p-ISSN 2622-3082
e-ISSN 2622-3090

Analysis of Differences Between Altman's and Zmijewski's Models in Predicting Financial Distress

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ABSTRACT

This study aims to see the comparation between Altman model and the Zmijewski model in forecasting financial problems in transportation corporation indexed on the Indonesia Stock Exchange (IDX) during 2019-2021. This research used descriptive quantitative method and select the sample using purposive sampling method, which is using certain criteria to select the sample. To test the hypothesis about the difference between two models, the research data is testing with wilcoxon test. The findings showed that there was no substantial difference between the Altman model and the Zmijewski model in forecasting financial problems in corporations indexed on the IDX during 2019-2021. However, the Zmijewski model is more accurate in forecasting financial problems in transportation corporations indexed on the IDX during that period.This research is important because it can help companies take the right steps when facing financial problems that can lead to bankruptcy.

Keywords: Altman Model, Zmijewski Model, Financial Distress

ABSTRAK

Penelitian ini bertujuan untuk membandingkan model Altman dan model Zmijewski dalam memprediksi masalah keuangan pada perusahaan transportasi yang terdaftar di Bursa Efek Indonesia (BEI) selama tahun 2019 -2021. Metode penelitian yang digunakan adalah deskriptif kuantitatif dengan pengambilan sampel purposif, yaitu memilih sampel berdasarkan kriteria tertentu. Data diolah menggunakan uji beda untuk menguji hipotesis perbedaan antara kedua model tersebut. Hasil penelitian menunjukkan bahwa tidak ada perbedaan signifikan antara model Altman dan model Zmijewski dalam memprediksi masalah keuangan pada perusahaan yang terdaftar di BEI selama tahun 2019-2021. Namun, model Zmijewski lebih akurat dalam memprediksi masalah keuangan pada perusahaan transportasi yang terdaftar di BEI selama periode tersebut. Penelitian ini penting karena dapat membantu perusahaan mengambil langkah-langkah yang tepat ketika menghadapi masalah keuangan yang dapat mengarah pada kebangkrutan.

Kata Kunci: *Model Altman, Model Zmijewski, Financial Distress*

Jurnal Akun Nabelo:
Jurnal Akuntansi Netral, Akuntabel, Objektif
Volume 7/Nomor 1/Juli 2024
doi:10.11594/untad.jan.6.1.24711
Jurusan Akuntansi FEB Universitas Tadulako

A. INTRODUCTION

The spread of COVID-19 has been felt and impacted in Indonesia since 2020, although its spread was felt by the world at the end of 2019. According to the Minister of Finance of the Republic of Indonesia, Sri Mulyani Indrawati, the COVID-19 pandemic has caused economic instability in Indonesia (CNBC, 2020). COVID-19 pandemic has caused an economic effect and can be felt through the business world, including in the transportation sector. Before the pandemic, urban populations led to higher demand for public transport and efficient mobility solutions. Infrastructure development focused on expanding road networks, public transit systems, and smart city initiatives. International trade boosted demand for efficient logistics and freight tansport. At the beginning of the pandemic, the transportation business was almost completely paralyzed because transportation modes were only used to transport logistics and not passengers. Lockdowns and social distancing reduced passanger transport, especially public transit and air travel. Government policies are very dynamic in dealing with the development of COVID-19 in Indonesia by considering the situation and local conditions. In the second quarter of 2020, Indonesia economy shrank by 5.32%, with the transportation sector experiencing the deepest contraction, according to the Central Statistics Agency (BPS). As a result of the data, companies engaged in the transportation sector experienced a significant decline. Government regulations must also consider economic and social aspects, but the decline in economic activity in the transportation sector can result in serious losses, even bankruptcy if not handled properly.

Some transportation companies have suffered losses during the pandemic, such as PT Garuda Indonesia Tbk. In the early six months of 2020, PT Garuda Indonesia reported a net deficit of US$ 712.72 million or around Rp 10.47 trillion, inversely proportional to the previous year's net profit of US$ 24.11 million or around Rp 354.48 billion. PT Garuda Indonesia (Persero) Tbk (GIAA) also reported a deficit of US$ 2.5 billion or around Rp 36.2 trillion previous year because of the pandemic (Media Indonesia, 2020). President Director of PT Blue Bird Tbk (BIRD), Noni Purnomo, revealed that the company's performance fell because of the COVID-19 pandemic, especially within taxi business which experienced a significant decline due to policies to prevent the spread of COVID-19 (Liputan6, 2020). PT Blue Bird Tbk reported a shortfall of Rp 93.67 billion in the early six months of 2020, but during the same time frame the year prior, the company earned a net profit of Rp 158.37 billion, showing a 129.15% decline in profitability (Katadata, August 13, 2020). PT.Kereta Api Indonesia also experienced a downturn during the Covid pandemic, show a sharp decline in passangers numbers for both long distance and commuter trains, PT KAI also reduced train frequencies and suspend some services during peak lockdown period. PT KAI recorded a loss of Rp.303,4 billion during the first quarter.To avoid further losses, the company undertook several masures to remain resilient amidst the COVID-19. According to the Minister of Transportation, transportation and logistics were the sectors most affected by the covid-19 pandemic.

Based on the data above, it appears that leading transportation companies in Indonesia are also experiencing the COVID-19 pandemic effect. Financial difficulties and the inability to fulfill a company's obligations due to lack of adequate funds to run its business are often referred to as financial distress. This condition generally occurs before bankruptcy. The financial performance of a company can be an early

indicator that the company is experiencing financial distress (Azzahra & Pangestuti, 2022). Bankruptcy can be avoided if companies can recognize the early signs of financial distress and take appropriate steps for management. In this study, two models are used to predict the early symptoms of corporate bankruptcy, namely the Altman model and the Zmijewski model. Prior to Ashraf et al (2019), both models still have a better value in predicting early symptoms of bankruptcy compared to other models. The Zmijewski model is considered more accurate than other models, while the Altman model is considered the best model for predicting bankruptcy in early and advanced stages. These two models suitable for business people, financial experts, administrators, and other stakeholder who pay special attention to investment in companies or organizations to improve the performance of these companies/organizations. Research by Melina & Susetyo (2021) shows Altman, Springate, and Zmijewski methods have substantial differences in forecasting bankruptcy in textile corporations indexed on the IDX beginning at 2017 to 2019, and the Zmijewski model has the highest level of accuracy in predicting bankruptcy. With this background, there are still inconsistencies in the results of previous studies, so the researcher intends to re-examine the Altman model and the Zmijewski model differences in forecasting financial distress and analyze which bankruptcy model is more accurate in predicting financial distress in transportation corporations indexed on the IDX from 2019 to 2021. This research aimed to determine whether Altman model and the Zmijewski model have a difference in forecasting the financial distress in transportation corporations indexed on the IDX start in 2019 until 2021 and to analyze which bankruptcy model is more accurate in predicting financial distress in transportation corporations indexed on the IDX from 2019 until 2021. The urgency of this research is to enable companies that show early signals of financial distress to be addressed promptly by management, thereby safeguarding the company from deterioration leading to bankruptcy.

B. LITERATUR REVIEW

In this study, Altman model, the Zmijewski model, and financial distress become related variables. The following is an explanation of each of these variables. There are several models used to predict the financial health of a company, two of them are Altman Model and Zmijewski Model. Both models still have a better value in predicting early symptoms of bankruptcy compared to other models.

Altman Model (Z-Score)

The Altman model has unified several ratios into a prediction model using a statistical technique called multiple discriminant analysis to estimate the probability of corporate bankruptcy, known as the Z-Score. The Altman models developed by Edward I.Altman in 1968. These models use various financial ratios derived from a company's financial statements to calculate a score, which indicates the company's financial health and bankruptcy risk. The Altman identified 5 types of financial ratios that can be combined to distinguish between corporations that are already bankrupt and not bankrupt yet. The original Altman Z-Score, developed in 1968 for publicy traded manufacturing companies, employs five financial ratios:

1. Working Capital/Total Assets: measures liquidity.
2. Retained Earnings/Total Assets: indicates cumulative profitability.

3. Earnings Before Interest and Texes (EBIT)/Total Assets: Measure operating efficiency.
4. Market Value of Equity/Book Value of Total Liabilities: Assesses leverage.
5. Sales/Total Assets: Evaluates asset turnover.

The formula below is used to calculate the value for Altman's Z-Score:
Z-Score = 1.2 X1 + 1.4 X2 + 3.3 X3+ 0.6 X4 + 1.0 X5
Altman (1968)
Description:
X1 = Working Capital to Total Assets
X2 = Retained Earned to Total Assets
X3 = Earning Before Interest and Tax to Total Assets
X4 = Market Value of Equity to Book Value to Total Debt
X5 = Sales to Total Assets

According to Rudianto (2013), Altman concluded that if a company has a bankruptcy index of 3 or higher, then the company will not be classified as experiencing bankruptcy. However, if the bankruptcy index of a company is 1.8 or less, then the company is considered in the bankrupt category. Processing results using the Z-score formula will produce scores that differ from one company to another. The score must then be compared with the following assessment standards to evaluate the company's survival:

Altman Z-Score Model Cut-Off Value

Prediction Cut-Off Value
Z < 1.8 Bankrupt Condition
1.8 < Z < 2.99 Gray Area Condition
2.99 < Z Healthy Condition
Source: Rudianto, processed 2020

Zmijewski X-Score Model

Zmijewski developed a bankruptcy prediction model in 1984 by Mark E.Zmijewski. This model asses a corporation's financial performance, leverage, and liquidity using several financial ratios. One of the regression methods used in the analysis is probit model, utilizing the cumulative normal probability distribution. To assess performance, leverage, and liquidity of a company, whether it is experiencing the financial distress of a company, Zmijewski's probit analysis utilizes some financial ratios. The Zmijewski model is less commonly known than the Altman Z-Score but is also a significant tool in bankruptcy prediction. The model is based on the following three financial ratios:

1. 1.Return on Assets (ROA): measure the profitability of a company relative to its total assets. It is calculated as Net Income/Total Assets.
2. Debt Ratio: measures the propotion of a company's assets that are financed by debt. It is calculated as Total Liabilities/Total Assets.
3. Current Ratio: measures the liquidity of a company.It it calculated as Current Assets/Current Liabilities.

Based on previous research (Ashraf et al., 2019), the accuracy of Zmijewski's analysis in predicting company bankruptcy reached 98.2%. The scores generated by the companies that are the subject of research from the above calculations can be compared with the threshold values for the categories as follows:
P = Φ(-4.336 - 4.513N ITA + 5.679TLTA + 0.004CACL)

Notes:
NITA =Net income/Total assets
TLTA =Total liabilities/Total assets
CACL =Current assets/Current liabilities
Source: Ashraf et al (2019)

Zmijewski X-Score Model Cut-Off Value
Predicted Cut-Off Value
0 < X Bankrupt Condition
X < 0 Non-bankrupt condition
Source: Rudianto, processed 2020

Financial Distress

Financial distress is a situation in which a corporation struggles to fulfill its debt obligations due to a lack of cash flow (Wruck, 1990). Understanding further the impact of financial distress can be done by looking at the decline in firm value before actual bankruptcy(Whitaker, 1999). Researchers use various models to identify financial distress with a high degree of accuracy. When companies show signs of bankruptcy, it is expected that they can immediately take corrective measures. The Altman Z-score Bankruptcy Prediction Model (Syafri, 2019) provides a formula to determine when a company is considered bankrupt. This formula involves financial ratios, which then produce a value that indicates the likelihood of company bankruptcy.

Profitability

According to Kasmir (2012), the ratio of profitability is a metric used to assess a corporation's capacity to turn a profit from regular business operations of said corporation. As an operating entity, the company has the main objective to achieve profit by selling products (goods or services) to customers. The main focus of the company's operations is achieving optimal short term and long term profitability. Management is expected to increase returns for company owners and at the same time improve employee welfare. The calculation of profitability applied in the Altman and Zmijewski models involves:
EBITDA = Earnings before interest & taxes/Total assets
STA = Sales/Total assets
NITA = Net income/Total assets
Source:Ashraf et al (2019)

Liquidity

According to Fahmi (2012), the ratio of liquidity utilized to evaluate the company's capacity to fulfill short-term loan obligations by specified dates. This ratio shows the amount of assets that 5hould be turned into cash in the same time frame to cover short-term creditors demands. The liquidity calculation applied in the Altman and Zmijewski models involves:
MCTL = Market value of equity/Book value of total liabilities
CACL = Current assets/Current liabilities
Source: Ashraf et al (2019)

Leverage

Kasmir (2012) states that leverage is the use of assets that must be carried out by the company to cover its fixed costs. Leverage is used to evaluate how large the proportion of expenditures made by fund owners is

compared to expenditures provided by creditors to fund the corporation's assets and needs. In the Altman and Zmijewski models, the calculation of leverage involves:
RETA= Retained earnings/Total assets
MCTL =Market value of equity/Book value of total liabilities
TLTA= Total liabilities/Total assets
Source: Ashraf et al (2019)

The previous study conducted by Melina & Susetyo (2021) concluded that the results of bankruptcy prediction scores between the Altman, Springate, and Zmijewski models are different. They found that Zmijewski model has higher accuracy compare to the other models. Because of that, this research propose the hypothesis as follows:

H1: Altman model and the Zmijewski model have difference ability to forecast financial distress in transportation corporation indexed on the IDX during the period of 2019-2021.

H2: It is assumed that compare to Altman model, the Zmijewski model has a higher level of accuracy in forecasting financial distress in transportation corporation indexed on the IDX during the period of 2019-2021.
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C. RESEARCH METHOD

This study evaluates the different abilities of the Altman model and the Zmijewski model in predicting financial distress conditions in transportation companies listed on the Indonesia Stock Exchange (IDX) during the 2019-2021 period. This research approach is descriptive quantitative by involving statistical tests and calculating the accuracy of the bankruptcy model to strengthen the findings on transportation companies on the IDX. The main objective of the study is to assess the difference between the Altman and Zmijewski Models in forecasting financial distress in transportation companies on the IDX in 2019-2021, while identifying the model that has a higher level of accuracy in predicting the condition of companies, especially transportation companies listed on the IDX during the period.

The independent variables evaluated in this study include Working Capital to Total Assets (WCTA), Retained Earnings to Total Assets (RETA), Earnings Before Interest and Taxes to Total Assets (EBITTA), Market Value of Equity to Book Value of Total Debt to Total Assets (MCTL), Sales to Total Assets (STA), Net Income to Total Assets (NITA), Total Liabilities to Total Assets (TLTA), and Current Assets to Current Liabilities (CACL). The dependent variable is financial distress, measured using two models. In the Altman Z-Score model, the company is considered bankrupt if $Z < 1.8$, is in a gray area if $1.8 < Z < 2.99$, and is considered healthy if $Z > 2.99$. While in the Zmijewski X-Score model, the company is considered bankrupt if $X > 0$, and not bankrupt if $X < 0$.

The research population consists of transportation companies whose shares are listed on the Indonesia Stock Exchange during the 2019-2021 period. The number of transportation companies listed on the IDX from 2019-2021 is 43 companies. These companies cover a variety of subsectors within transportation, including air,sea and land services. Sampling was carried out using purposive sampling technique by considering certain criteria in sample selection. The number of samples used in this research was 22 companies, with sampling technique using purposive sampling.The

observed data used in this research is 66 data. The data was processed using the Wilcoxon Test to examine the hypothesis of differences between two groups of related data.

In addition, to assess the level of accuracy, a comparison of the number of correct predictions with the number of samples was carried out (Melina & Susetyo, 2021).The Altman and Zmijewski models were compared to predict bankruptcy. The effectiveness of these models in forecasting the financial condition of transportation companies is expected to contribute to predicting bankruptcy and company survival. A high level of accuracy in a model can provide more reliable information for stakeholders such as investors, creditors, auditors, company management, and other parties, thus helping them make more informed decisions to avoid potential losses.
The research data was obtained through the financial statements of transportation companies listed on the IDX between 2019-2021, and this data was accessed through the website www.idx.co.id. There are abnormalities in the distribution of data, which may be due to natural variations in the population, the presence of outlier data, or special characteristics of the observed variables. Therefore, the hypothesis test in this study uses a non-parametric method with the Wilcoxon Test to assess the difference between two groups of interrelated data.

D. RESULTS AND DISCUSSION

Mean, max, min, and standard deviation values of the two research models in this study were determined by conducting descriptive analysis, namely the Altman model and the Zmijewski model in forecasting financial distress in transportation corporation indexed on the IDX during the period of 2019-2021.

Tabel 1.Descriptive Statistic Data

DESCRIPTIVE STATISTIC						
	Thn	N	Minimum	Maximum	Mean	Stdr.Deviasi
ALTMAN	2019-2021	66	-26,32	30,13	-2,1244	7,05293
ZMIJEWSKI		66	-12,73	14,48	-0,0816	3,98550

Source: data processed 2023

The table above shows the min, max, mean, and standard deviation values in both models in 2019, 2020, 2021, and overall years 19-21. The Altman model has the largest minimum value, which is -26.32, namely the PT. Berlian Laju Tanker Company is the worst-conditioned company. The maximum value that has the largest score in the Altman model is 30.13, namely the company PT Pelayaran Tempuran Emas Tbk is the best-conditioned company. The average value of companies that do not go bankrupt shows a score lower compare to the standard deviation, this suggests that the distribution is not normal and introduces bias, as the standard deviation reflects a high deviation, leading to subpar outcomes.

In this research, hypothesis get tested using Wilcoxon test. This testing used for test the differences between two groups of related data.

Tabel 2.Wilcoxon test results

WILCOXON TEST RESULTS					
		2019	2020	2021	2019-2021
Altman-Zmijewski	0.709	0,158	0,57	0,175	

Source: data processed 2023

The test results using the Wilcoxon test, show that no difference observe between the Altman model and the Zmijewski model in detecting financial distress in transportation corporations indexed on the IDX during 2019-2021 period. This is because the asymp sig value is> 5%, these results are the same in 2019, 2020, 2021, and even overall 2019-2021 which shows that there is no difference between the two models, namely the Altman model and the Zmijewski model in forecasting financial distress in transportation corporations indexed on the IDX during 2019-2021 period.

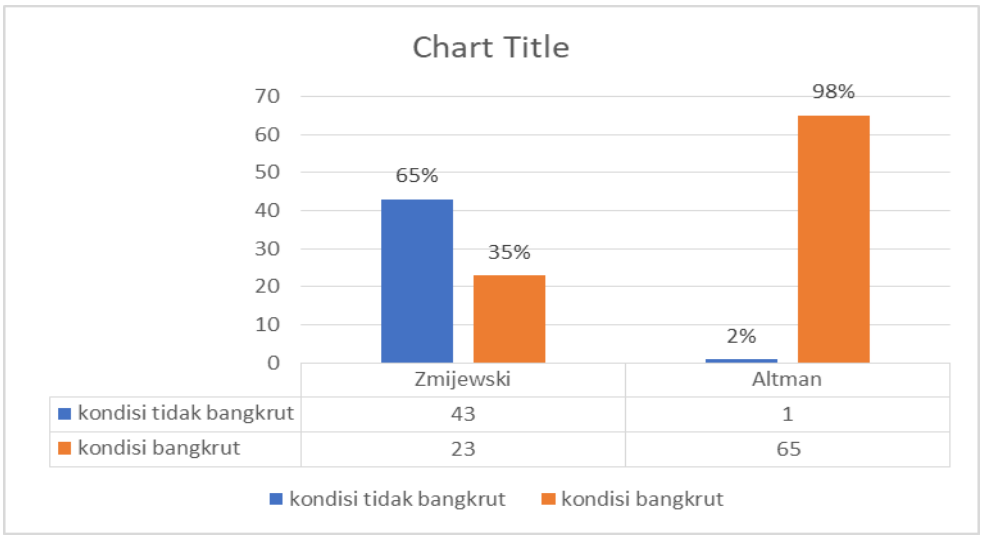
In this research, the number of accurate predictions divided by the total number of samples is used to calculate the accuracy level, the number of inaccurate predictions is known as the error type.

Tabel 3. Accuracy Level

Accuracy Level	Zmijewski	Altman	Zmijewski	Altman
kondisi tidak bangkrut	43	1	65%	2%
kondisi bangkrut	23	65	35%	98%

Source: data processed 2023

Diagram 1 Accuracy Level



Source: data processed 2023

From the outcome of test with the Altman model, it exhibits that 1 sample is predicted to be healthy. Then there is 1 correct prediction. While the other 65 data are predicted to go bankrupt. The accuracy level of bankruptcy prediction with the Altman model for transportation corporations indexed on the IDX in 2019-2021 is 2% with an error rate of 98% (table 3 and Diagram 1).

From the outcome of test with the Zmijewski model, it exhibits that 43 samples are predicted to be healthy. Then there are 43 correct predictions. Meanwhile, 23 other data are predicted to go bankrupt. The accuracy level of the Zmijewski model to forecast the bankruptcy of transportation corporations indexed on the IDX in 2019-2021 period is 65% with an error rate of 35%. (table 3 and diagram 1)

E. DISCUSSION

In this study, it can be concluded empirically that there is no difference between the Altman and Zmijewski Models in forecasting financial distress in transportation corporations indexed on the IDX. The data analysed covers the period 2019 to 2021 with a sample size of 22 transportation companies with a total of 66 data observed and the test results using the Wilcoxon test show that there is no difference between the two models in predicting financial distress in transportation corporations indexed on the IDX during 2019-2021 period. Based on the accuracy rate for predicting the bankruptcy of transportation corporations indexed on the IDX during 2019-2021, the Zmijewski model prove to be more accurate than the Altman model, with a percentage of accuracy shows 65% and percentage of error shows 35%. Meanwhile, the Altman model only achieves a percentage accuracy of 2% with percentage of error shows 98%.

Altman Model of Financial Distress

The outcomes of this research are not aligned with previous study Melina & Susetyo (2021). which found significant differences between the Altman, Springate, and Zmijewski models in forecasting bankruptcy in textile and garment corporations. However, the outcomes of this research are aligned with previous study Azzahra & Pangestuti (2022) which shows that the Altman model provides the lowest level of accuracy in forecasting the level of bankruptcy in transportation corporations indexed on the IDX. This shows that the Altman model is not as effective as the Zmijewski model in predicting financial distress in transportation corporations indexed on the IDX during 2019-2021 period.

Zmijewski X-Score Model Against Financial Distress

The outcomes of this research are also aligned with previous study Melina & Susetyo (2021)which shows that the Zmijewski model has the highest level of accuracy to forecast bankruptcy in textile and garment companies indexed on the IDX. This shows that the Zmijewski model is a

better choice for predicting the condition of companies experiencing financial problems. These results are consistent with the statements of previous research and show that the most effective model to forecasting financial distress in transportation corporations indexed on the IDX during 2019-2021 period is Zmijewski model. (Azzahra & Pangestuti ,2022)

During the COVID-19 pandemic, companies in the transportation sector faced extraordinary challenges that significantly impacted their financial health. Utilizing the Altman and Zmijewski models to analyze the likelihood of corporate bankruptcy in this sector provides valuable insights. The Altman and Zmijewski models allow companies to identify bankruptcy risk early, enabling them to take necessary mitigation actions. Companies can undertake financial restructuring, reduce operational cost, or seek additional funding sources to survive. Management can make more informed decisions based on the models analysis results. Although there is no significant difference between the Altman model and the Zmijewski model in forecasting bankruptcy in transportation corporations indexed on the IDX for 2019-2021, both of this models is still used as a reference in decision making for management. The accuracy of both models may vary depending on the dataset used and the characteristics of the company being analyzed. Factors such as the features and metrics used, the dataset used, differences in model methods, and sample size can affect the accuracy of each model. Overall, the use of the Altman and Zmijewski models during the Covid-19 pandemic provides a clear picture of the financial health of transportation companies, assists in strategic decision making and serves as a guide in addressing the economic crisis.

F. CONCLUTIONS AND RECOMMENDATION

CONCLUTIONS

1. No difference has found between the Altman and the Zmijewski models in forecasting financial distress in transportation corporations indexed on the IDX during 2019-2021 period.

2. Compare to Altman model, the accuracy level in signaling bankruptcy in transportation corporation is higher if using Zmijewski model.

RECOMMENDATION

This study recommends using the Zmijewski model in providing bankruptcy signals for the company because the accuracy rate is higher than the Altman model in transportation companies. In addition, researchers also recommend expanding research to other business sectors to gain a broader understanding of the prediction of corporate bankruptcy.

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