

An Analysis of Financial Distress Accuracy Models in Indonesia Coal Mining Industry: An Altman, Springate, Zmijewski, Ohlson and Grover Approaches

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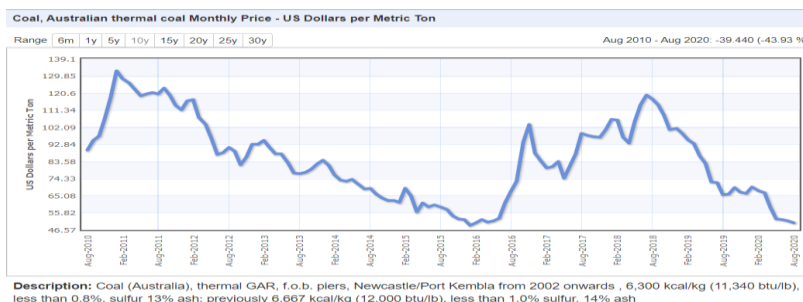
ABSTRACT

The purpose of this research is to determine companies financial distress base on Altman, Springate, Zmijewski, Ohlson and Grover Models and to assess the accuracy of those five prediction models in coal mining sector firms listed in Indonesia Stock Exchange (IDX) for the period 2015 – 2019. This research has 22 samples of 23 coal mining firms listed in IDX base on the purposive sampling technique. This study is a descriptive design using quantitative and panel data. The research data is analyzed using the Kruskal Wallis test because there are more than two prediction models to compare and the data are not normally distributed. The result indicates that the Modified Altman and Ohlson Models are the most accurate predictive models because these models have the highest accuracy rate of 90.91%, followed by Zmijewski Model, which has an accuracy rate of 86.36%, then Grover Model has 81.82% accuracy rate, and the lowest prediction rate is Springate Model with the value of 63.64%.

1. Introduction ¹

Coal prices fluctuation from 2010 to 2020 and high-cost operation have made the coal mining industry included in the high-risk business category. The decline of coal prices will affect company profits and if it continues getting losses, it will have an impact on company bankruptcy. The coal price shown in Picture 1 indicates that coal price falls in two periods, mainly from 2012 to 2016 and 2018 to 2020. Furthermore, this phenomenon impacts company profit shown in Table 1 that indicated some companies like Atlas Resource, Bumi Resources, Perdana Karya Perkasa, and SMR Utama have negative profits during 2015 – 2019. This signal can be assumed as an early warning of financial distress before bankruptcy occurs.

Research on corporate financial distress in Indonesia has been published. However, this study has some differences compared to previous research. The first point is about the differences in the object. Safitri and Hartono (2014) have been researched the financial sector. Puspita Sari (2015) analysed the transportation sector. Widyanty (2018) studied the LQ-45 companies. Primasari (2018) analysed financial distress in the consumer goods sector. Imelda & Alodia (2017) conducted research in the manufacture industry. The object of this research is the coal mining industry.



Picture 1. Coal price during 2010 to 2020 (source: www.indexmundi.com)

Table 1. List of ten coal companies profit and loss (source: www.idx.co.id)

N	Company	Code	Unit	2015	2016	2017	2018	2019
1	Adaro Energy	ADRO	USD (mio)	151	341	536	478	435
2	Atlas Resources	ARII	USD (mio)	(26)	(25)	(16)	(28)	(6)
3	Bumi Resources	BUMI	USD (mio)	(2185)	120	243	158	9
4	Harum Energy	HRUM	USD (mio)	(19)	18	56	40	20
5	Indika Energy	INDY	USD (mio)	(77)	(104)	322	98	5
6	Perdana Karya Perkasa	PKPK	IDR (bio)	(62)	(14)	(10)	(4)	(42)
7	Bukit Asam	PTBA	IDR (bio)	2037	2024	4574	5121	4040
8	Petrosea	PTRO	USD (mio)	(13)	(8)	12	23	31
9	SMR Utama	SMRU	IDR (bio)	(20)	(17)	2	(70)	(187)
10	Toba Bara Sejahtera	TOBA	USD (mio)	26	15	41	68	44

The second point is about the different models used in the study. Zainal Abidin Putera et al. (2016) used Altman, Springate, and Ohlson Models. Salim & Sudiono (2017) applied Altman, Springate, and Zmijewski Models. Hungan and Sawitri (2018) analysed Grover and Springate Models. Piscestalia & Maswar (2019) use four models are Springate, Ohlson, Zmijewski, and Grover. This research uses five predictor models. They are Altman, Springate, Zmijewski, Ohlson, and Grover.

The third point is about the gap of the best predictor model. Fatmawati (n.d.) stated that the Zmijewski Model is the best predictor model compared to Springate and Altman. Puspita Sari (2015) said that Altman Model is more accurate than Springate, Grover, and Zmijewski Models. Edi and Tania (2018) and Priambodo & Pustikaningsih (2018) stated that Springate Model has higher accuracy than Grover, Altman, and Zmijewski Models.

The conclusion of this research is expected can be used by management for internal evaluation. Investors and creditors can assess the corporate financial performance prior to commencing investment. The government is expected to review and establish mining regulation to help the company grow or survive during coal price pressure.

2. Literature Review

2.1 Definition of Financial Distress

According to Wruck (1990), the definition of financial distress is a situation when net cash flow is not sufficient to cover current debts. An extreme situation of financial distress is bankruptcy which can be very expensive, involving legal fees and forcing the company to release its assets at a depressed price.

2.2 Indicators of Financial Distress

Wruck (1990) provides several general indicators of corporate financial distress, they are continuous dividend reduction or even fail to provide dividend at all, unable to pay operations then impact the closure of several branches, layoffs occur to save the company from larger losses, resignation or sacking their executive, and falling of stock price as an indicator of the market value of the company. According to Altman (1968), Whitaker (1999) and Mumford (2003), financial distress occurs when a company cannot pay its debts. According to Kida (1980) and Mutchler (1985), corporate financial distress occurs if the company at least has one signal among some indicators such as negative working capital in the recent year, operating loss during three years before the bankruptcy, the deficit of retained earnings in the third year before bankruptcy, negative profits in three years before the bankruptcy.

Based on the above literature review, the financial distress indicators used in this research happen when the company has negative profits for three or more consecutive years, reduce or fail to pay a dividend at all, and increment of debt to equity ratio (DER).

2.3 Modified Altman Z"-Score Model

The most popular model for predicting corporate failure is the Z-score formula was developed in 1968 by Edward I. Altman, an assistant professor of finance at New York University. Altman uses the Multiple Discriminant Analysis (MDA) technique to predict company bankruptcy. In 1983, Altman revised his model to produce Z'-score by adjusting the model for the private company sector model since the previous Z-score was only used for going public manufacture. Furthermore, Altman modified his model to produce Z"-score by removing sales to total assets variable (Altman, 1968). EBIT to total assets ratio has the most contribution at this model version (Altman et al., 2017, p. 136). Altman Modification Model has cut-off value 2.60 and 1.10. The company suffers financial distress if the cut-off value less than 1.10. If the cut-off value is between 1.10 and 2.60, the company sits in a grey area position (Maina & Sakwa, 2010, p. 485).

2.4 Springate S-Score Model

The Springate Model was developed in 1978 use MDA technique to select four ratios from 19 popular financial ratios. They are working capital to total assets, EBIT to total assets, EBIT to current liabilities, and sales to total assets (Ari Rachmad, 2021). S-score has a cut-off value 0.862. If S-score is less than cut-off value, the company is predicted to be in financial distress (Primasari, 2018, p. 28).

2.5 Zmijewski X-Score Model

Zmijewski (1984) expanded his study in predicting bankruptcy by analysing return on assets, debt ratio, and current ratio. X-score has a cut-off value 0. If X-score is greater than the cut-off value, the company is predicted in financial distress condition (Edi & Tania, 2018).

2.6 Ohlson O-Score Model

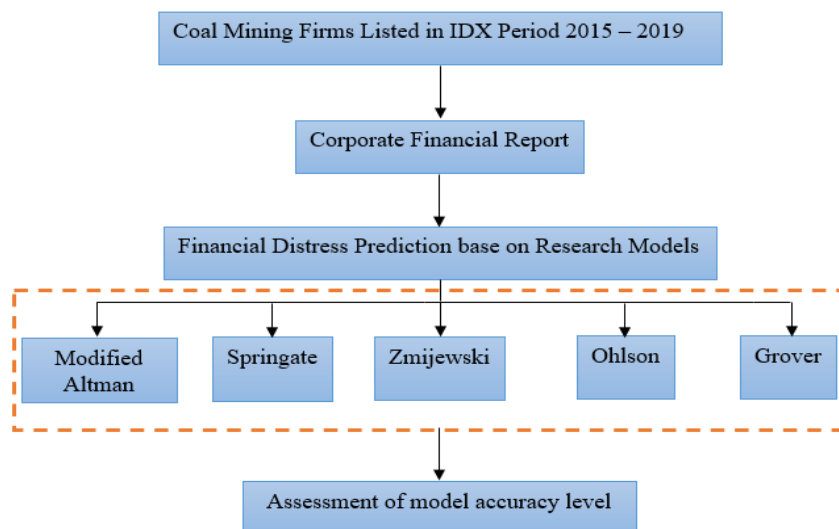
Ohlson (1980) published his research use logit or multiple logistic regression techniques to construct a bankruptcy predictor model. He uses a cut-off value greater than 0.38 to predict the company's financial distress condition (Safitri & Hartono, 2014, p. 330).

2.6 Grover G-Score Model

The Grover Model is created by redesigning and evaluating the Altman's Model by adding 13 new financial ratios use 35 bankrupt and 35 non-bankrupt companies in 1982 – 1996. The cut-off value for a bankrupt company if G-score produces value less than or equal to -0.02. Meanwhile, cut off more or equal to 0.01 indicate the non-bankrupt company (Salim & Sudiono, 2017, p. 381).

3. Theoretical Framework and Hypothesis

The research framework in this research as follows:



Picture 2. Framework

The hypotheses are formulated for this research as follow:

H₁: There are differences in financial distress prediction result using Modified Altman, Springate, Zmijewski, Ohlson, and Grover Models.

H₂: The Modified Altman Model is the most accurate model in predicting financial distress compared to Springate, Zmijewski, Ohlson, and Grover Models.

H₃: The Springate Model is the most accurate model in predicting financial distress compared to Modified Altman, Zmijewski, Ohlson, and Grover Models.

H₄: The Zmijewski Model is the most accurate model in predicting financial distress compared to Modified Altman, Springate, Ohlson, and Grover Models.

H₅: The Ohlson Model is the most accurate model in predicting financial distress compared to Modified Altman, Springate, Zmijewski and Grover Models.

H₆: The Grover Model is the most accurate model in predicting financial distress compared to Modified Altman, Springate, Zmijewski and Ohlson Models.

4. Research Methods

According to two criteria, the number of samples of this research is 22 of 23 populations from coal mining firms listed in IDX based on the purposive sampling technique. First, a coal mining company listed in IDX consecutively in the 2015 – 2019 period. Second, corporate financial statements are issued and complete audited during the period 2015 – 2019.

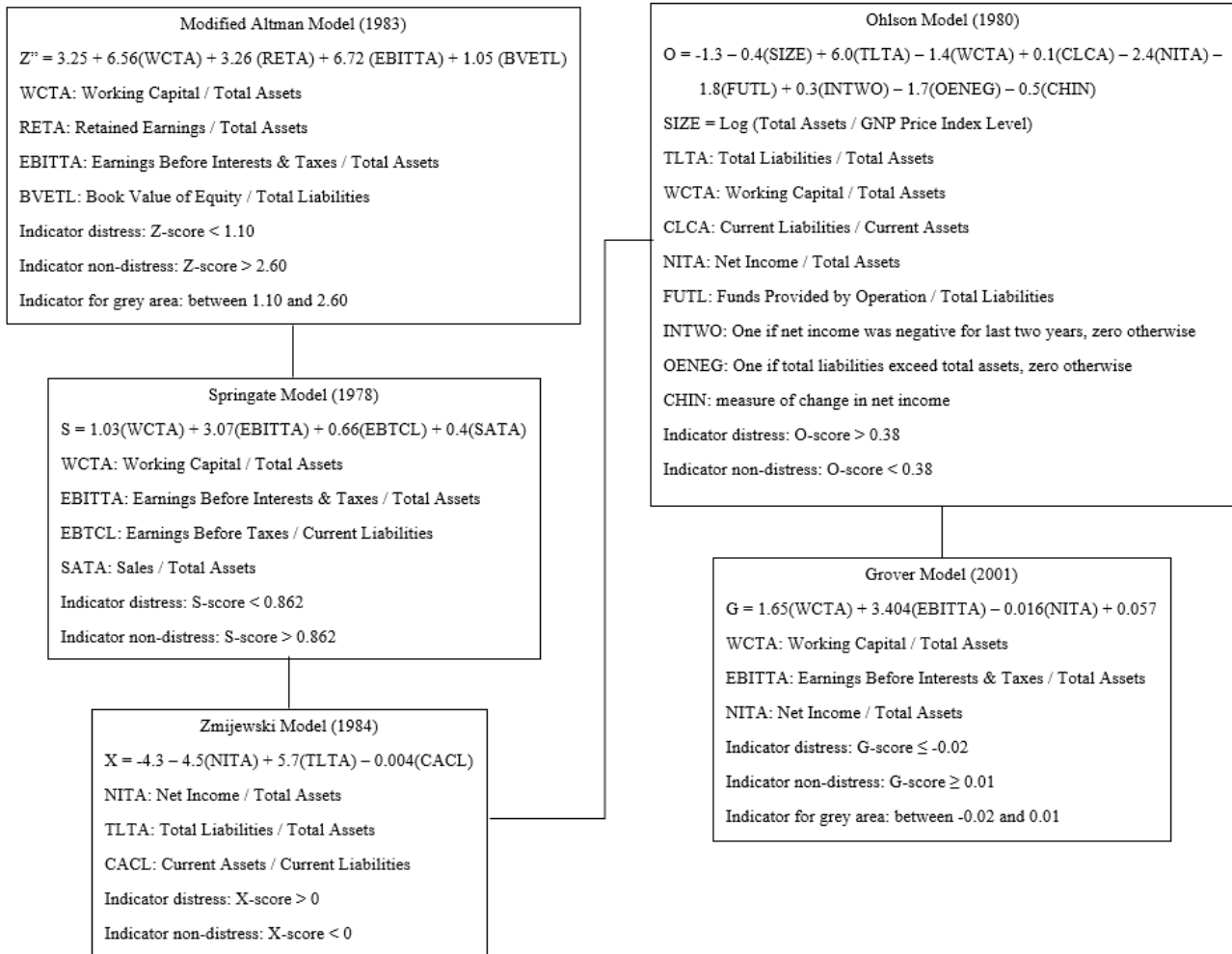
This study is a descriptive design using quantitative and secondary data type. Data are cross-section and time-series (panel data) with 22 samples for 5 years observation, so 110 total audited financial statements are to be explored to analyse financial ratios. The operational variables in Picture 3 are used in this research, as follow:

1. WCTA (Working Capital / Total Assets)
This variable is used to measure the company's liquidity. Altman, Springate, Ohlson, and Grover Models use this variable. The higher WCTA ratio indicates the greater company working capital from total assets and expected will increase the company profits. This variable can be measured using the company's financial statement data.
2. RETA (Retained Earnings / Total Assets)
RETA is used to measure the company's cumulative profitability. This variable is only used in Altman Model.
3. EBITTA (Earnings Before Interest and Taxes / Total Assets)
EBITTA is used to measure the company's profitability. This variable is used in the Altman, Springate, and Grover Models.
4. BVETL (Book Value of Equity / Total Liabilities)
BVETL is used to determine the company's value by investors in the capital market. This variable is only used in Altman Model.
5. SATA (Sales / Total Assets)
SATA is used to determine the company's ability to generate sales by existing assets. This variable is only used in Springate Model.
6. EBTCL (Earnings Before Taxes / Current Liabilities)
EBTCL is used to measure company's profitability. EBT data is obtained from the profit or loss statement. This variable is only used in Springate Model.
7. SIZE (Log (Total Assets / GNP Price Level Index)
SIZE is used to measure the company's size. This variable is only used in Ohlson Model. Gross National Product (GNP) price level index data is obtained in www.bps.go.id.
8. TLTA (Total Liabilities / Total Assets)
TLTA is a variable to measure the company's total liquidity. This variable is used in Ohlson and Zmijewski Models. This ratio is determined to measure the company's leverage. The company is in difficult financial position when this ratio continues larger and will increase risk of inability to pay company's liabilities.
9. CLCA (Current Liabilities / Current Assets)
CLCA is used to measure the company's short-term liquidity. This variable is only used in Ohlson Model. If current liabilities exceed current assets, the company will difficult to pay the short-term debt.
10. NITA (Net Income / Total Assets)
NITA is used to measure the company's profitability. This variable is used in Zmijewski, Ohlson, and Grover Models. Net income and total assets are obtained in the profit or loss statement and balance sheet.
11. FUTL (Cash Flow from Operation / Total Liabilities)
FUTL is used to measure the company's liquidity and determine company's ability to generate sufficient cash to pay liabilities. This variable is only used in Ohlson Model. The data is obtained in cash flow statement and balance sheet.
12. INTWO
INTWO is used to measure the company's profitability. This variable is only used in Ohlson Model. If during the last two years the company getting losses, it may be financial distress condition.
13. OENEG
OENEG is used to measure the company's liquidity. This model is only present in Ohlson Model. If total debt exceeds total assets, the company is likely in financial distress condition.
14. CHIN

CHIN is used to measure the changing of company's profitability. This model is only present in Ohlson Model. The data is obtained in profit or loss statement. This variable is determined by measuring the changing of net income during the last two years.

15. CACL (Current Assets / Current Liabilities)

CACL is used to determine the effectiveness of current assets to pay current liabilities. This variable is only present in Zmijewski Model. The data is obtained in company's balance sheet.



Picture 3. Operational variables

5. Findings and Discussion

5.1 Descriptive Statistic Analysis

The descriptive statistic in Table 2 is measured using minimum, maximum, mean, and standard deviation of 22 research samples of each model. For example, Modified Altman Model has a mean value of 6.9568, a minimum value of -2.4, and a maximum value of 15.88 as well as the other models. The standard deviation in Modified Altman Model is the highest value compared to the other four models. It indicates that samples in Modified Altman Model are more varied and more dispersed than the mean. On the other hand, the Grover Models has the lowest standard deviation value of 0.68815. It indicates that samples data in Grover Model are more homogeneous.

Table 2. Descriptive statistics result

Model	N	Minimum	Maximum	Mean	Std. Deviation
Modified Altman	22	(2,41)	15,88	6,9568	4,39125
Springate	22	(15,81)	3,33	0,2164	3,77836
Zmijewski	22	(4,18)	3,45	(1,8700)	1,84454
Ohlson	22	(7,34)	2,40	(3,3977)	2,29656
Grover	22	(0,86)	2,03	0,6084	0,68815

5.2 Financial Condition

As mentioned earlier, the financial distress indicators used in this research when for three or more consecutive years the company has negative profits, reduce or fail to pay dividend at all, and increase debt to equity ratio (DER).

Table 3 indicates that there are two companies suffer financial distress. They are ARII and PKPK. While the other 20 companies in healthy financial condition. ARII and PKPK challenging to manage the indicators to avoid financial distress. Both companies have negative profits and fail to pay dividends for five years. ARII has to increase DER during 2015 – 2018 from 3.28% to 34.0%. PKPK has better DER than ARII but relatively increase from 1.05% to 4.07% for five years. These conditions trigger financial distress and if they can not manage them, bankruptcy cannot be prevented. The decline of coal price must impact these conditions but some companies can survive because they have adequate financial management.

Table 3. Financial distress companies base on profit, dividend and DER indicators

Company	Year	Profit	Dividend	DER (%)
ARII (USD mio)	2015	-26	0	3.28
	2016	-25	0	4.88
	2017	-16	0	7.18
	2018	-28	0	34.00
	2019	-6	0	6.91
PKPK (IDR bio)	2015	-62	0	1.05
	2016	-14	0	1.26
	2017	-10	0	1.32
	2018	-4	0	1.31
	2019	-42	0	4.07

5.3 Financial Distress Model Analysis

The financial ratio processed from the financial statement is an effective tool to describe the condition of the company. It is used as operational variables contained in each prediction model. The results of this research using calculation of model’s formula and summarized in Table 4.

According to The Modified Altman Model shown in Table 4, two companies have an average Z”-score below 1.10. ARII and BUMI are predicted in difficult financial condition. ARII has Z”-score of -0.9833 and BUMI has Z”-score of -2.4054.

The calculation result base on Springate Model has predicted 10 companies have financial problem, more than the Modified Altman approach. ARII, BUMI, DEWA, DSSA, GTBO, INDY, PKPK, PTRO, SMMT, and SMRU have average S-score below 0.862.

The Zmijewski approach indicates that three companies have financial distress situation. ARII, BUMI, and DOID have an average X-score > 0. ARII has an average X-score 0.7982, BUMI has 3.4523, and DOID has 0.2295.

The calculation result using Ohlson Model stated that ARII and BUMI have financial difficulties. Both companies have an O-score of more than 0.38 as the cut-off value. ARII has O-score 0.7982 and BUMI has 3.4523. The Ohlson Model's calculation has a similar conclusion with the Modified Altman Model, which states that ARII and BUMI are in financial distress.

Based on Grover Model result, four of 22 companies have financial problems due to their average G-score less than -0.02. The distressed companies are ARII, BUMI, SMMT, and SMRU.

The calculation result mentioned in Table 4 indicates that five models have different results, but all models have the same prediction that ARII and BUMI will have financial distress problems.

Table 4. Model Prediction result

No	Code	Z"-Score	S-Score	X-Score	O-Score	G-Score
1	ADRO	7.1312	1.1819	(2.1762)	(4.3714)	0.6132
		Safe zone	Safe zone	Safe zone	Safe zone	Safe zone
2	ARII	(0.9833)	(0.6201)	0.7982	1.1045	(0.8591)
		Distress	Distress	Distress	Distress	Distress
3	BSSR	8.6694	2.3280	(3.3679)	(5.4958)	1.1488
		Safe zone	Safe zone	Safe zone	Safe zone	Safe zone
4	BUMI	(2.4054)	(0.3728)	3.4523	2.3993	(0.6143)
		Distress	Distress	Distress	Distress	Distress
5	BYAN	7.0469	1.9935	(1.8314)	(3.4588)	1.1931
		Safe zone	Safe zone	Safe zone	Safe zone	Safe zone
6	DEWA	4.0142	0.3695	(4.1765)	(4.2917)	0.1396
		Safe zone	Distress	Safe zone	Safe zone	Safe zone
7	DOID	5.3631	0.9287	0.2295	(1.1988)	0.7552
		Safe zone	Safe zone	Distress	Safe zone	Safe zone
8	DSSA	6.1902	0.7588	(1.6198)	(3.2023)	0.4657
		Safe zone	Distress	Safe zone	Safe zone	Safe zone
9	GEMS	7.8374	1.5720	(2.2522)	(4.0637)	1.0095
		Safe zone	Safe zone	Safe zone	Safe zone	Safe zone
10	GTBO	9.3134	(2.2122)	(2.9132)	(4.1065)	0.0823
		Safe zone	Distress	Safe zone	Safe zone	Safe zone
11	HRUM	15.8782	1.4323	(3.8020)	(2.9846)	1.2122
		Safe zone	Safe zone	Safe zone	Safe zone	Safe zone
12	INDY	5.7808	0.6036	(0.5631)	(2.2738)	0.5165
		Safe zone	Distress	Safe zone	Safe zone	Safe zone

13	ITMG	10.2951	1.9830	(3.2436)	(5.7049)	1.1954
		Safe zone	Safe zone	Safe zone	Safe zone	Safe zone
14	KKGI	12.8064	1.4280	(3.4085)	(5.7367)	0.7321
		Safe zone	Safe zone	Safe zone	Safe zone	Safe zone
15	MBAP	13.4593	3.3336	(4.0827)	(7.3391)	2.0309
		Safe zone	Safe zone	Safe zone	Safe zone	Safe zone
16	MYOH	11.6064	2.3516	(3.3648)	(6.1236)	1.4614
		Safe zone	Safe zone	Safe zone	Safe zone	Safe zone
17	PKPK	2.9411	(15.8081)	(0.1262)	(1.0060)	0.2264
		Safe zone	Distress	Safe zone	Safe zone	Safe zone
18	PTBA	8.4017	1.8582	(2.8930)	(5.1291)	1.1380
		Safe zone	Safe zone	Safe zone	Safe zone	Safe zone
19	PTRO	6.5028	0.6945	(0.9261)	(3.2221)	0.5409
		Safe zone	Distress	Safe zone	Safe zone	Safe zone
20	SMMT	4.1145	(0.0589)	(2.0625)	(2.6628)	(0.1623)
		Safe zone	Distress	Safe zone	Safe zone	Distress
21	SMRU	2.9980	(0.2641)	(0.9770)	(3.0179)	(0.0650)
		Safe zone	Distress	Safe zone	Safe zone	Distress
22	TOBA	6.0883	1.2794	(1.8341)	(2.8647)	0.6239
		Safe zone	Safe zone	Safe zone	Safe zone	Safe zone
Total Safe zone		20	12	19	20	18
Total Distress		2	10	3	2	4

5.4 Different Test

A statistical difference test is carried out to determine the significance of the five prediction models. The different test method can be done using ANOVA test or Kruskal Wallis test because this research has more than two sample groups. The ANOVA test should be chosen if the data have a normal distribution. Otherwise, The Kruskal Wallis test is the option if the data are not normally distributed.

Table 5. Test of normality result

Tests of Normality						
	Kolmogorov-Smirnov ^a			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Financial distress	0.489	550	0.000	0.495	550	0.000

a. Lilliefors Significance Correction

Table 5 shows that Kolmogorov-Smirnov and Shapiro-Wilk normality test have a significance value of 0.000. Due to a significance value less than 0.05, it can be concluded that the data are not normally distributed. The Kruskal Wallis test can be performed to determine different test.

The hypothesis used in this test is as follows:

H_0 : There is no difference in the prediction of financial distress using Altman, Springate, Zmijewski, Ohlson, and Grover Models for coal mining issuers in 2015 – 2019.

H_a : There are differences in the prediction of financial distress using Altman, Springate, Zmijewski, Ohlson, and Grover Models for coal mining issuers in 2015 – 2019.

By a significance level of less than 0.05, H_0 is rejected and it is concluded that the prediction result is significantly different, whereas if the significance level more than 0.05, then H_0 is not rejected and it is concluded that there is no difference is prediction result.

Table 6. Kruskal Wallis test result

Test Statistics ^{a,b}		Financial distress
•	Kruskal-Wallis H	67.322
•	df	4
•	Asymp. Sig.	0.000
a. Kruskal Wallis Test		
b. Grouping Variable: Metode		

Base on the analysis results in Table 6, the significance value is 0.000 or less than 0.05. It can be concluded that H_0 is rejected and it means the five models have a significant difference.

5.5 Accuracy Rate of Financial Distress Models

The previous analysis result state that the five models have different prediction results. The following Table 7 compares the accuracy level of the five prediction models compared with a real condition as shown previously in Table 3.

The measurement result in Table 7 indicates that Modified Altman and Ohlson Model have the same accuracy rate of 90.91% with an error measurement of 9.09%. These models are the most accurate rate compared to other models, followed by Zmijewski Model that has an accuracy rate of 86.36% and error measurement of 13.64%. Grover Model has an accuracy rate and error measurement of 81.82% and 18.18%, respectively. Springate Model has the lowest accuracy rate of 63.64% and the highest error measurement of 36.36%.

Table 7. Accuracy rate of prediction models

No	Code	Measurement Accuracy of Each Models				
		Mod. Altman	Springate	Zmijewski	Ohlson	Grover
1	ADRO	Correct	Correct	Correct	Correct	Correct
2	ARII	Correct	Correct	Correct	Correct	Correct
3	BSSR	Correct	Correct	Correct	Correct	Correct
4	BUMI	Incorrect	Incorrect	Incorrect	Incorrect	Incorrect
5	BYAN	Correct	Correct	Correct	Correct	Correct

6	DEWA	Correct	Incorrect	Correct	Correct	Correct
7	DOID	Correct	Correct	Incorrect	Correct	Correct
8	DSSA	Correct	Incorrect	Correct	Correct	Correct
9	GEMS	Correct	Correct	Correct	Correct	Correct
10	GTBO	Correct	Incorrect	Correct	Correct	Correct
11	HRUM	Correct	Correct	Correct	Correct	Correct
12	INDY	Correct	Incorrect	Correct	Correct	Correct
13	ITMG	Correct	Correct	Correct	Correct	Correct
14	KKGI	Correct	Correct	Correct	Correct	Correct
15	MBAP	Correct	Correct	Correct	Correct	Correct
16	MYOH	Correct	Correct	Correct	Correct	Correct
17	PKPK	Incorrect	Correct	Incorrect	Incorrect	Incorrect
18	PTBA	Correct	Correct	Correct	Correct	Correct
19	PTRO	Correct	Incorrect	Correct	Correct	Correct
20	SMMT	Correct	Incorrect	Correct	Correct	Incorrect
21	SMRU	Correct	Incorrect	Correct	Correct	Incorrect
22	TOBA	Correct	Correct	Correct	Correct	Correct
Total Correct		20	14	19	20	18
% Correct		90.91%	63,64%	86.36%	90.91%	81.82%
Error measurement		9,09%	36,36%	13,64%	9,09%	18,18%

5.6 Hypothesis Test

The hypothesis test in this study is based on the result of statistical tests that have been carried out. Hypothesis test 1 is conducted a different test using Kruskal Wallis test, while the testing of hypotheses 2 to 6 is based on the result of the model's accuracy in predicting financial distress. The following Table 8 is the summary of hypothesis test results to answer this research.

Table 8. Summary of hypothesis test result

No	Hypothesis	Result	Conclusion
1	There are differences of financial distress prediction result using Modified Altman, Springate, Zmijewski, Ohlson, and Grover Models for coal mining sector listed in IDX period 2015 – 2019.	Sig. Kruskal Wallis test: 0,000	Accepted
2	The Modified Altman Model is the most accurate model in predicting financial distress compared to Springate, Zmijewski, Ohlson, and Grover.	<ul style="list-style-type: none"> • Accuracy: 90,91% • Error: 9.09 	Accepted
3	The Springate Model is the most accurate model in predicting financial distress compared to Modified Altman, Zmijewski, Ohlson, and Grover.	<ul style="list-style-type: none"> • Accuracy: 63,64% • Error: 36,36% 	Rejected
4	The Zmijewski Model is the most accurate model in predicting financial distress compared to Modified Altman, Springate, Ohlson, and Grover.	<ul style="list-style-type: none"> • Accuracy: 86,36 • Error: 13,64 	Rejected

5	The Ohlson Model is the most accurate model in predicting financial distress compared to Modified Altman, Springate, Zmijewski and Grover.	<ul style="list-style-type: none"> • Accuracy: 90,91% • Error: 9.09 	Accepted
6	The Grover Model is the most accurate model in predicting financial distress compared to Modified Altman, Springate, Zmijewski and Ohlson.	<ul style="list-style-type: none"> • Accuracy: 81,82% • Error: 18,18% 	Rejected

6. Conclusion

The calculation of accuracy level generates that Modified Altman and Ohlson Models are the most accurate models compared to Springate, Zmijewski, and Grover. Both models have a prediction accuracy rate of 90.91% and an error measurement of 9.09%. The Zmijewski Model has an accuracy rate and error measurement of 86.36% 13.64%, respectively, followed by Grover Model with an accuracy rate of 81.82% and an error measurement of 18.18%. Springate Model is the worst prediction model with an accuracy rate of 63.64% and the highest error measurement of 36.36%. These are in accordance with the Kruskal Wallis test which states that all models have a significant difference.

This study will be very relevant for further researchers who are concerned with how to measure the level of financial difficulty in coal mining sector companies listed on the Indonesia Stock Exchange (IDX) for the 2019-2021 period beyond.

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