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COMPARATIVE ANALYSIS OF THE ALTMAN, SPRINGATE, GROVER AND ZMIJEWSKI MODELS AS PREDICTING FINANCIAL DISTRESS

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ABSTRACT

This study aims to analyze the financial distress and accuracy of the Altman Z-Score method, the Springate method, the Zmijewski method, and the Grover method in the coal subsector mining companies listed on the Indonesia Stock Exchange in the 2014-2018 periods.The research sample consisted of 17 companies using purposive sampling.This research uses descriptive method by conducting Independent Sample T-test and one way ANOVA test to find out the difference between the Grover method and the Altman Z-Score, the Grover method with the Springate method, the Grover method with the Zmijewski method.The results of the study stated that there were significant differences between the Grover model and the Altman Z-Score, the Grover model with Zmijewski but the Grover models with the Springate model were no differences. The final result of one way ANOVA there is a significant difference between the four models and has an accuracy level of Altman Z-Score of 72.22%, Springate 66.67%, Zmijewski and Grover of 83.33%

INTRODUCTION

Economic growth in Indonesia from 2014 to 2018 has increased. The Central Statistics Agency records that in 2018 it reached 5.17 percent, which is higher than the 2017 growth of 5.07 percent, even the highest in the last 4 years, this is evidenced from the 2014 BPS data which reached 5.01 percent, while in 2015 decreased by 0.13 percent. The Head of the Central Statistics Agency said that in 2015 there was an economic slowdown in terms of production caused by four things, namely construction performance related to the delay in realization of infrastructure spending, declining supply of imported goods, all categories of

consumer goods, raw materials, declining capital materials, declining food sector due to the delay in the park period and the production of crude oil and coal has contracted or declined (www.economy.okezone.com). Indonesian coal production results in the 2014-2018 period experienced fluctuations, beginning in 2014 coal production experienced over supply according to the Indonesia Minning Institute of 250 million tons (www.merdeka.com). As coal production accelerates in 2018, followed by an average coal reference price of $ 98.96 / ton, it is a breath of fresh air for entrepreneurs who run coal mining companies. From 2014 to 2015 coal production was again corrected, this was due to a drop in world coal prices.

Evaluation through the issuer's financial performance needs to be done the issuers experienced a net loss, especially in 2015. In 2016 the reference coal prices crept up. From 2017 to 2018 coal prices tend to increase coal mining companies are slowly improving the company's performance. However, there are companies that suffer losses, so companies that have been listed on the Indonesia Stock Exchange need to be evaluated through financial performance as transparency to investors, to find out which companies of healthy or bankrupt issuers can be assessed through bankruptcy analysis or financial distress.The global economic slowdown in 2015 affected the drop in the reference coal prices which impacted on coal companies, the impact of which caused several companies to suffer losses. Fahmi (2015: 169) defines finacial distress as a stage of decline in financial conditions that occurred before the occurrence of bankruptcy in or liquidity.Financial distress starts from the inability to fulfill its obligations, especially short-term obligations including liquidity obligations, and also includes obligations in the category of solvency. Nidhi and Saini (2013) stated that the company's financial situation can be assessed using standard financial ratios. Bankruptcy model as a bankruptcy detection tool can be used, namely the Altman Z-Score model (1968), the Spirngate model (1978), the Zmijewski model (1983) and the Grover model (2001). Salim (2016) predicts the financial condition of a company by using the Altman Z-Score using 5 types of financial ratios to predict company bankruptcy, including working capital to total assets, retained earnings to total assets, earnings before interest and taxes to total assets, market value equity to book value of total debt dan sales to total assets.Rahayu (2016) explains that the analysis of the Zmijewski model (1984) requires one thing to be crucial. The proportion of the sample and population must be determined at the earliest, so that the obtained frequency of the company's financial distress prediction is obtained. This frequency is obtained by dividing the number of samples that experience financial distress by the total sample size.Zmijewski used the probit analysis applied to 40 companies that had gone bankrupt and 800 companies that survived at this time.

Discovered by Zmijewski using 3 financial ratiosreturn on assets debt ratio and current ratio.Salim (2016) explains that the Grover (2001) model was discovered by Jeffrey S. The Grover model uses 3 types of ratiosworking capital to total assets, earning before interest and taxes to total Assers dan return on assets.Prabowo (2015) research results concluded that the best delisting predictor method is the Altman Z-Score method which has an accuracy rate of

71%.Prabowo's results are not in line with research conducted by Concerned and Ratnasari (2013) where there are differences between the Grover model and the Altman Z-Score, Springate, and Zmijewski models. The Grover model is the most suitable prediction model applied to Food and Beverage Companies listed on the Indonesia Stock Exchange.

LITERATURE REVIEW

Financial Distress

Sondakh et al (2014) bankrutcy is a condition in which a company is no longer able to pay off its obligations. This condition is usually no longer able to pay off obligations. This condition usually does not just appear at the company, there are early indications from the company that can usually be recognized earlier if the financial statements are analyzed more carefully in a certain way. Another opinion conveyed by Fahmi (2015: 169) defines financial distress as a stage of decline in financial conditions that occurred before the occurrence of bankruptcy or liquidity. Financial distress starts from the inability to fulfill its obligations, especially short-term obligations including liquidity, and also includes obligations in the solvency category.

Altman model

The Altman method was developed by Edward Altman in 1960, using financial ratios Tambunan (2015) revealed "Altman's Z-Score analysis is one of the statistical techniques used to predict corporate bankruptcy. Altman and Hotchkiss in Rahayu (2016) said that Multi Discriminant Analysis is a statistical technique used to classify an observation into one of several priori groupings dependent upon the observation's individual characteristics. Multi Discriminant Analysis is a statistical technique used to classify observations into one of several groups that are a priori dependent on the individual characteristics of these observations. Altman Z-Score (1968) predicts bankruptcy with the Z-Score model using financial ratios that are classified into 5 categories: liquidity ratios, profitability ratios, leverage ratios, market test ratios, and performance. This method is able to predict bankruptcy with an accuracy rate of 95% in the company for 12 months. The Altman method was developed as a prediction of bankruptcy of manufacturing companies that did not go public and manufacturing companies that went public.Prabowo (2015) explains that the best delisting predictor method is the Altman method which has an accuracy of 71%, then the second position is the springate method which has an accuracy not much different from the Altman Z-Score method of 70%, and the last ranked is the method Zmijewski which only has an accuracy of 65%.

Springatemodel

Prihanthini and Sari (2013) suggested research conducted by Gordon L. V Springate (1978) produced a bankruptcy prediction model created by following the Altman model.The bankruptcy prediction model known as the Springate model uses 4 financial ratios selected based on 19 financial ratios in various literacies. According to Rahayu (2016) states that Gordon L. V Springate uses the same method as Altman (1968), namely Multiple Discriminate Analysis.The sample used by Springate is 40 companies located in Canada.Springate (1978) also conducted research that produced a bankruptcy prediction method called Springate. The sample used as many as 40 companies using the MDA method.Springate found 4 financial ratios that can be used in predicting the potential for bankruptcy against companies with an accuracy rate of 92.5%. Priambodo (2017) The highest accuracy prediction model starts with the Springate model with an accuracy rate of 84.21%, then the Grover model with an accuracy level of 78.94%, followed by an Altman prediction model with an accuracy level of 76.31%, and the model Zmijewski with an accuracy rate of 67.10%.

Zmijewski model

Sondakh et al. (2014) revealed a study conducted by Zmijewski using a non-random sample with the population of companies studied including all companies listed on the American and New York Stock Exchanges during the period 1972-1978 with a population ranging between 2082-2241 per year.Each company was identified as a bankrupt company or not, using three sources namely the Capital Changes Reporter, the Wall Street Journal Index, and the Compustat Research File. Based on the identification results, there were 129 bankrupt companies, of which 81 of them had complete data.Two types of data are used, namely the listing period in the CRSP Daily Return File and financial reports obtained from the SEC 10K (for bankrupt companies) and from the Compustat Annual Industrial File (for non-bankrupt companies, where 67% of them have complete data) (Zmijewski, 1984: 59-64). Zmijewski (1983) managed to find a bankruptcy analysis model after a bankruptcy study for 20 years.Zmijewski used a sample of 75 companies that went bankrupt and 3573 companies that were healthy during the year and were not healthy as indicated by the F-Test indicator against the group ratio.Salim (2016) states the Zmijewski Model is the most accurate prediction model that can be applied to coal mining companies listed on the Indonesia Stock Exchange, because this model has the highest level of accuracy compared to other prediction models that is 78.95%.The Springate model has an accuracy rate of 47.37%, and the last is the Altman model only 5.26%.

Grover model

Prihanthini and Sari's research (2013) suggests that the Grover Model is a model created by designing and re-evaluating the Altman Z-Score model. Jeffrey S.

Grover used a sample according to the Altman Z-Score model in 1968, adding thirteen new financial ratios. Grover (2001) succeeded in creating a model used to analyze the potential for bankruptcy of a company by redesigning the first Altman Z-Score. Grover used a sample of 70 companies, namely 35 companies that went bankrupt and 35 companies that did not go bankrupt in 1982 to 1996. Grover used 35 financial ratios and then used 3 financial ratios that were considered to most influence the company's bankruptcy.Prihanthini (2013) states that the Grover Model is the most suitable prediction model applied to food and beverage companies listed on the Indonesia Stock Exchange by 100%. The Atlman Z-Score model has an accuracy of 80%, while the Springate Model is 90% and the Zmijewski model is 90%.

H_1 : There is a difference between the Grover Model and the Altman Z-Score model in predicting bankruptcy
H_2 : There is a difference between the Grover model and the Springate model in predicting bankruptcy.
H_3 : There is a difference between Grover's model and Zmijewski's model in predicting bankruptcy.

RESEARCH METHODS

This research uses descriptive method by conducting Independent Sample T-test and one way ANOVA test to find out the differences between the Grover Model method, Altman Z-Score model, Springate model, Zmijewski model in predicting bankruptcy. By using the purposive sampling method, 17 companies were selected as research samples in the coal subsector mining companies listed on the Indonesia Stock Exchange in the 2014-2018 period.

Table 1 Normality Test ResultOf The Altman Z-Score Method, Springate Method, Zmijewski Method and Grover Method pada For Coal Companies 2014-2018

Tests of Normality							
Method		Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
Bankruptcy Prediction Result	Altman Z-Score Method	.180	17	.146	.950	17	.463
	Springate Method	.143	17	.200*	.968	17	.782
	Zmijewski Method	.166	17	.200*	.933	17	.241
	Grover Method	.118	17	.200*	.978	17	.937
*. This is a lower bound of the true significance.							
a. Lilliefors Significance Correction							

The results of normality test from the Altman Z-Score method, Springate method, Zmijewski method and Grover method have significance values normally

distributed. Altman Z-Score method has a significance value of 0.146> 0.05 then the data is normally distributed or Ho is accepted Ha is rejected. The Springate method of 0.200> 0.05 indicates that Ho is accepted and Ha is rejected then the normal distribution and the Zmijewski method have a significance value of 0.200> 0.05 then the data are normally distributed. The significance value of the Grover method of 0.200> 0.05 data is normally distributed. Analysis of the most accurate method in predicting the potential bankruptcy of Altman Z-Score, Springate, Zmijewski, and Grover on coal companies listed on the Indonesia Stock Exchange Period 2014-2018.

Bankruptcy Predictions of the Altman Model, the Springate Model, the Zmijewski Model, and the Grover Model for Coal Sub-Sector Mining Companies listed on the Indonesia Stock Exchange in the 2014-2018 period.

Table 2: Results of Fear Level Prediction of Potential Bankruptcy

Prediction	**Method**			
	Z-Score	**S-Score**	**X-Score**	**G-Score**
Bankrupt	4	6	3	3
Gray	3	0	0	1
Not Bankrupt	10	12	15	14
Total Samples	18	18	18	18
% Accuracy	72,22	66,67	83,33	83,33
% Error Type	27,78	33,33	16,67	16,67

Source: Data Processing Result

DISCUSSION RESULT

The Altman Z-Score model predicts that there are 5 companies that have the potential to go bankrupt, 3 companies that have gray areas and 10 companies that have not gone bankrupt. The Altman Z-Score model has an accuracy rate of 72.22% with an error type of 27.78%.The Springate Model predicts there are 6 companies that will go bankrupt while 12 companies are predicted not to go bankrupt. From the explanation of the table above, it can be concluded that this model has an accuracy rate of 66.67% with an error type of 33.33%.Zmijewski's model predicts that there are 3 companies that will go bankrupt and 15 companies are predicted not to go bankrupt. The Zmijewski model has a smaller error rate compared to the Springate and Altman Z-Score methods with an error type of 16.67% and an accuracy rate of 83.33%. Grover's model predicts that there are 3 companies in potential bankruptcy, 1 company in gray condition and 14 companies predicted in non-bankrupt or healthy condition. Grover's model has the same error rate and accuracy as Zmijewski's Model, which is 16.67% and an accuracy rate of 83.33%.The Grover Model and the Zmijewski Model show an accuracy rate of 83.33% and an error rate of 16.67%. Furthermore, the Altman Z-Score model with an accuracy rate of 72.22% and the Springate model with an accuracy rate of 66.67%.It can be concluded that the Zmijewski model and the

Grover model are the most accurate prediction models that can be used in predicting bankruptcy at a Coal Mining company listed on the IDX.

CONCLUSION

1. The results of the Altman Z-Score model analysis during the study period there were 31 companies predicted to be potentially bankrupt, 14 companies predicted in gray area conditions and 59 companies included in the category of not going bankrupt.
2. Analysis of the Altman Z-Score model during the study period there were 31 companies predicted to be potentially bankrupt, 14 companies were predicted to be in the gray area condition and 59 companies included in the category of not going bankrupt.
3. The results of the Springate model analysis during the study period there were 31 companies predicted to be bankrupt and 59 companies included in the non-bankrupt category.There is a potential bankruptcy of coal mining companies listed on the Indonesia Stock Exchange in the 2014-2018 period by implementing Grover analysis. The results of the Grover model analysis from 2014-2018 there were 16 companies predicted to be bankrupt, 1 company predicted gray area and 73 companies included in the category of not going bankrupt.
4. The results of the Zmijewski model analysis show that there are 17 companies predicted to be bankrupt and 73 companies included in the category of not going bankrupt.
5. The independent sample t test results showed that there was a significant difference between the Grover method and the Altman Z-Score method, there was no difference between the Grover method and the Springate method, there was a significant difference between the Grover method and the Zmijewski method. One Way ANOVA test results concluded that there were significant differences between the Altman Z-Score, Springate, Zmijewski and Grover methods.
6. Bankruptcy analysis in this study, the Zmijewski and Grover model is the most accurate prediction model that can be applied to coal mining companies listed on the Indonesia Stock Exchange (BEI), because both models have an accuracy rate of 83.33%. Followed by the Altman Z-Score model with an accuracy rate of 72.22% and the Springate model with an accuracy rate of 66.67%.

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