

## Comparison of the grover, zmijewski, and springate methods in predicting financial distress (Case study of pharmaceutical companies listed on the IDX 2019-2021)

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### ABSTRACT

Financial distress is a condition of financial difficulties experienced by companies. The company's negative net income can mark this. If this condition continues, the worst possibility is that the company will go bankrupt. Several studies have developed methods to make it easier for companies to detect early if the company is in an unhealthy condition. This study aims to determine the differences between the Grover, Zmijewski, and Springate methods in predicting financial distress in pharmaceutical companies. The population used in this study was 11 pharmaceutical companies registered on the IDX for 2019-2021, with a sample selection using a purposive sampling technique. The independent variables in this study are the Grover, Zmijewski, and Springate methods, with the dependent variable being financial distress. The data analysis technique used in this study is a statistical analysis using variable calculations from each method, normality test, paired sample T-test, level of accuracy and type of error. The results showed that the method with the highest level of accuracy was Grover with 96.97%, then Zmijewski with 84.85% and Springate with 72.73%. The Paired Sample T-Test test shows that each method has a significant difference even though several methods use the same variables. For further research, more company samples and a more extended observation period can be used so that the results are wider.

### KEYWORDS

Financial Distress; Grover;  
Zmijewski; Springate

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## Introduction

The pharmaceutical industry is a sector that is important for the sustainability of the industrial sector in Indonesia. The development of pharmaceutical industry in Indonesia has a high opportunity to grow; where in the 2015-2019 period, the chemical, pharmaceutical and traditional medicine industries in Indonesia have 132 new industries, and with the fourth largest population in the world, the Indonesian pharmaceutical industry has a considerable market size. The growth of the chemical, pharmaceutical and traditional medicine industries in 2019 showed a percentage of 8.51%.

The Covid-19 pandemic has caused an increase in demand for medicines, vitamins and health supplements. Hence, the growth of the pharmaceutical industry continues to increase in 2020 by 9.41%, and in 2021 it will reach 9.65%. The increase in growth experienced by the pharmaceutical industry is still experiencing problems due to the pandemic. Most pharmaceutical companies in Indonesia still import as much as 90% of their medicinal raw materials from several countries, such as America, India, Germany and France (Ministry of Industry, 2021).

According to BPS (Central Statistics Agency), the import value for the chemical, pharmaceutical and traditional medicine industries in 2019 was 74.2 million USD with an import weight of 1.8 million kg. In 2020 the import value rose to 111 million USD with an import weight of imported 2.4 million kg, and in 2021 the value of imports will reach 790.5 million USD with an import weight of 2.3 kg. As a result of the pandemic, which requires pharmaceutical companies to meet the demand for medicinal products and health supplements, coupled with rising prices for medicinal raw materials, pharmaceutical companies have a large total debt. PT Kalbe Farma Tbk (KLBF) had debt in 2019 with a total of 3.5 trillion rupiahs. This value will increase again in 2020, namely 4.2 trillion rupiahs; in 2021, it will reach 4.4 trillion rupiahs.

The pandemic has affected many companies, so companies must be more effective and efficient in carrying out their operations (Gunawan, 2021). This is done in order to avoid unwanted problems. If the company cannot handle it correctly, the threat of financial distress to company bankruptcy cannot be avoided. According to Fahmi (2013), Financial distress is a decline in financial conditions before bankruptcy/bankruptcy. Financial distress begins when a company cannot meet its schedule of obligations when they fall due (Darsono & Ashari, 2005).

Various methods can be used to predict financial distress in a company, and companies can use the results of these various methods to evaluate company performance. Jeffery S. Grover developed the Grover method in 2001

by redesigning the Altman method. The sample used by Grover was 70 companies, with 35 companies going bankrupt and 35 others being healthy during 1982-1996. Mark E. Zmijewski developed the Zmijewski method in 1983 with 20 years of research. Grodon L. V. Springate developed the Springate method in 1978. Springate uses multidiscriminant analysis (MDA).

Previous research conducted by Hungan and Sawitri (2018) using the Springate and Grover methods for coal companies listed on the IDX in 2012-2016 showed that the Grover method had a higher accuracy rate of 78% compared to the Springate method. However, Martanti et al. (2021) research on tourism, hospitality and restaurants obtained the Springate method as the model with the highest degree of accuracy. Hau and Oanh (2021) used a sample of pharmaceutical-medical firms listed on the Vietnam Stock Exchange to obtain the Zmijewski method, which has an accuracy of 81.9% compared to Altman's 68.57% and Springate's 79%.

## Literature review

### *Signaling theory*

Signalling theory is an action taken by the company to instruct investors about how management sees the company's prospects; this information will provide an opportunity for investors to be able to assess the company's ability to increase its value in the future (Brigham & Houston, 2010). Information is essential for investors and business people because information provides information, notes or descriptions of past, present and future conditions for a company's survival and how the stock market works (Farha, 2022).

### *Financial report*

According to Baridwan (2015), financial statements are a summary of the recording of financial transactions carried out during the relevant financial year. According to Sari and Yunita (2019), financial statements are a summary of the calculation process activities that are carried out every time the book is closed or a tool used to test the performance of the bookkeeping section used in assessing and determining financial position, and achievements of the company.

### *Financial statement analysis*

According to Harahap (2015), financial statement analysis is a process for producing the right decisions by summarizing various financial reports and seeing significant relationships between quantitative and non-quantitative data to find out more about the company's financial condition.

### *Financial ratio analysis*

According to Harahap (2015), financial ratios are numbers obtained from comparing one financial report item with another. Financial ratios can simplify the information depicted between posts so that users can quickly assess and interpret the information obtained. Financial ratio analysis can compare numbers in financial reports by dividing one number by another (Kasmir, 2015).

### *Financial distress*

According to Fahmi (2013), financial distress is a decline in financial conditions before bankruptcy or liquidation occurs. According to Sudrajat and Wijayanti (2019), financial distress is a condition that arises as a result of the company's cash flow being insufficient to pay a current debt or can also be referred to as a financial crisis. Financial difficulties begin when the company cannot pay its obligations, especially for its short-term obligations. When a company cannot pay off its obligations, creditors will lose confidence in its credibility, and the company will likely accept lawsuits from creditors (Hery, 2016).

## Methods

The type of research to be used is quantitative and comparative research using descriptive statistics. This study aims to examine the differences in results between the Grover, Zmijewski, and Springate methods in predicting financial distress in a company. The population in this study are pharmaceutical companies listed on the Indonesia Stock Exchange for the 2019-2021 period. The sample used in this study used a purposive sampling method. According to Sugiyono (2018), purposive sampling is a technique that determines specific criteria. This study uses data from the annual financial reports of pharmaceutical companies for the 2019-2021 period on the Indonesia Stock Exchange. The data analysis method uses descriptive statistics, which include the average value (mean), maximum value, minimum value, and standard deviation (Ghozali, 2011). Then the normality test is performed on data to see whether the distribution of residual values is normal. Paired Sample T-Test is a type of method for testing the difference in mean to find out the difference in the mean value of two paired data.

As well as testing the accuracy of the prediction method using the formula:

$$\text{Accuracy Rate} = \frac{\text{Correct Prediction}}{\text{Samples}} \times 100\%$$

$$\text{Type Error} = \frac{\text{Incorrect Prediction}}{\text{Samples}} \times 100\%$$

### **Grover method**

Grover uses several variables from Altman's research, namely working capital to total assets and EBIT to total assets. Then Grover added ROA in researching company financial distress (Yuliana, 2018). The Grover method categorizes a company in a state of financial distress if the G-Score  $\leq -0.02$ , whereas if the G-Score  $\geq 0.02$  then the company is categorized as not experiencing financial distress. The formula for the Grover method equation is:

$$\text{G-SCORE} = 1,650X1 + 3,404X2 - 0,016 \text{ ROA} + 0,057$$

Note:

- X1 = Working Capital / Total Assets  
 X2 = EBIT / Total Assets  
 ROA = Net Income / Total Assets

### **Zmijewski method**

This method uses the ratio of liquidity measurements, performance and company leverage related to the calculation of financial distress predictions (Rudianto, 2013). The Zmijewski method categorizes companies as experiencing financial distress if the X-Score  $> 0$ , whereas if the X-Score  $< 0$ , the company is categorized as not experiencing financial distress. The Zmijewski method equation formula is:

$$\text{X-SCORE} = -4,3 - 4,5X1 + 5,7X2 - 0,004X3$$

Note:

- X1 = ROA  
 X2 = Total Liability / Total Assets  
 X3 = Current Assets / Current Liability

### **Springate method**

The Springate method echoes previous research conducted by Altman using MDA (Multiple Discriminant Analysis) (Brigham and Weston, 2005). The Springate method categorizes companies as experiencing financial distress if the S-Score is  $< 0.862$ , whereas if the S-Score is  $> 0.862$  the company is categorized as not experiencing financial distress. The Springate method equation formula is:

$$\text{S-SCORE} = 1,03X1 + 3,07X2 + 0,66X3 + 0,4X4$$

Note:

- X1 = Working Capital / Total Assets  
 X2 = EBIT / Total Assets  
 X3 = EBT / Current Liability  
 X4 = Sales / Total Assets

## **Results**

### **Descriptive statistical analysis**

**Table 1.** Descriptive Statistical Analysis

	N	Minimum	Maximum	Mean	Std. Deviation
MKTA	33	-0,04	0,65	0,2946	0,18881
EBITTA	33	0,03	0,39	0,1209	0,08432
EBTLJP	33	0,01	2,97	0,5933	0,74926
TLTA	33	0,13	0,81	0,4456	0,22378
ALLJP	33	0,9	5,94	2,5095	1,32841
PTA	33	0,51	2,76	1,2135	0,57648
ROA	33	-0,02	0,31	0,0771	0,07627

Valid N (listwise) 33

Source: SPSS (2022)

The minimum value in MKTA is -0.04, obtained by PT Kimia Farma Tbk. (KAEF), PT Organon Pharma Indonesia Tbk obtains the maximum value. (SCPI) with a value of 0.65, an average value of 0.2946 and a standard deviation of 0.18881. The minimum value on EBITTA is 0.03 from PT Indofarma Tbk. (INAF), the maximum value obtained by PT Industri Jamu dan Pharmacy Sido Muncul Tbk. (SIDO) is 0.39, the mean value is 0.1209, and the standard deviation is 0.08432. The minimum value on EBTLP is 0.01 from PT Millennium Pharmacon International Tbk. (SDPC), PT Sido Muncul Tbk Herbal Medicine and Pharmacy Industries Tbk obtained the maximum value of 2.97. (SIDO), the mean is 0.5933, and the standard deviation is 0.74926. The minimum value on TLTA is 0.13 from PT Industri Jamu dan Pharmacy Sido Muncul Tbk. (SIDO), PT Millenium Pharmacon International Tbk obtained a maximum value of 0.81. (SDPC), the mean is 0.4456, and the standard deviation is 0.22378. The minimum value on ALLJP is 0.90 from PT Kalbe Farma Tbk. (KLBF), PT Organon Pharma Indonesia Tbk obtained a maximum value of 5.94. (SCPI), the mean is 2.5095, and the standard deviation is 1.32841. The minimum PTA value was obtained at 0.51 from PT Kimia Farma Tbk. (KAEF), PT Pyridam Farma Tbk obtains a maximum value of 2.76. (PYFA), the mean is 1.2135, and the standard deviation is 0.57648. The minimum ROA value obtained is -0.02 from PT Indofarma Tbk. (INAF), PT Sido Muncul Tbk Herbal Medicine and Pharmaceutical Industry Tbk obtained the maximum value of 0.31. (SIDO), the average is 0.0771, and the standard deviation is 0.07627.

### Normality Test

**Table 2.** One-Sample Kolmogorov-Smirnov Test

		SQRT
N		71
Normal Parameters <sup>ab</sup>	Mean	1,0187
	Std. Deviation	0,37794
Most Extreme Differences	Absolute	0,114
	Positive	0,093
	Negative	-0,114
Test Statistic		0,114
Asymp. Sig. (2-tailed)		,024 <sup>c</sup>
Monte Carlo Sig. (2-tailed)	Sig.	,294 <sup>d</sup>
	95% Lower Bound	0,285
	Confidence Interval Upper Bound	0,303

Source: SPSS (2022)

Kolmogorov Smirnov test results obtained Asymp value. Sig. (2-tailed) of 0.024 after the outlier and changing the data using sqrt. However, this value is still less than the 0.05 significance level, which means that the data is not normally distributed. Then the test was carried out again using Monte Carlo so as to obtain a Monte Carlo Sig value. (2-tailed) 0.303. The result is greater than the significance level of 0.05, so it can be concluded that the data in this study are normal.

### Calculation results of prediction methods

**Table 3.** Calculation Results of Prediction Methods

No.	IDX Code	Year	Net Income	Prediction		
				Grover	Zmijewski	Springate
1	DVLA	2019	221.783.249.000	TFD	TFD	TFD
		2020	162.072.984.000	TFD	TFD	TFD
		2021	146.725.628.000	TFD	TFD	TFD
2	INAF	2019	7.961.966.026	TFD	TFD	TFD
		2020	30.020.709	TFD	TFD	FD
		2021	-37.571.241.226	TFD	FD	FD
3	KAEF	2019	15.890.439.000	TFD	TFD	FD
		2020	20.425.756.000	TFD	TFD	FD
		2021	289.888.789.000	TFD	TFD	FD
4	KLBF	2019	2.537.601.823.645	TFD	TFD	TFD
		2020	2.799.622.515.814	TFD	TFD	TFD
		2021	3.232.007.683.281	TFD	TFD	TFD
5	MERK	2019	78.256.797.000	TFD	TFD	TFD
		2020	71.902.263.000	TFD	TFD	TFD
		2021	131.660.834.000	TFD	TFD	TFD
6	PEHA	2019	102.310.124.000	TFD	TFD	FD
		2020	48.665.149.000	TFD	TFD	FD

		2021	11.296.951.000	TFD	TFD	FD
		2019	112.652.526.000	TFD	TFD	TFD
7	SCPI	2020	218.362.874.000	TFD	TFD	TFD
		2021	118.691.582.000	TFD	FD	TFD
		2019	7.880.007.292	TFD	FD	TFD
8	SDPC	2020	2.804.331.066	TFD	FD	TFD
		2021	9.571.235.584	TFD	TFD	TFD
		2019	595.154.912.874	TFD	TFD	TFD
9	TSPC	2020	834.369.751.682	TFD	TFD	TFD
		2021	877.817.637.643	TFD	TFD	TFD
		2019	9.342.718.039	TFD	TFD	TFD
10	PYFA	2020	22.104.364.267	TFD	TFD	TFD
		2021	5.478.952.440	TFD	FD	FD
		2019	807.689.000.000	TFD	TFD	TFD
11	SIDO	2020	934.016.000.000	TFD	TFD	TFD
		2021	1.260.898.000.000	TFD	TFD	TFD

Source: Excel (2022)

Based on Table 3. from a comparison of net income with the predicted results of the Grover, Zmijewski, and Springate methods, there are several differences. When net income is positive, the Zmijewski method provides predictions of indications of financial distress in several companies. The Springate method also provides predictions of indications of financial distress in several companies. However, when net income has a negative value, the Grover method still predicts that the company is not in financial distress.

#### Accuracy level and error type calculation results

**Table.4** Accuracy Level and Error Type Calculation Results

Method	Sampels	Prediction		Accuracy Level
		Accord	Not Accord	
Grover	33	32	1	96,97%
Zmijewski	33	28	5	84,85%
Springate	33	24	9	72,73%

  

Method	Sampels	Prediction		Type Error
		Accord	Not Accord	
Grover	33	32	1	3,03%
Zmijewski	33	28	5	15,15%
Springate	33	24	9	27,27%

Source: Excel (2022)

Based on Table 4. it can be seen that Grover has the highest accuracy rate of 96.97% with an error type of 3.03%, then Zmijewski 84.85% with an error type of 15.15% and Springate 72.73% with an error type of 27.27%.

#### Paired sample t-test

**Table 5.** Paired Sample T-Test

		Paired Differences							
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference		t	df	Sig. (2-tailed)
					Lower	Upper			
Pair 1	G-Score - X-Score	3,07091	2,05581	0,3579	2,3415	3,7999	8,581	32	0,000
Pair 2	G-Score - S-Score	-0,5978	0,44788	0,078	-0,7566	-0,439	-7,67	32	0,000
Pair 3	X-Score - S-Score	-3,6688	2,34444	0,4081	-4,5000	-2,837	-8,99	32	0,000

Source: SPSS (2022)

Based on Table 5. Pair 1 is a pair between Grover and Zmijewski getting a Sig. (2-tailed) of 0.000, this value is less than the significance level of 0.05, so it can be concluded that the Grover and Zmijewski methods significantly differ in predictive scores. In pair two between Grover and Springate, the value of Sig. (2-tailed) of 0.000, this value is smaller than the significance level of 0.05, so it can be concluded that the Grover and Springate methods significantly differ in predictive scores. Moreover, pair three between Zmijewski and

Springate got a Sig. (2-tailed) of 0.000, this value is less than the significance level of 0.05, so it can be concluded that the Zmijewski and Springate methods significantly differ in predictive scores.

## Discussion

### ***Pharmaceutical companies with indications of financial distress with the grover, zmijewski, and springate calculation methods***

The results of calculations using the Grover, Zmijewski, and Springate methods indicate that several companies are experiencing financial distress. In the Grover method, the calculation results of this method show that there are no pharmaceutical companies with indications of financial distress. Because Grover assesses the company's financial distress when the total assets owned by the company are unable to generate profits for the company. The Zmijewski method found that five companies indicated financial distress in 2019-2021. The five companies are PT Millennium Pharmacon International Tbk. (SDPC) with indications of financial distress during 2019-2021, PT Indofarma Tbk. (INAF) indicated in 2021, and PT Pyridam Farma Tbk. (PYFA) which is indicated in 2021. The calculation of the Springate method shows that there are nine companies with indications of financial distress during 2019-2021. In the 2019 Springate method, there are three indicated companies: PT Indofarma Tbk. (INAF), PT Kimia Farma Tbk. (KAEF), and PT Phrapos Tbk. (PEHA). In 2020 there are two companies, namely, KAEF and PEHA. In 2021 there will be four companies which are INAF, KAEF, PEHA and PYFA.

### ***Significant difference in prediction score from grover, zmijewski, and springate methods***

The Paired Sample T-Test test shows that from the Grover, Zmijewski, and Springate methods, there is a significant difference in the prediction scores. In pair 1, the significant score difference proves that although Grover and Zmijewski use the ROA variable in each method, the resulting scores will still be significantly different. This study's results align with Ick and Tarigan's (2018) research on mining companies on the IDX, which stated a significant difference in scores between the Grover and Zmijewski methods. The Pair 2 Grover and Springate methods use the same two variables: working capital to total assets (MKTA) and EBIT to total assets (EBITTA). However, the score results are still significantly different, so the two samples are unrelated. The results of this research align with the research conducted by Permana et al. (2017) in manufacturing companies listed on the IDX, which stated that there was a significant difference in scores between the Grover and Springate methods. The Pair 3 Zmijewski and Springate methods do not use the same variables so the resulting scores will differ. This study's results align with research conducted by Asmaradana and Satyawan (2022) in the consumer services subsector stated that there was a significant difference in scores between Zmijewski and Springate.

### ***Prediction method with the highest degree of accuracy***

Calculation of the level of accuracy and type of error is carried out to determine the prediction method with high accuracy with few errors. The results of the Grover method show that the method has an accuracy rate of 96.97% with an error type percentage of 3.03%. Then for the Zmijewski method, the accuracy percentage results are 84.85% with an error type of 15.15%. Moreover, the Springate method with the smallest accuracy percentage is 72.73%, with an error type value of 27.27%. The results of this study align with research conducted by Verlekar and Kamat (2019) in the banking sector in India by obtaining a different score result that the Grover method has the highest level of accuracy, namely 95% compared to Zmijewski 90% and Springate 88%.

## Conclusion

Based on calculations using the Grover method, there are no companies with indications of financial distress. However, in actual circumstances there was 1 company that experienced negative net income. Calculations using the Zmijewski method obtained 5 samples indicating financial distress, and for the Springate method obtained 9 samples indicating financial distress. The results of the hypothesis test show that the Grover, Zmijewski, and Springate methods have significant differences in results. Because the Grover, Zmijewski, and Springate methods use different variables in predicting financial distress in companies. Calculation of the level of accuracy and type of error, it was found that the Grover method had the highest accuracy rate of 96.97%, then the Zmijewski method 84.85% and Springate 72.73%.

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