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Test The Accuracy of The Bankruptcy Prediction Model for Health Sector Companies on The Indonesian Stock Exchange In 2012-2022

Uji Tingkat Akurasi Model Prediksi Kebangkrutan pada Perusahaan Sektor Kesehatan di Bursa Efek Indonesia Tahun 2012-2022

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ABSTRACT
The purpose of this research is to determine the level of accuracy or accuracy of the Altman Z-Score, Fulmer, Grover, Springate, Taffler, Zavgren and Zmijewski models in predicting bankruptcy in Health sector companies listed on the Indonesia Stock Exchange. The period of years in this study is 2012 to 2022. This type of research used is a descriptive quantitative design. The population in this study amounted to 33 health sector companies. Then the sample of this study amounted to 9 with a period of 11 years which resulted in a total of 99 samples with the sampling process using the sampling method to be used in this study is the judgment sampling method, which is one form of purposive sampling. The data used is secondary data in the form of company financial reports from the website www.idx.co.id. The grover and fulmer model is determined as the most accurate model in predicting the bankruptcy of Health sector companies listed on the Indonesia Stock Exchange based on the results of this study with a score of 100%. The next model is the zavgren model with a score of 94.95%, and the zmijewski model with a score of 92.93%. Furthermore, followed by the springate model with a score of 83.84%, the taffler model of 70.71% and the last place is occupied by the altman z-score model with an accuracy score of only 53.54%.
Keywords : *Bankruptcy prediction model, Bankruptcy, Financial Statements, Healthcare Companies.*

ABSTRAK
Tujuan dari dilakukannya penelitian ini yaitu untuk mengetahui tingkat akurasi atau ketepatan model Altman Z-Score, Fulmer, Grover, Springate, Taffler, Zavgren dan Zmijewski dalam memprediksi kebangkrutan pada perusahaan sektor Kesehatan yang terdaftar di Bursa Efek Indonesia. Periode tahun dalam penelitian ini yaitu tahun 2012 sampai tahun 2022. Jenis penelitian ini yang digunakan adalah desain kuantitatif deskriptif. Populasi dalam penelitian ini berjumlah 33 perusahaan sektor kesehatan. Kemudian sampel penelitian ini berjumlah 9 dengan periode tahun berjumlah 11 tahun yang menghasilkan sebanyak 99 sampel dengan proses pengambilan sampel menggunakan metode pengambilan sampel yang akan digunakan dalam penelitian ini adalah metode judgement sampling, yaitu salah satu bentuk purposive sampling. Data yang digunakan adalah data sekunder berupa laporan keuangan perusahaan berasal dari website www.idx.co.id. Model grover dan fulmer ditetapkan sebagai model yang paling akurat dalam memprediksi kebangkrutan Perusahaan sektor Kesehatan yang terdaftar di Bursa Efek Indonesia berdasarkan hasil penelitian ini dengan skor 100% . Model selanjutnya yang yaitu model zavgren dengan skor 94,95%,dan model zmijewski dengan skor 92,93%. Selanjutnya diikuti oleh model springate dengan skor 83,84%, model taffler sebesar 70,71% dan urutan terakhir diduduki oleh model altman z-score dengan skor tingkat akurasi hanya sebesar 53,54%.
Kata Kunci : Model Prediksi Kebangkrutan, Kebangkrutan, Laporan Keuangan, Sektor Kesehatan.

1. Introduction

Financial difficulties that are not immediately resolved by the company's management will definitely end in the bankruptcy of the company (Karim, 2023). Bankruptcy is a problem or one of the many issues that must be given more attention for every company. The potential bankruptcy of a company will cause concern for interested parties, both internal and external. Bankruptcy that occurs in a company means that the company has failed to operate and no

longer earns or generates profits that are able to maintain the running of the company (Kason et al., 2020).

The Covid-19 pandemic that has occurred in Indonesia in recent years has also caused companies that have been listed on the Indonesia Stock Exchange to not be able to avoid the impact of this phenomenon. The phenomenon is the occurrence of a global economic downturn which results in companies experiencing financial difficulties. Of the various sectors listed on the Indonesia Stock Exchange, the Health sector, which at that time was at the forefront and at the same time a much-needed sector, also could not be denied to be able to escape the impact of the Covid-19 pandemic. However, as time goes by, now that the Covid-19 pandemic has begun to be controlled in Indonesia, it also accompanies the state of the Indonesian economy which is slowly recovering. The status of Public Helath Emergency of International Concern (PHEIC) or global health emergency for Covid-19 has been officially revoked by WHO on May 5, 2023 (sehatnegeriku.kemkes.go.id). The government officially lifted the Covid-19 pandemic status on Wednesday, June 21, 2023 and began entering the endemic period (www.setneg.go.id). The revocation of the status made the health stock sector weak at the close of trading to shrink by 1.25 % (www.*idx*.co.id).

Data obtained from the Indonesia Stock Exchange website, shows that in early trading (1/8/2023) the health sector was observed to weaken by 3%. The decline in several hospital stocks and medical device companies was one of the causes of this weakening. The decline in stocks in this sector is also in line with the decline in the bottom line performance of pharmaceutical and hospital emitters. Of the health sector companies listed on the Indonesia Stock Exchange, 13 stocks from this sector were observed to weaken (www.*idx*.co.id). Companies that experienced the weakening included medical equipment companies, namely PT Prodia Widyahusada Tbk (PRDA) experienced the deepest decline or until it reached 10%. The company's reported net profit fell 6.9% to Rp. 148.7 billion. Although there is an increase in the income generated from Rp. 1,06 trillion but it is still not enough to cover the growing burden from 8.88% to Rp. 478.4 billion. Furthermore, the shares of the hospital PT Sarana Meditama Metropolitan Tbk (SAME) fell by 5.41%, which as of June 30, 2023, the company was only able to record a net profit of Rp. 1.36 billion, this is quite good if compared to the previous year's period, the loss was recorded at Rp. 23 billion. However, the owner of the parent entity as of June 30, 2023 also recorded an attributable net loss of Rp. 1.48 billion. (www.*idx*.co.id).

Companies should not be careless about what will happen in the future, for this reason, it is necessary to analyze as early as possible to predict bankruptcy if the company is experiencing financial difficulties. Signs of bankruptcy that appear early will make it easier for management and companies to make improvements or evaluations and creditors and shareholders can also make preparations or plans to overcome various bad possibilities that will occur. Bankruptcy prediction is intended for Company management to be able to carry out a plan or strategy from an early warning about the Company's financial condition. Because if financial difficulties have occurred in a company, it will definitely result in bankruptcy of the company (Lutfiyyah & Bhilawa, 2021).

Models in predicting potential bankruptcy have various types that can be used. Calculation and interpretation of financial ratios is one analysis that can be done in analyzing financial statements. There are several analysis models in predicting bankruptcy that use financial ratios (Nisa et al., 2022). Experts have developed various models that can be used in predicting bankruptcy prediction, among others, which will be used in this study, namely *Altman Z-Score, Fulmer, Grover, Springate, Taffler, Zavgren*, and *Zmijewski*.

This research refers to the research of Piscestalia & Priyadi 2019, namely with the object analyzed being coal mining companies listed on the Indonesia Stock Exchange. The results of his research show that the greatest level of accuracy is the Springate model with a score of 85%,

while the Zmijewski model is 66%, Grover is 65%, and Ohlson with the lowest score of 62%. This is also supported by the Springate analysis model which focuses more on the current debt value of a company (Piscestalia & Priyadi, 2019).

This study uses the health sector listed on the Indonesia Stock Exchange with the period 2012-2022 as the object to be studied. The main reason researchers conduct this research is because there are different predictions in each company sector. Such as research conducted by (Wahyuni & Rubiyah, 2021) resulted in the most accurate Altman model with the sector studied being plantations. Then research conducted by in the property and real estate sector produced the most effective Zmijewski model. Meanwhile, research from (Asmaradana & Satyawan, 2022) on the consumer services subsector resulted in the conclusion that the Grover model is the best model for predicting bankruptcy. Then the research conducted by (Prakoso et al., 2022) in retail companies results in the most accurate Taffler model. However, with the same sector, namely retail companies, research conducted by (Taufan Fahma & Dwi Setyaningsih, 2019) resulted in the Zavgren model with the highest accuracy. Furthermore, research conducted by (Peter et al., 2021) obtained results with the highest level of accuracy, namely from the Fulmer model in the cement industry in Indonesia. This difference is the reason researchers are interested in conducting research in different sectors. This research is also expected to help and have an impact on companies, especially in the health sector. This research can be used as a consideration to estimate the possibility of company bankruptcy, so that a review and improvement of performance can be carried out to keep the company from going bankrupt.

2. LITERATURE REVIEW

Bankruptcy Concept

Companies sometimes do not always go according to plan. Under certain conditions, financial difficulties may be faced by the Company. Anticipation of these conditions is needed, if not resolved and overcome then these conditions will lead to bankruptcy. Bankruptcy is the inability of a business to continue operating to generate profits or profits. A company is said to be insolvent or financially collapsed if its rate of return is lower than the entire amount of costs it has to pay in the long run (Oktavia et al., 2016). While (Irham, 2017) states "bankruptcy is a condition of a company that is illiquid and insovable, where its short-term liabilities and short-term liquidity and debts that exist in various places that are due from the Company are no longer able to be repaid or as well as its solvency obligation".

Bankruptcy Prediction Model

The models that will be used as a means of predicting bankruptcy in health sector companies listed on the Indonesia Stock Exchange will be described as follow:

1. Model Altman Z-Score

The Altman Z-Score model was first introduced in 1968 by Edward I. Altman, a professor at New York University as a tool to anticipate corporate bankruptcy called Z-Score. The purpose of the Z-Score analysis model is to predict company bankruptcy by combining several widely used financial ratios and giving different weights to each ratio. Z-Score is a score obtained from the calculation of financial ratios. As a result, the Altman z-score model can predict or estimate a company's likelihood of bankruptcy (Altman, 1968). The ratios used in the Altman z-score model are contained in the following formula:

$$Z = 1{,}2X_1 + 1{,}4X_2 + 3{,}3X_3 + 0{,}6X_4 + 1{,}0X_5$$

Description:

Z = *Z-score*

X_1 = *Net Working Capital to Total Assets*

X_2 = *Retained Earnings to Total Assets*

X_3 = *Earnings Before Interest and Taxes to Total Assets*
X_4 = *Market Value of Equity to Book Value of debt*
X_5 = *Sales to Total Assets*
With the following cut-off points :

a. Not bankrupt if the value of Z > 2,99
b. Bankrupt if the value Z < 1,81
c. Grey area with value 1,81 < Z < 2,99

2. Model Grover

The development of the previous Altman model gave birth to this Grover model, in this model the return on assets ratio is included after the company's market value and the ratio of retained earnings to total assets are eliminated when making the Grover model. The Grover model has advantages in terms of the capacity of each company to manage its assets to generate net profit after tax as indicated by the return on assets ratio. The researcher of this model, Jeffry S. Grover, in conducting his research chose a sample of 35 bankrupt companies and 35 companies that did not go bankrupt between 1982 and 1996. With an accuracy rate of 97.7%, the findings of this study show that Grover's model can effectively identify financial problems in a business or company (Grover, 2001). The equation of this model is :

$$G = 1{,}650X_1 + 3{,}404X_2 + 0{,}016ROA + 0{,}057$$

Description :
G = G-*score*
X_1 = *Working Capital to Total Assets*
X_2 = *Earnings Before Interest and Taxes to Total Assets*
ROA = *Net income to Totas assets*
This model analyzes its cut-off points as follows :

a. Not bankrupt if the value of G ≥ 0,01
b. Bankrupt if the value G ≤ -0,02
c. Grey area with value -0,02 ≤ G < 0,01

3. Model Fulmer

The Fulmer model was developed by Fulmer in 1984. This model predicts the likelihood of corporate bankruptcy using 9 financial ratio indicators. To establish this bankruptcy prediction, Fulmer used step wise multiple discriminant analysis in his study to assess 40 financial ratios applied to a sample of 60 companies, 30 of which failed and the remaining 30 succeeded, with an average asset size of $455,000. According to Fulmer, his research findings were 81% accurate more than a year before bankruptcy and 98% accurate for companies that were a year away from failure (Fulmer, J.J.M. & Erwin., 1984). The equation in this Fulmer model can be seen as follows :

$$H = 5{,}52X_1 + 0{,}212X_2 + 0{,}073X_3 + 1{,}27X_4 - 0{,}12X_5 + 2{,}335X_6 + 0{,}0575X_7 + 1{,}082X_8 + 0{,}894X_9 - 6{,}075$$

Description :
H = S-*score*
X_1 = *Retained Earning to Total Assets*
X_2 = *Revenue to Total Assets*
X_3 = *Earnings Before Interest and Taxes to Total Equity*
X_4 = *Cash Flow from Operations to Total Liabilities*
X_5 = *Total Liabilities to Total Equity*
X_6= *Current Liabilities to Total Assets*
X_7= LOG *Fixed Assets*
X_8 = *Working Capital to Total Liabilities*
X_9= LOG *Earnings Before Interest and Taxes to Interest Expense*

With the following cut-off points :

a. Not bankrupt if the value H > 0
b. Bankrupt if the value H < 0

4. Model Springate

Gordon L.V. Springate created the Springate model in 1978. Similar to Grover's model, this bankruptcy likelihood model was created by using Multiple Discriminant Analysis developed by Altman Z-score in predicting bankruptcy. Springate uses 4 out of 19 financial ratios as a tool to predict bankruptcy in a company. Companies that are classified as bankrupt or not can be distinguished using this model. With a high accuracy rate of 92.5%, the findings of this study indicate that this model can be used to analyze financial distress (Springate, 1978). S-Score is a term known as the formula created by Gordon L.V. Springate, the following equation of this model formula:

$$S = 1{,}03X_1 + 3{,}07X_2 + 0{,}66X_3 + 0{,}4X_4$$

Description :

S = S-*score*

X_1 = *Working Capital to Total Assets*

X_2 = *Earnings before interest and taxes to Total Assets*

X_3 = *Earnings Before Taxes to Current liabilities*

X_4 = *Sales to Total Assets*

With a cut-off point of :

a. Not bankrupt if the value S > 0,862
b. Bankrupt if the value S < 0,862

5. Model Taffler

The formulation of the Taffler model was first formulated for manufacturing companies in London in 1993. This model in its development is also based on the previous model, namely the Altman z score. This model has 4 financial ratio variables to be used, namely the ratio of profit before tax to current liabilities, current assets to total liabilities, current liabilities to total assets, and net profit after tax to total assets. The accuracy rate according to this Taffler model in predicting bankrupt companies is 95.7% for and an accuracy rate of 100% for companies that are not bankrupt in predicting bankruptcy (Taffler, 1984). The Taffler model equation is formulated in the following ratios:

$$T = 0{,}53X_1 + 0{,}13X_2 + 0{,}18X_3 + 0{,}16X_4$$

Description :

T = T-*score*

X_1 = *Earnings Before Taxes to Current liabilities*

X_2 = *Current Assets to Current Liabilities*

X_3 = *Current Liabilities to Total Assets*

X_4 = *Sales to Total Assets*

The Taffler model classifies the cut-off points in its model as follows:

a. Not bankrupt if the value T > 0,3
b. Bankrupt if the value T < 0,2
c. Grey area with value T = 0,2-0,3

6. Model Zavgren

Christine V. Zavgren was the person who first put forward this Zavgren model in 1985. Christine Zavgren conducted research on 90 industrial companies in America, 45 of which are still operating and 45 of which have been declared bankrupt. The research conducted by Christine resulted in an accuracy rate for this model of 82%. In this model, where the results will be presented as probabilities in the form of percentages and logit analysis are also used. While the financial ratios that will be used in the Zavgren model include Inventory turnover, Receivable

turnover, Cash ratio, Quick ratio, ROI, Debt ratio, and Asset turnover (Zavgren, 1985). The financial ratios in this model are formulated as follows:

$$Y = -0{,}23883 - 0{,}108X1 - 1{,}583X2 - 10{,}78X3 + 3{,}074X4 + 0{,}481X5 + 4{,}35X6 + 0{,}11X7$$

Description :
Y = Function multivariabel
X_1 = *Inventory to Total Sales*
X_2 = *Receivable to Inventory*
X_3 = *Cash to Total Assets*
X_4 = *Current Assets to Curret Liabilities*
X_5 = *Net Profit to Working Capital*
X_6 = *Longterm Liabilities to Working Capital*
X_7 = *Sales to Working Capital + Fixed Assets*
The results of the calculation of the ratios above will be implemented into the Zavgren logit model bankruptcy probability formula, namely :

$$P = \frac{1}{1+ey}$$

The power of y represents a multivariable function consisting of constants and coefficients of a set of financial variables or ratios. In contrast, e has a value of 2.1828 which is a natural number. Financial distress will cluster if the likelihood value almost reaches 1/1 or 100%. The difference between bankrupt and non-bankrupt companies will be seen through this logit analysis (Zavgren, 1985).
The cut-off points of the Zavgren model are as follows :

a. The company is declared not bankrupt or healthy if the value of $P_i < 1$
b. The company is declared bankrupt or potentially bankrupt if the value of $P_i = 1$ atau > 1

7. Model Zmijewski

Mark E. Zmijewski is the creator of the Zmijewski model in 1984. Financial ratios that assess performance, leverage, and liquidity are included in Zmijewski's probit analysis to forecast a firm's financial distress. Based on 40 failed companies and 800 non-bankrupt companies, Zmijewski's analysis in predicting corporate bankruptcy has an accuracy of 84%, in accordance with the findings of previous studies (Zmijewski, 1984). The Zmijewski model equation is formulated as follows:

$$X = -4{,}3 - 4{,}5X_1 + 5{,}7X_2 + 0{,}004X_3$$

Description :
X = X-*score*
X_1 = ROA (*Return on Asset*)
X_2 = *Debt ratio*
X_3 = *Current Ratio*
Zmijewski classifies the cut-off points on his model as follows:

a. Not bankrupt if the value X < 0
b. Bankrupt if the value X > 0

Signaling Theory

George Akerlof and Kenneth J. Arrow were the first to publish signal theory in 1970 which was then further developed by Michael Spence in 1973. Signaling theory reveals that the company's management will use reliable information it has to communicate signals to the

market and then receive feedback on the company's value. Based on this statement, companies will try to communicate the performance they have achieved to external parties through the financial statements they have published (Asmaradana & Satyawan, 2022).

The purpose of signaling theory, according to the economics and finance literature, is to clearly show that those who are part of the company's environment (corporate insiders, consisting of officers and directors) generally have better knowledge about business conditions and prospects than those outside the company, such as investors, creditors, government, or even shareholders. In other words, outsiders who have an interest in the company do not have more information that company insiders have. In finance theory, information asymmetry refers to a situation where one party has more information than the other party (Gumanti, 2018).

Signal theory and this research are related because if a bankruptcy prediction analysis is carried out and produces predictive results using the appropriate model, it will be able to explain why the evaluated company is unlikely to be declared bankrupt. In this case, the company will provide positive signals (good news) to investors and if it has the potential to experience bankruptcy, it will provide negative signals (good news) (Nia Arnela Anggraeni & Retna Safriliana, 2019).

Financial Statement Analysis

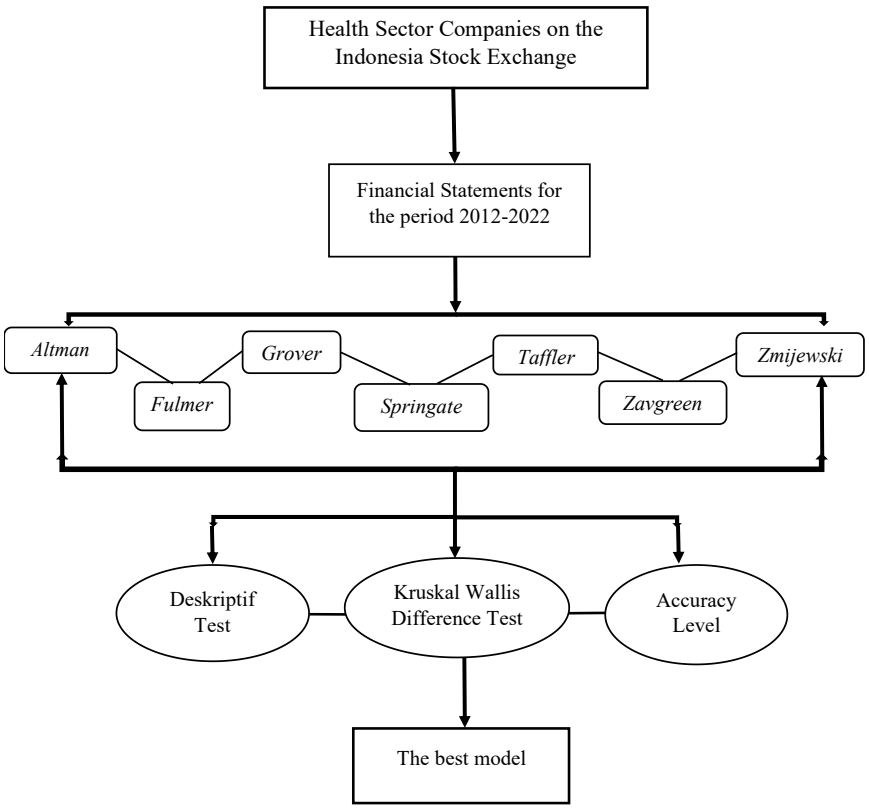
Financial statements aim to inform current and potential creditors, lenders, and investors about the company's financial situation so that they can decide how best to allocate resources to the company (Sari et al., 2020). Financial statements can also be used to predict bankruptcy as well as examine a company's performance over a period of time (Setyaningrum dkk., 2020).

Financial statement analysis is a technique that can help decision makers determine a company's strengths and weaknesses by using data from financial statements to analyze them. The process of breaking down financial statements into their component parts and examining these parts to gain a solid understanding of the financial statements is known as financial statement analysis (Hery, 2018).

Ratio analysis is one of the methods for analyzing financial statements. One of the most widely used and preferred instruments for financial analysis is ratio analysis. Financial ratios are created by relating various estimates found in financial statements. These ratios can be used to assess the performance and financial health of a business.

Framework

The framework of this study illustrates that the subject of this research comes from a sample of health sector companies from which the sample will collect financial statement documents from the company for the period 2012 to 2022. Then from the documents that have been collected, calculations will be made using the Altman Z-score, Fulmer, Grover, Springate, Taffler, Zavgren and Zmijewski models. These models will be calculated, then the results of these calculations will then be descriptive tests on each model to determine the minimum, maximum, mean and standard deviation values. Then proceed with conducting a different test with the Kruskal Wallis Test to see if there are differences from each bankruptcy prediction model used. Finally, calculate the level of accuracy and type error to find out which method is the most accurate and appropriate in predicting the bankruptcy of health sector companies listed on the Indonesia Stock Exchange.



Picture 1. Framework

The hypothesis proposed in this study is as follows:

H1 = There are differences in bankruptcy predictions in Health sector companies listed on the Indonesia Stock Exchange in 2012-2022 using the Altman Z-score, Fulmer, Grover, Springate, Taffler, Zavgren and Zmijewski models.

H2 = There is a bankruptcy prediction model with the highest level of accuracy in predicting the Health sector companies listed on the Indonesia Stock Exchange in 2012-2022 using the Altman Z-score, Fulmer, Grover, Springate, Taffler, Zavgren and Zmijewski models.

3. Methodology

Research Method

This research uses a descriptive quantitative design. A method whose process begins with data collection, data interpretation, and ends with results that attempt to describe or describe objectively about a situation using statistics. This study will explain the value of each variable used, such as the Altman Z-Score, Fulmer, Grover, Springate, Taffler, Zavgren, and Zmijewski models to get an overview of the value of these variables.

The population used in this study are health sector companies listed on the Indonesia Stock Exchange for the period 2012-2022. The total number of companies included in the population in this study was 33 companies. The sample selection method that will be used in this study is the judgment sampling method which results in 9 companies with a total sample multiplied by 11 years to 99 samples.

The data collection technique used in this research is the documentation method and library research. The documentation technique is a method of retrieving data and facts that have

been documented in the form of official financial reports of Health sector companies on the Indonesia Stock Exchange for the period 2012-2022. The library research method is a method of collecting data from various sources including the internet, scientific papers, articles, literature and books.

Data Analysis Technique

This research will be conducted and analyzed using data that has been obtained through the following steps :

a. Calculation of each prediction model and classify the values obtained based on the cut off point of each bankruptcy prediction model.
b. Conduct descriptive statistical tests to determine the minimum, maximum, average (mean) and standard deviation values of the prediction model calculation results. Then conducting a different test using the Kruskal wallis test will determine whether there are differences from seven statistically significant bankruptcy prediction models by comparing the average value of each model..
c. Measuring the accuracy level of the bankruptcy prediction model and type error with the formula:

$$Accuracy\ Level = \frac{number\ of\ correct\ predictions}{number\ of\ samples} \times 100\%$$

$$Type\ error\ I = \frac{number\ of\ type\ I\ errors}{number\ of\ samples} \times 100\%$$

$$Type\ error\ II = \frac{number\ of\ type\ II\ errors}{number\ of\ samples} \times 100\%$$

4. RESULT AND DISCUSSION

Table 1. The results of the Altman model analysis calculation

Year	Company stock code								
	KAEF	DVLA	KLBF	MERK	PYFA	SCPI	SRAJ	TSPC	INAF
2012	28,27	3,22	4,7	4,33	2,93	0,14	1,16	3,75	2,16
2013	22,77	2,72	4,3	4,7	2,49	1,29	1,01	3,46	1,45
2014	54,35	2,83	4,4	4,13	2,73	1,4	0,9	3,51	2,19
2015	2,91	2,8	4,24	4,41	3	2,45	0,78	3,34	1,97
2016	166,49	2,93	4,07	4,3	2,88	3,52	0,98	3,47	2,18
2017	34,36	2,92	4,14	4	3,14	2,82	0,8	3,23	1,93
2018	5,73	3,13	4,02	1,8	3,04	3	0,8	5,96	1,61
2019	17,35	3,15	3,86	2,99	3,08	3,36	0,77	3,36	2,04
2020	231,5	2,82	3,81	2,82	4,65	3,76	2,57	3,38	2,05
2021	21,61	2,8	3,78	3,41	1,99	4,25	0,97	3,36	1,99
2022	1,83	2,93	3,77	3,74	2,53	4,08	0,9	2,98	-0,42
Average	**53,38**	**2,93**	**4,1**	**3,7**	**2,95**	**2,73**	**1,06**	**3,62**	**1,74**

Source : Data processed by researchers (2024)

Table 2. The results of the Grover model analysis calculation

Year	Company stock code								
	KAEF	DVLA	KLBF	MERK	PYFA	SCPI	SRAJ	TSPC	INAF
2012	1,48	2,04	2,2	2,21	1,62	0,18	1,4	1,86	1,37
2013	1,91	1,5	2,09	2,48	1,48	1,22	1,3	1,77	1,53
2014	1,66	1,73	2,15	2,37	1,45	1,04	1,18	1,75	1,04
2015	1,62	1,67	2,09	2,36	1,54	1,15	1,05	1,64	0,4
2016	1,39	1,76	2,13	2,33	1,55	2,09	1,95	1,65	0,98
2017	1,36	1,72	2,13	2,01	1,73	1,16	1,17	1,55	0,73
2018	1,32	1,84	2,1	0,92	1,68	1,67	1,13	4,32	0,82
2019	1,35	1,86	2,05	1,7	1,74	1,99	1,05	1,65	1,3
2020	1,19	1,6	2,01	1,63	1,86	1,61	1,08	1,75	1,01
2021	1,34	1,58	2,02	1,89	1,41	1,91	0,96	1,77	0,94
2022	1,15	1,65	1,99	2,11	2,16	1,86	0,98	1,48	-0,42
Average	**1,41**	**1,72**	**2,08**	**2**	**1,65**	**1,44**	**1,14**	**1,93**	**0,88**

Source : Data processed by researchers (2024)

Table 3. The results of the Fulmer model analysis calculation

Year	Company stock code								
	KAEF	DVLA	KLBF	MERK	PYFA	SCPI	SRAJ	TSPC	INAF
2012	21,56	24,45	28,03	25,13	19,77	7,32	18,28	25,4	19,04
2013	21,45	22,94	26,6	25,6	19,25	7,48	9,67	24,98	8,76
2014	20,7	24,26	28,19	27,04	19,24	7,86	9,38	25,2	19,77
2015	20,69	23,2	28,64	25,87	20,17	19,08	8,96	24,74	19,46
2016	20,25	23,4	29,24	26,61	20,04	19,42	10,2	24,85	18,66
2017	20,11	23,21	29,96	25,19	21,14	20,4	10,06	24,43	9,63
2018	20,21	23,34	30,6	20,66	20,4	20,01	9,42	50,68	17,83
2019	19,8	24,13	29,57	23,8	20,95	21,64	8,74	24,95	18,069
2020	20,27	22,97	29,43	23,16	21,4	22,7	18	25.24	17,95
2021	20,38	23,5	29,51	23,94	18,77	28,48	19,17	25,36	18,04
2022	20,14	23,21	28,6	25,21	20,3	24,85	10,91	24,38	6
Average	**20,5**	**23,51**	**28,94**	**24,74**	**20,13**	**18,11**	**12,07**	**27,3**	**15,75**

Source : Data processed by researchers (2024)

Table 4. The results of the Springate model analysis calculation

Year	Company stock code								
	KAEF	DVLA	KLBF	MERK	PYFA	SCPI	SRAJ	TSPC	INAF
2012	1,95	2,49	2,92	3	1,8	0,05	0,92	2,3	1,37
2013	2,39	1,91	2,68	2,53	1,54	0,9	0,7	2,08	0,7
2014	1,57	1,82	2,83	3,22	1,65	0,8	0,55	2,06	1,14
2015	1,97	1,75	2,71	3,25	1,71	1,58	0,53	1,88	0,63
2016	1,57	1,92	2,83	3,41	1,69	2,93	0,59	1,92	1,13
2017	1,45	1,88	2,89	2,8	2,03	1,6	0,59	1,74	0,84
2018	1,32	2,09	2,83	0,8	1,91	1,97	0,68	6,29	0,52
2019	0,95	2,12	2,7	1,79	2,01	2,6	0,7	1,86	1,28
2020	1,04	1,69	2,52	1,64	2,02	2,15	1.46	2	1,08
2021	1,25	1,64	2,55	2,18	1,35	2,55	0,82	2,02	1,18
2022	0,94	1,74	2,44	2,6	2,48	2,41	0,72	1,53	-0,61
Average	**1,49**	**1,91**	**2,72**	**2,57**	**1,84**	**1,77**	**0,75**	**2,34**	**0,84**

Source : Data processed by researchers (2024)

Table 5. The results of the Taffler model analysis calculation

Year	Company stock code								
	KAEF	DVLA	KLBF	MERK	PYFA	SCPI	SRAJ	TSPC	INAF
2012	0,64	1,06	1,1	1,09	0,42	0,04	0,06	0,77	0,34
2013	0,57	0,9	0,93	1,32	0,3	0,11	0,02	0,7	0,19
2014	0,5	0,76	1,07	1,36	0,29	0,09	-0,03	0,66	0,28
2015	0,49	0,61	1,06	1,2	0,35	0,37	-0,01	0,56	0,28
2016	0,36	0,65	1,85	1,41	0,37	0,81	0,11	0,57	0,25
2017	0,33	0,62	1,27	0,98	0,52	0,52	0,07	0,5	0,22
2018	0,3	0,73	1,27	0,45	0,44	0,46	0,06	4,63	0,23
2019	0,19	0,74	1,13	0,6	0,52	0,8	0,07	0,53	0,24
2020	0,19	0,54	1,03	0,56	0,67	0,35	0,12	0,62	0,24
2021	0,23	0,53	1,12	0,72	0,23	0,9	0,2	0,65	0,24
2022	0,21	0,58	1	0,97	0,74	0,78	0,13	0,45	-0,11
Average	**0,36**	**0,7**	**1,11**	**0,97**	**0,44**	**0,48**	**0,07**	**0,97**	**0,22**

Source : Data processed by researchers (2024)

Table 6. The results of the Zavgren model analysis calculation

Year	Company stock code								
	KAEF	DVLA	KLBF	MERK	PYFA	SCPI	SRAJ	TSPC	INAF
2012	0,045	0,001	0,0006	7,00E-05	0,002	1,00E-05	0,1482	0,0105	0,291
2013	0,23	0,0003	0,0003	8,00E-05	0,0127	1,00E-05	0,2967	0,0093	0,1812
2014	0,07	1,00E-05	0,0003	5,00E-05	0,015	0,0001	0,3054	0,0038	0,1106
2015	0,05	0,006	0,0002	0,0003	0,0034	0,0029	0,7028	0,0167	0,176
2016	0,03	0,034	4,00E-05	1,00E-05	0,0019	1,00E-05	0,5541	0,0078	0,0451
2017	0,022	0,091	1,00E-05	0,0002	2,00E-05	0,0008	0,8084	0,0135	0,1372
2018	0,011	0,012	9,00E-05	0,35	0,0003	5,00E-05	1,0002	0,0114	0,1794
2019	0,001	0,006	2,00E-05	0,0105	2,00E-05	2,00E-05	1,0001	0,0098	0,0144
2020	0,0002	0,018	9,00E-05	0,0027	0,0005	0,8492	1,0003	0,005	0,6237
2021	0,0001	0,021	2,00E-05	0,0045	0,0037	0,0002	1,0002	0,0013	0,0615
2022	0,002	0,002	7,00E-05	0,0003	0,0013	0,0003	1,0005	0,0015	0,0383
Average	**0,05**	**0,002**	**0,0001**	**0,0335**	**0,0037**	**0,0776**	**0,7106**	**0,0082**	**0,1451**

Source : Data processed by researchers (2024)

Table 7. The results of the Zmijewski model analysis calculation

Year	Company stock code								
	KAEF	DVLA	KLBF	MERK	PYFA	SCPI	SRAJ	TSPC	INAF
2012	-3,29	-3,68	-3,91	-3,62	-2,45	-3,74	-1,63	-3,34	-1,88
2013	-2,42	-3,45	-3,66	-3,92	-1,81	1,39	-1,94	-3,2	-1,01
2014	-2,24	-3,33	-3,84	-4,11	-1,87	1,8	-1,87	-3,22	-1,28
2015	-2,3	-2,98	-3,83	-3,8	-2,29	0,6	-1,71	-2,91	-0,82
2016	-1,67	-3,06	-3,95	-3,99	-2,34	0,08	-2,67	-2,98	-0,92
2017	-1,25	-2,92	-4,03	-3,5	-2,69	-4,17	-2,68	-2,83	-0,42
2018	-0,82	-3,2	-4,02	-5,08	-2,42	-0,7	-2,28	-4,43	-0,46
2019	-0,9	-3,21	-3,86	-2,74	-2,54	-1,92	-1,75	-2,86	-0,7
2020	-0,91	-2,77	-3,77	-2,7	-2,96	-2,18	-0,89	-3	-0,03
2021	-0,99	-2,69	-3,89	-2,98	0,19	3,61	-1,07	-3,07	0,04
2022	-1,19	-2,91	-3,79	-3,54	-1,07	-3,3	-0,45	-2,78	2,34
Average	**-1,63**	**-3,11**	**-3,87**	**-3,64**	**-2,02**	**-0,78**	**-1,71**	**-3,15**	**-0,47**

Source : Data processed by researchers (2024)

Description :

Green = Not bankrupt
Red = Bankrupt
Grey = Grey Area

Table 8. Descriptive Statistics Test Results

Descriptive Statistics Variabel Operasional					
Ratio	N	Minimum	Maximum	Mean	Std. Deviation
Altman Z-Score	99	-.41	231.50	8.47	28.80
Grover	99	-.42	4.32	1.59	.56
Fulmer	99	5.99	50.68	21.23	6.58
Springate	99	-.61	6.29	1.80	.92
Taffler	99	-.11	4.63	.59	.55
Zavgren	99	.000025	100.052	.11615	.26355
Zmijewski	99	-5.08	3.61	-2.26	1.55
Valid N (listwise)	99				

Source : Data processed by IBM SPSS (2024)

Table 8 above illustrates in general that the standard deviation value of each model or variable has a lower value than the mean or average value so that it can be concluded that the variable value of this model is well spread and quite varied. The minimum value of several models such as the grover, fulmer, zavgren and zmijewski models explains that according to these models the company at that time was still in a safe zone from bankruptcy conditions and could still operate properly. While the maximum value according to the taffler, springate, and altman z-score models also illustrates the Company's healthy condition.

Table 9. Kruskal Wallis Test Results

	Rata-rata model prediksi
Kruskal-Wallis H	56,155
df	6
Asymp.Sig	<0,001
a. Kruskal Wallis Test	
b. Grouping Variable : Model Prediksi	

Source : Data processed by IBM SPSS (2024)

The Kruskal wallis test results in table 16 show that the Asymp.Sig value is 0.001. The Asymp.Sig value means 0.001 <0.05, which means H0 is rejected and H1 is accepted, so in this research there is a significant difference in the prediction results of bankruptcy in Health sector companies listed on the Indonesia Stock Exchange in 2012-2022 with the models used, namely Altman Z-Score, Fulmer, Grover, Springate, Taffler, Zavgren, and Zmijewski. Variations in the financial ratios used explain the differences in the predictive results of each bankruptcy prediction model. Other differences also exist in the cut off point criteria for each prediction model.

Table 10. Recapitulation of Accuracy Rate and Type Error Results

Model	**Accuracy Level**	***Type Error***
Altman Z-Score	53,54%	18,18%
Grover	100%	0%
Fulmer	100%	0%
Springate	83,84%	16,16%
Taffler	70,71%	18,18%
Zavgren	94,95%	5,05%
Zmijewski	92,93%	7,07%

Source : Data processed by researchers (2024)

Data from table 10 can be concluded that the grover model and fulmer model are the most accurate models for predicting bankruptcy in Health sector companies listed on the Indonesia Stock Exchange in 2012-2022 with an accuracy score of 100%. The Zavgren model, which has an accuracy rate of 94.95%, and the Zmijewski model, which has a score of 92.93%, are next in line. Furthermore, followed by the springate model with a score of 83.84%, the taffler model of 70.71% and the last order with an accuracy rate score of only 53.54% is occupied by the altman z-score model.

There are two categories of type error in this study: type error I and type error II. Type error I refers to the error that occurs when the model predicts that the sample will not experience distress, but in reality experience distress. Then for type error II appears if the error occurs if the sample in the model is predicted to experience distress but in fact does not experience distress. Type error I from the results of this study resulted in 0% for each model,

because the samples used in reality were not experiencing financial difficulties and were still listed on the Indonesia Stock Exchange.

Type error II generated from this study is quite varied between each bankruptcy prediction model. The Grover model is ranked first with the lowest type error with a score of 0% along with the Fulmer model which also has a type error of 0%. Then followed by the Zavgren and Zmijewski models with the next lowest type error scores with slightly different values of 5.05% and 7.07% respectively. Next followed by the springate model with a type error rate of 16.16%. The last rank is again occupied by the altman z-score model with a type error rate of 18.18% along with the taffler model. Although the accuracy rate of the taffler model is higher than the altman z-score model, this indicates that the accuracy rate of the taffler model also has a fairly large type error rate.

The best bankruptcy prediction model based on this research for Health sector companies listed on the Indonesia Stock Exchange based on the data obtained if the seven bankruptcy prediction models are sorted, then the grover and fulmer models are the best models among the seven other bankruptcy prediction models with an accuracy level of 100% and a type error of 0%. These results mean that the grover model and fulmer model are able to predict the bankruptcy of a company accurately and the error or error is very small compared to the other seven models. Then the second rank was achieved by the zavgren model, then the third rank by the zmijewski model, then the fourth rank by the springate model, the fifth rank was the taffler model and the last rank was achieved by the altman z-score model.

The results of this study are in accordance with research from (Masdiantini Putu Riesty & Warasniasih Ni Made Sindy, 2020) with research title "Laporan Keuangan dan Prediksi Kebangkrutan Perusahaan" with the object studied is the cosmetics and household needs sub-sector companies listed on the Indonesia Stock Exchange with the result that the fulmer model is determined as the bankruptcy prediction model with the highest level of accuracy with the same score of 100%. The results of this study are also supported by research conducted by (Asmaradana & Satyawan, 2022) with research title "Analisis *Financial Distress* dengan Model *Altman, Grover, Springate*, *Zmijewski*, dan *Ohlson* pada Perusahaan Subsektor Jasa Konsumen yang terdaftar di BEI" that the grover model has the most accurate level of accuracy even though only with a score of 82% being the highest score among other models conducted in the study.

Contrast with research conducted by (Taufan Fahma & Dwi Setyaningsih, 2019) in his research entitled "Analisis *Financial Distress* dengan Metode *Altman, Zmijewski, Grover, Springate, Ohlson* dan *Zavgren* Untuk Memprediksi Kebangkrutan Perusahaan Ritel" said that the altman z-score model is the model that has the highest level of accuracy with a score of 80% in contrast to this study which only reached 53.54%. This study also has quite different results from research conducted by (Prakoso et al., 2022) with research title "Analisis Perbandingan Model *Taffler, Springate*, Dan *Grover* Dalam Memprediksi Kebangkrutan Perusahaan" explained that the taffler model has the highest level of accuracy with a score of 96% while in this study the score of the tafller model accuracy level is only 70.71%.

5. CONCLUSION

Based on the results of the Kruskal wallis test, there are differences between bankruptcy prediction models in Health sector companies listed on the Indonesia Stock Exchange in 2012-2022 using the Altman Z-score, Fulmer, Grover, Springate, Taffler, Zavgren and Zmijewski models. The most accurate model in predicting bankruptcy of Health sector companies listed on the Indonesia Stock Exchange based on the results of this study is the grover and fulmer model with a score of 100% without the value of the type error. The next model that still has a fairly high score is the zavgren model with a score of 94.95%, and the zmijewski model with a score of 92.93%. This is followed by the springate model with a score of 83.84%, the taffler model of

70.71% and the last place is occupied by the altman z-score model with an accuracy score of only 53.54%.

For interested parties, they can use the grover or fulmer method to make decisions, considerations and references to take better and wiser actions, especially related to Health sector companies. Such as Company management as a consideration in predicting Company bankruptcy and avoiding financial risk. investors as a predictive tool to consider investing and creditors in considering the Company in paying loans before providing loans to debtors so as to prevent the risk of default from the Company. For further research, it is recommended to add other prediction models such as the Ohlson and Foster models. Further research is also recommended to try other Company sectors and expand the research sample.

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