Analysis Of The Use Of Altman, Springate And Zmijewski Models In Predicting Financial Distress In Perumda Tirta Pakuan Bogor City

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Abstract

The purpose of this study was to determine whether Perumda Tirta Pakuan Bogor experienced *financial distress* during the 2017-2022 period according to the Altman, Springate and Zmijewski models, and to find out how the use of the Altman, Springate, Zmijewski models in predicting the possibility of *financial distress*. This research uses a descriptive method with a quantitative approach. The data used in this study are secondary data in the form of annual company financial reports. This study uses the population of the Tirta Pakuan Regional Public Company of Bogor City for the 2017-2022 period. The sample in this study was purposive sampling. The results of predicting financial distress using the Altman method. Springate and Zmijewski show that they do not experience financial distress with all non-distress results.
Keywords: Financial Distress, Altman, Springate, Zmijewski

Introduction

In daily life, water is the component closest to humans that is a basic need for the quality and sustainability of human life. Therefore, water must be available in adequate quantity and quality. Drinking water companies are one of the companies that produce water services to the community where water is a natural resource needed for the livelihood of many people and is a very basic need for all living things, both humans, animals and plants.

A company is a business entity established by individuals or institutions whose activities produce goods and services to meet the economic needs of society according to (Pasrizal, 2014: 04) in (Putri, t.t., p. 1). The development of the current economy which is balanced by intense and competent competition, this requires companies to develop company strategies in order to compete to grow. Generally, the purpose of establishing a company is to increase income and make a profit. Every company always expects maximum profit and prosperity. In order for the company to compete, the company must be able to improve the quality of goods or services produced, create good company performance and maintain stable company conditions. Companies that are unable to control their companies to remain stable will make the company weak in competition, and will reduce investor interest in investing because of course it will have an impact on poor financial conditions. So that the company lacks funds to manage the company. This will threaten the company with failure or bankruptcy.

Financial condition is an important factor to determine the extent to which the company maintains the smooth running of its business activities which can be seen through financial reports. known ratio Return on Assets (ROA) shows an average of 0.07%, which means that the rate of return on profit / investment is predicted to only reach 0.07% or low. the ROE result has an average of 0.08%, it can be interpreted that the company's ROE is low, Perumda Tirta Pakuan Bogor is predicted to be unable to generate significant net profit with the capital it has. cash and cash equivalents at Perumda Tirta Pakuan Bogor in the last 7 years have decreased, where in 2016 cash and cash equivalents amounted to Rp.157.422,630,490 and experienced a significant decline in 2019 reaching Rp.61,369,617,559.80, the declining condition of cash and cash equivalents has the potential to cause liquidity problems if the company's short-term loans increase. One of the things that indicates that the company is experiencing *financial distress* is a decrease in Total Asset Turn Over, sales, profits, working capital, profits and profitability and an increase in corporate debt according to Subramanyam (2014) in (Christiana, t.t., p. 1).

To ensure this, the company must make an early prediction of the company's financial condition as an early warning system for potential *financial distress*. Based on this background description, the authors are interested in conducting research with the title **"Analysis of the Use of the Altman, Springate and Zmijewski Models in Predicting Financial Distress at Perumda Tirta Pakuan Bogor City"**

Methods

Population
Population is an object / subject that has certain qualities and characteristics set by researchers to study and then draw conclusions according to Sugiyono (2015, p. 115) in (Rachmadi et al., 2020). In this study, the population used is the Regional Public Company Tirta Pakuan Bogor City for the 2017-2022 period.

Sample
The sample method in this study is purposive sampling, which is a sampling technique based on certain criteria according to (Sugiono, 2018) in (Wahyudin, 2020). In sampling, researchers have predetermined criteria which are as follows:
1. The Regional Public Company located in Bogor City is the Tirta Pakuan Regional Public Company of Bogor City.
2. Tirta Pakuan Regional Public Company of Bogor City has financial statements for the period relevant for analysis, which is more than the last five years.
3. Tirta Pakuan Regional Public Company of Bogor City which has complete data required t o calculate Altman, Springate and Zmijewski scores

Data Type and Data Source
This research uses a descriptive method with a quantitative approach, which is a research method that describes or describes a situation using numbers or quantitative data. Quantitative descriptive research is to describe, examine, and explain something that is studied as it is, and draw conclusions from phenomena that can be observed using numbers according to (Sulistyawati & Trinuryono, 2022, p. 70).

Data Collection Technique
The data collection technique in this study is using the documentation method by observing and analyzing the annual financial statements of Perumda Tirta Pakuan Bogor for the period 2017-2022 which are available on the company's website.

Data Analysis Method
1. Altman Z-Score
   Altman's *Z-Score* analysis is one of the statistical techniques used to predict corporate bankruptcy. The Altman method was developed by an American national researcher named Edward I. Altman in the mid-1960s, using financial ratios (Kurniawanti, 2012: 3-4) in (Tambunan, t.t.-b, p. 5), the following is the Altman model equation:

$$Z = 1.2X_1 + 1.4X_2 + 3.3X_3 + 0.6X_4 + 0.999X_5$$

Description:
X_1 = Working Capital / Tottal Assets
X_2 = Retained Earnings / Total Assets
X_3 = Earning Before Interest and Tax / Total Assets
X_4 = Market Value of Equity / Book Value of Debt
X_5 = Sales / Total Assets
Z = Overal Index

Table 1 Model Altman Z-Score Cut-off

Cut-off Value	Category
Z > 2,60	Non-Distress
1,1 < Z < 2,60	Grey
Z < 1,1	Distress

Source: (Irfani,2020)

2. Springate S-Score

This model was developed in 1978 by Gorgon L.V. Springate. Gordon L.V. Springate (1978) conducted research to find a model that could be used to predict potential (indications) of bankruptcy. Springate (1978) used 19 popular financial ratios that can be used to predict financial distress. Springate finally found 4 ratios that can be used in predicting the potential (indication) of company bankruptcy which according to Ghodrati has an accuracy rate of up to 92.5% (2012) in (Ben & Ar, t.t.-a, p. 3). The following is the formula of the Springate model:

$$S = 1.03X_1 + 3.07X_2 + 0.66X_3 + 0.4X_4$$

Description:

X1 = Working Capital to Assets Ratio

X2 = Earning Before Interest and Taxes to Total Asset Ratio

X3 = Earning Before Taxes to Current Liabilities

X4 = Sales to Total Assets

S = Overal Index

Table 2 Model Springate Cut-off

Cut-off Value	Category
S > 0,862	Non-Distress
S < 0,862	Distress

Source: (Irfani,2020)

3. Zmijewski

The Zmijewski bankruptcy prediction model is also one of the bankruptcy prediction models introduced in 1984. In his research, Zmijewski used a sample of 40 companies in the bankrupt bankruptcy category and 800 others from companies that were not bankrupt where the sampling was done randomly (Januri, Sari and Diyanti, 2017) in (Kholifah et al. - 2020 - p. 502). The determination of groups of ratios is rate of return, liquidity, leverage, turnover, fixed payment coverage, trends, firm size and stock return volatility, showing a significant difference between healthy and unhealthy companies. The following is the formula for the Zmijewski model:

$$X = -4.3 - 4.5X_1 + 5.7 X_2 - 0.004X_3$$

Description:

X1 = Net Income / Total Assets

X2 = Total Debt / Total Assets

X3 = Current Assets / Current Liabilities

X = Zmijewski method analysis results

Table 3 Model Zmijewski Cut-off

Cut-off Value	Category
X > 0	*Distress*
X < 0	*Non-Distress*

Source: (Irfani,2020)

Results

Descriptive Analysis

1. **Financial distress prediction results at Perumda Tirta Pakuan Bogor 2017-2022 using the Altman Z-Score Model**

Table 4. Altman Model Calculation Results

Year	X1	X2	X3	X4	X5	Z	Category
2017	0.24	0.12	0.24	2.79	0.37	3.33	Non-Distress
2018	0.20	0.09	0.26	2.58	0.42	3.22	Non-Distress
2019	0.20	0.11	0.29	2.67	0.47	3.45	Non-Distress

2020	0.25	0.09	0.29	3.35	0.44	3.84	Non-Distress
2021	0.21	0.13	0.26	4.05	0.43	4.18	Non-Distress
2022	0.22	0.14	0.28	3.25	0.47	3.83	Non-Distress

Source: Data processed, 2023

Based on table 4 for the last 6 years, namely the 2017-2022 period, Perumda Tirta Pakuan Bogor has increased every year on the Z-Score value. This is due to capital funding in 2017 which funds, namely, APBN, SDA, Cipta Karya, DAK, APBD I, APBD II, PDAM and other funding. In 2018, the Z-Score value decreased to 3.22 because those who funded it were the APBN, DAK, APBD II, PDAM and other funding. In 2020 to 2021, there was an increase in the Z-Score value of the largest capital, namely because in 2020 the APBN funded the largest capital and in 2021 APBD II funded the largest until it had a Z-Score of 4.18. And in 2022 it decreased again until the Z-Score number was 3.83 because the funding source in 2022 funding was relatively average in each year. From the explanation above, it can be concluded that the company does not have a financial condition problem because it is above the cut-off value above Z-Score, which is more than 2.60. From 2017 to 2022 each year is declared good and in a healthy state for the next one to two years.

2. **Results of Financial distress Prediction at Perumda Tirta Pakuan Bogor 2017-2022 Using the Springate Model**

Table 5. Springate Model Calculation Results

Year	X1	X2	X3	X4	S	Category
2017	0.24	0.24	0.93	0.37	1.77	Non-Distress
2018	0.19	0.26	0.96	0.42	1.83	Non-Distress
2019	0.20	0.29	1.13	0.47	2.06	Non-Distress
2020	0.24	0.29	1.02	0.44	2.00	Non-Distress
2021	0.21	0.26	1.01	0.43	1.88	Non-Distress
2022	0.21	0.28	1.20	0.47	2.08	Non-Distress

Source: Data processed, 2023

Based on the results of the calculation of *financial distress* predictions carried out using the springate method as stated in the table above, that for the last six years From the results of this study, it can be seen that the company's Springate S-Score value has increased every year. In 2017 to 2019, the S- Score number increased to 2.06 in 2019 due to having a water sales revenue figure with total revenue in 2019 of Rp.275,546,803,271.00 compared to the previous year such as in 2018, namely Rp.228,586,131,600.00 and 2017, namely Rp. 203,445,448,010.00. In 2021, there was a decrease in the S-Score number of 1.88, which was due to decreased water sales revenue due to the effects of the co-19 pandemic, but it was still relatively not having financial condition problems. And in 2022 it increased again until it reached sales in 2022 of Rp. 299,220,882,900.00, this is the highest sales figure from previous years, because in 2021 it received the most funding from APBD II for the business plan, namely the widening of the construction of waterways until 25 widening items have been carried out from 30 existing activity items, thereby increasing water sales revenue in 2022. In this case, the explanation above that in 2017-2022 has an average S-Score value of 2.09 where the value is above 0.86, this shows that the company has good financial performance and it can be said that the company is far from bankruptcy, with the results from 2017-2022 having a non-distress category.

3. **Financial distress prediction results at Perumda Tirta Pakuan Bogor 2017-2022 using the Zmijewski model**

Table 6. Zmijewski Model Calculation Results

Year	X1	X2	X3	X	Category
2017	0.06	0.26	3.54	-3.10	Non-Distress
2018	0.07	0.27	3.48	-3.08	Non-Distress
2019	0.08	0.27	3.17	-3.13	Non-Distress

2020	0.07	0.22	4.20	-3.37	Non-Distress
2021	0.06	0.27	3.42	-3.04	Non-Distress
2022	0.07	0.23	3.45	-3.31	Non-Distress

Source: Data processed. 2023

Based on table 6 that the results of the calculation with the zmijewski model, in 2018 the X-Score value decreased to -3.08 compared to 2017, namely -3.10 which was due to a decrease because current assets increased and current liabilities also increased. In 2019 it increased again so that the X value was -3.13 until 2020 to -3.37, in 2020 the biggest increase was due to current assets and current liabilities also increasing but still large current assets compared to current liabilities so that these results show that from 2017 to 2022 it is in the non-distress category or not experiencing financial problems because the results are less than 0, which means below the cut-off value with an average result value of -3.17, negative results tend not to face financial distress conditions, Perumda Tirta Pakuan Bogor City consistently produces good operating cash.

4. **Analysis of Accuracy Level and Error Type of Altman, Springate and Zmijewski Models Discussion**

This test is carried out on the Altman, Springate and Zmijewski models, the following is the calculation of the accuracy rate of the Altman, Springate and Zmijewski models with the Formula:

$$Accuracy\ Rate = \frac{Number\ of\ Correct\ Predictions}{Number\ of\ Samples} X\ 100\%$$

Table 7. Altman, Springate and Zmijewski Model Accuracy

Prediction	Altman	Springate	Zmijewski
Correct Prediction	1	1	1
Wrong Prediction	0	0	0
Total Sample	1	1	1
%Accuracy	100%	100%	100%

Source: Data processed, 2023

The following is the calculation of the type of error for the Altman, Springate and Zmijewski models with the formula:

$$Type\ Error = \frac{Number\ of\ Correct\ Predictions}{Number\ of\ Samples} X100\%$$

Table 8. of Error Types of Altman, Springate and Zmijewski Models

Prediction	Altman	Springate	Zmijewski
Correct Prediction	1	1	1

Wrong Prediction	0	0	0
Total Sample	1	1	1
%Type Error	0%	0%	0%

Source: Data processed, 2023

From the calculation of the accuracy of the three *financial distress* prediction models Altman, Springate and Zmijewski that Perumda Tirta Pakuan Kota Bogor Period 2017 - 2022 none of them experienced *financial distress*. This is in accordance with the fact that no one has experienced bankruptcy because it is still operating well until now. Of the three models Altman, Springate and Zmijewski have no errors in predicting so that the accuracy rate is 100% and the error type is 0%.

5. Analysis Results and Discussion

The results of this study indicate that there is agreement between the research results and the previous theory, namely using the altman, springate and zmijewski models, the results are non-distress in predicting bankruptcy. Prediction of *financial distress* at Perumda Tirta Pakuan Bogor City using the altman, springate and zmijewski models, the majority is non-distress in the 2017-2022 period. The most accurate models to use in predicting financial distress at Perumda Tirta Pakuan are the Altman, Springate and Zmijewski models. These results support several studies such as research conducted by (Ulfah & Moin, 2022) where the altman model, zmijewski results are non-distress, the highest accuracy rate is 100% and springate accuracy rate is 66%. Research conducted by (Nurasia, 2016) where the Altman and Zmijewski models are the models with the highest level of accuracy with non-distress prediction results and research conducted by (Meiliawati & Isharijadi, 2017) where the springate model is the most accurate result in predicting financial distress.

Conclusion

1) The results of predicting *financial distress* using the altman model show that Perumda Tirta Pakuan Bogor does not experience *financial distress* from 2017 to 2022 with the Non-Distress result category. The results of predicting *financial distress* using the springate model show that Perumda Tirta Pakuan Bogor does not experience *financial distress* from 2017 to 2022 with the Non-Distress result category. *Financial distress* prediction results with using the zmijewski model shows that Perumda Tirta Pakuan Bogor is not experiencing any problems. *financial distress* from 2017 to 2022 with a Non-Distress outcome category. 2) In using the prediction model, both altman, springate and zmijewski, the first step is to calculate the financial ratios used in each prediction model. For the altman model, the financial ratios used include *working capital to total assets ratio, retained earnings to total assets ratio, earnings before interest and taxes to total assets ratio, book value of equity to book value of debt ratio and sales to total assets*. Meanwhile, the springate model includes, *working capital to total assets ratio, earning before interest and tax to total assets ratio, earning before tax to current liabilities ratio, and sales to total assets ratio*. And for the zmijewski model includes, *net income to total assets, total debt to total assets, and current assets to current liabilities*. After calculating the financial ratios, the next step is to determine the Z-Score for Altman, S-Score for Springate and X-Score for Zmijewski using their respective formulas. The formula for the altman model is $Z = 6.56X1 + 3.26X3 + 6.72X3 + 1.05X4 + 0.999X5$, for the formula used by springate, namely $S = 1.03X1 + 3.07X2 + 0.66X3 + 0.4X4$ and for the formula used by zmijewski, namely $X = -4.3 - 4.5X1 + 5.7 X2 - 0.004X3$. From the results of the Z-Score, S-Score and X-Score calculations, we can determine whether the company is experiencing *financial distress* or not by categorizing each of these values in accordance with the discrimination zone or cut-off value

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