table 4, it can be seen that in 2016 there were 3 companies that went bankrupt and 9 companies that did not go bankrupt. Then in 2016 there were 5 companies that

Table 7.
Wilcoxon signed rank test results of Altman and Foster's Z-Score model in the period of 2016 – 2018

		N	Mean Rank	Sum of Ranks
Foster 2016 - Altman 2016	Negative Ranks	6 ^a	3,50	21,00
	Positive Ranks	6 ^b	9,50	57,00
	Ties	0 ^c		
	Total	12		
Foster 2017 - Altman 2017	Negative Ranks	5 ^d	4,00	20,00
	Positive Ranks	7 ^e	8,29	58,00
	Ties	0 ^f		
	Total	12		
Foster 2018 - Altman 2018	Negative Ranks	6 ^g	3,50	21,00
	Positive Ranks	6 ^h	9,50	57,00
	Ties	0 ⁱ		
	Total	12		

a. Foster 2016 > Altman 2016

b. Foster 2016 = Altman 2016

c. Foster 2017 < Altman 2017

d. Foster 2017 > Altman 2017

e. Foster 2017 = Altman 2017

f. Foster 2018 < Altman 2018

g. Foster 2018 > Altman 2018

h. Foster 2018 = Altman 2018

Note. From processed data.

went bankrupt and 7 companies that did not go bankrupt. Whereas in 2018 there were 4 companies that went bankrupt and 8 companies that did not go bankrupt.

The company that is predicted to go bankrupt for three years is the Indomobil Sukses International Tbk company with a Z-Score of 0.085 in 2016, 0.394 in 2017, and 0.390 in 2018. Then the Multistrada Arah Sarana Tbk company with a Z-Score of -0.293 in 2016, -0.169 in 2017, and 0.109 in 2018. Then there is the Prima Alloy Steel Universal Tbk company which went bankrupt for 3 years too, with a Z-Score of 0.108 in 2016, 0.109 in 2017 and in 2018.

Comparison analysis of Altman and Foster bankruptcy estimation

In Table 5, it can be seen that the difference in predictions was found in 2016 for the Multi Prima Sejahtera Tbk company where

according to the Altman model it declared bankruptcy while the Foster Model stated it was not bankrupt.

Meanwhile, the same predictions between Altman and Foster models for 3 periods are found in Garuda Metalindo Tbk with a prediction of not going bankrupt, Multistrada Arah Sarana Tbk with a prediction of bankruptcy, Prima Alloy Steel Universal Tbk with a prediction of bankruptcy, and Selamat Sempurna Tbk with a prediction of not going bankrupt.

The results of the bankruptcy predictions of the two Altman and Foster models carried out from 2016 to 2018 prove Adnan and Kurniasai's research which says that a company's bankruptcy can be measured two years before the company goes bankrupt.

Hypotheses testing

From Table 6, it can be seen that Kolmogorov-Smirnov only has 2 data that

Table 8.
Wilcoxon signed rank test results of Altman and Foster's Z-Score model in the period of 2016 – 2018

	Foster 2016 - Altman 2016	Foster 2017 - Altman 2017	Foster 2018 - Altman 2018
Z	-1,412 ^b	-1,490 ^b	-1,412 ^b
Asymp. Sig. (2-tailed)	,158	,136	,158

a. Wilcoxon Signed Ranks Test (sumber: pengolahan data, spss 22)

b. Based on negative ranks.

Note. From processed data.

are normally distributed with sig values of 0.117 and 0.125, where the data is said to be normal when the sig value > 0.05.

Wilcoxon Signed Rank Test

From Table 7 it can be seen that in 2016 the Z-Score altman and Foster had a negative rank of N 6 and a mean of 3.50 with a total rank of 21.00, in 2017 a negative rank of N 5 and a mean of 4.00 with a total rank of 20, 00, and in 2018 the negative value of ranks N is 6 and the mean is 4.00 with a total rank of 21.00. Then it can also be seen that the positive value of ranks N in 2016 is 6 and the mean is 9.50 with a total rank of 67.00, in 2017 the positive value of ranks N is 7 and the mean is 8.29 with a total rank of 58.00, and in 2018 the value of positive ranks N 6 and mean 9.50 with a total rank of 57.00.

From table 8, it can be seen that the Wilcoxon Signed Rank test value obtained was in 2016 Asymp.sig of 0.158. Because the value is $0.158 > 0.05$, then H_0 is accepted, meaning there is no difference. In 2017 the value of Asymp.sig is 0.136. Because the value is $0.136 > 0.05$, then H_0 is accepted, meaning there is no difference. And in 2018 the value of Asymp.sig is 0.158. Because the value is $0.158 > 0.05$, then H_0 is accepted, meaning there is no difference.

This confirms the research conducted by Kosasih (2010) which said there was no difference between the results of the bankruptcy analysis of the Altman and Foster models, as well as making Evi Wardani's research unproven which said there was a difference in the level of bankruptcy between the Altman and Foster models.

CONCLUSION

Based on the resulted of the research described in the discussion of the previous chapter, this research has similarities with previous research, namely using the Altman and Foster bankruptcy prediction model, but has different indications from previous research, namely the number of companies and types of companies studied. The study provided several important findings.

First, there is no statistical difference from the results of the Altman and Foster bankruptcy predictions in 3 years of research, 2016, 2017 and 2018. This is because the results of hypothesis testing have a probability value greater than 0.05 which can be concluded that H_0 is accepted, which means no there is a significant difference from the prediction of bankruptcy of the Z-Score Altman and Z-Score Foster models. Second, theoretically the results of the research prove that the Altman and Foster model can be used to detect the possibility of bankruptcy.

However, although this paper provides several contributions, there are several limitations that need to be addressed. First, to predict bankruptcy can not only be done with the Altman and Foster models, but there are other models such as Springate, Zmijewski, Grover and others, which will add other financial ratios such as ROA (Net Profit/Total Assets), Leverage (Total Debt/Total Assets), Liquidity (Current Assets/Current Liabilities), working capital/total asset ratio, net profit before interest and taxes/total asset ratio, net profit before taxes/current liabilities ratio, sales/total asset ratio, and Earnings Before

Interest and Taxes to Total Assets in each bankruptcy model. Then further research is expected to look at other factors in measuring bankruptcy, such as internal and external companies, namely economic or political conditions. If the model and other factors are used and added to predict bankruptcy, a more accurate bankruptcy prediction will be obtained.

Second, for companies, it is expected to be careful especially for managers who manage the company's financial statements. In order to optimize its assets properly, to avoid interruptions in business. Third, investors must be more vigilant and careful in their decisions to invest their money in automotive and component companies that are included in companies that have the potential to go bankrupt. Fourth, for further research, it is recommended to use models from Springate, Zmijewski, Grover and others, in the next time series data period.

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