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ANALYSIS OF FINANCIAL DISTRESS POTENTIAL USING THE ZMIJEWSKI METHOD IN COAL MINING SUBSECTOR COMPANIES LISTED ON THE INDONESIA STOCK EXCHANGE FOR THE 2019-2023 PERIOD

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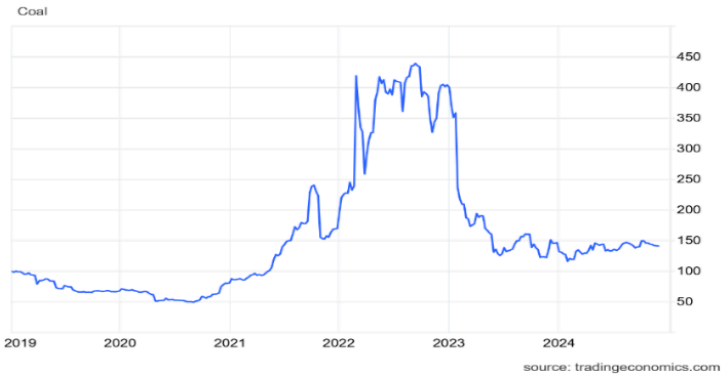
Abstract: Significant fluctuations in coal prices during the 2019-2023 period impacted the financial performance of coal mining subsector companies listed on the Indonesia Stock Exchange. This condition increased the risk of financial distress, which refers to financial difficulties that could potentially lead to bankruptcy if not properly addressed. This research aims to analyze, determine the accuracy level, and formulate strategies to address potential financial distress in 14 selected companies using the purposive sampling method. This descriptive quantitative research utilizes financial report data from 2019-2023, analyzed using the Zmijewski method, which involves the Return on Assets (ROA), Debt Ratio, and Current Ratio. The results indicate that, on average, companies remained in the non-financial distress category throughout the period. However, two companies, CNKO and DWGL, consistently experienced financial distress. Additionally, AIMS faced financial distress in 2023, BSML in 2019, and CBRE from 2019 to 2021. The accuracy rate of the Zmijewski X-Score method was 77%, with an error rate of 23%. Strategies for addressing financial distress include increasing ROA through operational efficiency, prudent debt management to reduce the Debt Ratio, and managing current liabilities, inventory, and receivables to improve the Current Ratio.

Keywords: Financial Distress, Coal Mining, Zmijewski Method

INTRODUCTION

Introduction

Indonesia is among the top coal producers and exporters globally, with 67% of its domestic power plants still relying on coal as a fuel source. In 2023, the coal sector contributed approximately 100 trillion rupiahs in Non-Tax State Revenue (PNBP). Indonesia supplies 30-40% of global coal demand, primarily for China and India. This industry also employs over 330,000 workers and allocates around 2.5 trillion rupiahs for community empowerment programs (Sinaga, 2024). However, the coal sector faces significant challenges. Coal price fluctuations in recent years have been influenced by various factors. The following is data on the Coal Benchmark Price (HBA) for 2019-2023.



Picture 1
Coal Reference Price (HBA) for 2019-2023
Source: traingeconomics.com

In 2019, the price was relatively stable at around USD 100 per ton. However, in 2020, it dropped to USD 65.77 per ton due to the COVID-19 pandemic (esdm.go.id, 2020). In 2021, prices recovered to USD 215.01 per ton before plunging by 26% due to increased domestic production in China (Kompas.com, 2021). In 2022, Indonesian coal prices surged due to the European energy crisis (Andrianto, 2023). However, in 2023, prices drastically dropped to USD 128.05 per ton, influenced by the weakening Chinese economy, reduced purchasing power, and decreased imports from India (cnbcindonesia.com, 2023). The price decline had significant impacts, including the termination of employment (layoffs) affecting approximately 500 workers in South Sumatra (Munir, 2024), as well as 286 workers impacted in Kalimantan after three mining companies halted production (Dzulviqor & Khairin, 2023).

There is a negative impact on the mining sector through various factors, including decreasing income and companies experiencing losses. This situation can increase the risk of financial distress, namely a situation in the form of financial distress when the company cannot fulfill its financial obligations (Brigham & Daves in Lau, 2021). Financial distress encompasses conditions ranging from an inability to pay short-term obligations (illiquid) to insolvency, which, if not addressed, may lead to bankruptcy. Hofer, as cited in Sunanto et al. (2023), adds that this condition is often characterized by negative net income over several years. The causes of financial distress include suboptimal corporate governance, making it necessary to monitor the financial condition through financial ratio analysis, which can be obtained from financial statements. This analysis of potential financial distress aims to provide early warning about the company's financial condition, enabling management to develop appropriate plans or strategies (Lutfiyyah & Bhilawa, 2021).

Previous researchers have developed various models to predict financial distress. Among the many models developed, three of the most frequently used are the Altman, Springate, and Zmijewski models. Each of these models provides a different approach in analyzing and predicting the potential financial difficulties experienced by companies (Hikmah & Harjayanti, 2024). This research focuses on measuring the potential financial distress using the Zmijewski model, which utilizes three main variables: ROA to measure profitability ratio, Debt Ratio to measure leverage ratio, and Current Ratio to measure liquidity. One advantage of the Zmijewski model is its use of the current ratio, which shows the company's ability to pay short-term obligations, compared to the Altman model, which does not use the current ratio in analyzing financial distress (Wulandari & Fauzi, 2022). Although it only uses three variables, the Zmijewski method provides a comprehensive view of the company's financial condition, making it simpler yet still effective in supporting decision-making compared to other more complex methods.

The researcher chose to use the Zmijewski model because this research focuses on testing the strength of the model rather than comparing it with other models. Furthermore, the variables used in the Zmijewski model are highly relevant to the stages leading to bankruptcy, as explained by Kordestani et al. (2011). The first stage is the latency stage, where the company begins experiencing a decline in profits and assets. This condition relates to ROA, one of the variables in the Zmijewski model. The second stage is a shortage of cash, where the company faces a lack of cash flow to meet short-term obligations, corresponding to the current ratio in the Zmijewski model. The third stage is the condition of financial distress itself, where the company is unable to pay its obligations when they are due. This is closely related to the Debt Ratio, which is also part of the Zmijewski model.

A research by Ramadhani et al. (2023) conducted an investigation using the Grover model, Altman, and then used the Zmijewski model in predicting financial difficulties in transportation and logistics companies with the listing on the Indonesian stock exchange, with an observation period from 2018 to 2021. The sample consisted of 23 companies, revealing differences in financial distress predictions among the three models analyzed. In terms of accuracy, the Zmijewski method was the most accurate, with 65.22%, compared to Altman's method at 60.87% and Grover's method at 63.04%. Another research by Muzanni & Yuliana (2021) titled "Comparative Analysis of Altman, Springate, and Zmijewski Models in Predicting the Bankruptcy of Retail Companies in Indonesia and Singapore" they found that the Zmijewski technique is the most valid model in making the bankruptcy of retail companies in Indonesia predictable. A third research by Dhany et al. (2022) analyzed financial distress using the Zmijewski X-Score model on consumer goods industry companies listed on the Indonesia Stock Exchange. Of the 28 companies, 27 were in healthy condition, and one company was predicted to experience financial difficulties. Based on the background explained above, the researcher is interested in conducting a research titled "Analysis of Financial Distress Potential Using the Zmijewski Method in Coal Mining Subsector Companies Listed on the Indonesia Stock Exchange for the 2019-2023 Period."

Research purposes

Based on the formulated problems, the objectives of this research are:

1. To analyze the potential for Financial Distress using the Zmijewski method in coal mining sub-sector companies listed on the Indonesia Stock Exchange for the period 2019–2023.
2. To determine the accuracy level of Financial Distress potential using the Zmijewski method in coal mining sub-sector companies listed on the Indonesia Stock Exchange for the period 2019–2023.
3. To establish strategies for addressing the potential for Financial Distress using the Zmijewski method in coal mining sub-sector companies listed on the Indonesia Stock Exchange for the period 2019–2023.

LITERATURE REVIEW

Financial Ratio Analysis

According to Ningsih & Permatasari (2019), The definition of financial ratio analysis is that it is based on accounting data and also financial reports held in the process of determining important operations and the financial characteristics of a company. In carrying out this analysis the aim is that the efficiency of management performance can be assessed by reflecting it on the financial reports and notes. In the Zmijewski technique, various forms of this ratio are used, including solvency ratios, profitability ratios, as well as liquidity ratios.

Financial Distress

Financial distress, or financial difficulty, is often confused with bankruptcy, though they are actually different concepts. Hikmah & Harjayanti (2024)states that financial distress is the initial stage of a company's financial decline that occurs before bankruptcy. According to Brigham and Gapenski in Ningsih & Permatasari (2019), when there is difficulty in making the company's obligations fulfilled, it can be seen through its cash flow or when the company no longer makes the payment schedule meet, then that makes the company's financial difficulties begin. There could be damage to the entire company system if financial difficulties occur, including its financial system and human resources (Hasnidar et al., 2024).

Zmijewski X-Score Method

Zmijewski (1984) is the researcher who developed the financial distress potential model, which later became known as the Zmijewski model, named after him. According to Winaya et al. (2020), Zmijewski criticized the sampling methods used by previous researchers. He argued that the matched-pair sampling technique often led to inaccurate or biased results. Therefore, Zmijewski chose to use random sampling in his research. In applying this technique, he emphasized the importance of establishing the proportion between the sample and the population from the outset in order to calculate the frequency of financial distress. This frequency is calculated by dividing the number of companies experiencing financial distress by the total sample size. Zmijewski used a sample of 840 companies, with 40 companies experiencing financial distress and 800 companies not experiencing financial distress. The data was obtained from the Compustat Annual Industrial File, covering the period from 1972 to 1978. Zmijewski used logistic regression as his statistical model, similar to the model used by Ohlson. With this model, Zmijewski successfully developed the following equation model:

X = -4,3 – 4,5(X1) + 5,7(X2) – 0,004(X3)

Description:

X1 = Net Income After Tax / Total Assets (Return on Asset)

The definition of ROA is a profitability ratio that shows the company's ability when using assets by comparing net profit after tax collection through the total assets owned by the company in order to create profits for the company. (Permatasari et al., 2019).

X2 = Total Liabilities / Total Assets (Leverage or Debt Ratio)

This ratio compares the total debt to total assets to measure the company's overall liquidity. The lower this ratio, the better the financial condition of the company (Permatasari et al., 2019)

X3 = Current Assets / Current Liabilities (Liquidity or Current Ratio)

The calculation of this ratio is by measuring current assets against current liabilities with the aim of assessing the company's liquidity, with the short period being the priority (Permatasari et al., 2019).

The criteria applied in this method are that if the Zmijewski X-Score calculation results in a positive value, the company is considered to be in an unhealthy condition. The larger the positive value, the higher the potential for financial distress. Conversely, if the result is negative, the company is considered to be in a healthy condition (Dhany et al., 2022).

RESEARCH METHODOLOGY

The research design used in this study is applied descriptive quantitative research. This research generally does not focus on identifying or explaining relationships between variables or testing hypotheses. This study utilizes data from secondary data sources. Siyoto & Sodik (2015) define secondary data as data obtained or collected by researchers from various pre-existing sources (researchers act as second-hand data collectors). Secondary data can be obtained from various sources, such as books, reports, journals, and others. Data from the

company along with annual financial report data originating from coal mining subsector companies listed on the BEI for the period 2019 to 2023 are various data needed to carry out this research, with www.idx.co.id as the official website of the BEI used in get it.

The sample selection in this research was conducted using purposive sampling, which means the samples were chosen based on specific criteria (Sugiyono, 2019). Out of a total population of 44 companies, 14 companies that met the criteria were selected as the research sample. The sampling criteria used in this research (Ramadhani et al., 2023) are as follows:

1. Coal Mining Subsector companies listed on the Indonesia Stock Exchange for the 2019-2023 period.
2. Coal Mining Subsector companies that publish complete and audited annual financial reports for the 2019-2023 period.
3. Coal Mining Subsector companies that issue financial reports using the Indonesian Rupiah currency for the 2019-2023 period.

The data collection in this research was conducted through documentation and literature review. The collected data consists of financial statement items, which are then calculated into financial ratios. The stages of data analysis are as follows.

1. Calculating financial ratios using the Zmijewski method, namely Return on Assets (ROA), Debt Ratio, and Current Ratio.
2. Calculating the X-Score based on the formula in the Zmijewski X-Score discriminant model:

X = -4,3 – 4,5(X1) + 5,7(X2) – 0,004(X3)

Explanation:
X1 = ROA (Return on Assets)
X2 = Leverage (Debt Ratio)
X3 = Liquidity (Current Ratio)

If X < 0 (negative), the company is considered financially healthy. However, if X > 0 (positive), the company is classified as experiencing financial distress (Ramadhani et al., 2023).

3. Calculating the accuracy rate using the following method.

$$\textbf{Accuracy Rate} = \frac{Number\ of\ Correct\ Predictions}{Total\ Sample} x\ 100\%$$

Correct predictions are determined based on the actual financial condition of the company, as reflected in its net profit. The model is considered to provide an accurate prediction if the company records a positive net profit and the model predicts it as not bankrupt, or if the company records a negative net profit and the model predicts financial distress. Conversely, a prediction is considered incorrect if the company has a positive net profit but the model predicts bankruptcy, or if the company has a negative net profit but the model predicts it as not bankrupt. The error rate is calculated using the following formula (Fitriyani, 2023):

$$\textbf{\textit{Type Error}} = \frac{Number\ of\ Incorrect\ Predictions}{Total\ Sample} x\ 100\%$$

RESULTS AND ANALYSIS

Zmijewski X-Score Calculation Results

The following presents the interpretation of values to assess the potential financial distress of coal mining sub-sector companies listed on the Indonesia Stock Exchange for the 2019-2023 period.

Table 1
Interpretation of Zmijewski Method Calculation Results

No	Code	Year	ROA	Debt Ratio	Current Ratio	X-Score	Category
1	AIMS	2019	-0,040	0,222	5,910	-2,879	Non Distress
		2020	-0,042	0,385	0,868	-1,921	Non Distress
		2021	0,111	0,346	1,186	-2,831	Non Distress
		2022	0,006	0,468	1,062	-1,663	Non Distress
		2023	-3,540	0,532	0,014	14,660	Financial Distress
2	BESS	2019	0,017	0,650	0,231	-0,677	Non Distress
		2020	0,083	0,489	0,972	-1,887	Non Distress
		2021	0,169	0,354	1,240	-3,046	Non Distress
		2022	0,072	0,363	1,179	-2,563	Non Distress
		2023	0,115	0,170	2,266	-3,858	Non Distress
3	BSML	2019	0,007	0,780	0,195	0,112	Financial Distress
		2020	0,002	0,756	0,201	-0,001	Non Distress
		2021	0,018	0,620	1,518	-0,853	Non Distress
		2022	0,059	0,598	1,018	-1,161	Non Distress
		2023	0,067	0,516	1,133	-1,665	Non Distress
4	CBRE	2019	-0,050	0,993	1,898	1,579	Financial Distress
		2020	-0,015	1,008	0,965	1,508	Financial Distress
		2021	0,032	0,985	0,037	1,171	Financial Distress
		2022	0,058	0,297	0,466	-2,868	Non Distress
		2023	0,003	0,522	6,338	-1,361	Non Distress
5	CNKO	2019	0,071	1,416	0,450	3,447	Financial Distress
		2020	-0,240	2,036	0,237	8,385	Financial Distress
		2021	-0,062	2,015	0,325	7,464	Financial Distress
		2022	-0,066	2,418	0,228	9,780	Financial Distress
		2023	-0,043	2,359	0,277	9,337	Financial Distress
6	CUAN	2019	-0,263	0,537	0,485	-0,058	Non Distress
		2020	-0,090	0,589	0,386	-0,542	Non Distress
		2021	0,018	0,399	0,680	-2,110	Non Distress
		2022	0,323	0,268	1,978	-4,236	Non Distress
		2023	0,066	0,475	3,490	-1,900	Non Distress
7	DWGL	2019	-0,025	1,054	1,350	1,815	Financial Distress
		2020	0,051	1,075	0,890	1,595	Financial Distress
		2021	0,076	0,890	0,930	0,432	Financial Distress
		2022	0,002	0,900	0,980	0,817	Financial Distress
		2023	0,008	0,915	1,042	0,874	Financial Distress

No	Code	Year	ROA	Debt Ratio	Current Ratio	X-Score	Category
8	FIRE	2019	0,019	0,375	2,801	-2,262	Non Distress
		2020	0,027	0,302	2,256	-2,713	Non Distress
		2021	-0,093	0,378	1,392	-1,733	Non Distress
		2022	-0,260	0,412	0,488	-0,782	Non Distress
		2023	-0,001	0,490	0,684	-1,503	Non Distress
9	PTBA	2019	0,155	0,294	2,490	-3,330	Non Distress
		2020	0,100	0,296	2,160	-3,073	Non Distress
		2021	0,222	0,329	2,428	-3,438	Non Distress
		2022	0,282	0,363	2,283	-3,511	Non Distress
		2023	0,162	0,444	1,520	-2,507	Non Distress
10	RMKE	2019	0,047	0,602	0,857	-1,086	Non Distress
		2020	0,079	0,539	0,852	-1,591	Non Distress
		2021	0,141	0,427	1,384	-2,510	Non Distress
		2022	0,241	0,280	2,168	-3,795	Non Distress
		2023	0,137	0,339	1,843	-2,991	Non Distress
11	SGER	2019	0,032	0,753	1,237	-0,156	Non Distress
		2020	0,040	0,656	1,429	-0,746	Non Distress
		2021	0,164	0,649	1,466	-1,343	Non Distress
		2022	0,175	0,700	1,413	-1,106	Non Distress
		2023	0,149	0,676	1,490	-1,121	Non Distress
12	SMMT	2019	0,007	0,329	0,611	-2,457	Non Distress
		2020	-0,027	0,360	0,584	-2,132	Non Distress
		2021	0,238	0,222	2,127	-4,111	Non Distress
		2022	0,341	0,140	1,074	-5,037	Non Distress
		2023	0,254	0,207	1,077	-4,269	Non Distress
13	TCPI	2019	0,088	0,532	0,997	-1,663	Non Distress
		2020	0,021	0,480	0,824	-1,663	Non Distress
		2021	0,041	0,459	0,799	-1,820	Non Distress
		2022	0,041	0,413	0,818	-2,132	Non Distress
		2023	0,054	0,403	0,901	-2,250	Non Distress
14	TEBE	2019	0,051	0,266	1,343	-3,018	Non Distress
		2020	-0,003	0,214	1,054	-3,070	Non Distress
		2021	0,167	0,177	2,507	-4,054	Non Distress
		2022	0,252	0,191	1,934	-4,354	Non Distress
		2023	0,193	0,055	9,445	-4,889	Non Distress

Source : Processed Data (2025)

Accuracy Calculation Results

The following table presents the accuracy level of the Zmijewski method.

Table 2
Accuracy Level of the Zmijewski Method

Prediction	Zmijewski
Financial Distress	15
Non Financial Distress	55
Total	70
Correct Predictions	54
Incorrect Predictions	16
Accuracy Level	77%
Error Rate	23%

Source : Processed Data (2025)

Based on Table 2, it can be seen that the Zmijewski Method has an accuracy rate of 77% in assessing the potential for financial distress in coal mining sub-sector companies listed on the Indonesia Stock Exchange for the 2019-2023 period.

Discussion

Based on Table 1, it is known that out of the 14 (fourteen) coal mining sub-sector companies that were sampled, there were 9 (nine) companies that remained in a financially healthy condition or fell under the non-financial distress category for five consecutive years from 2019 to 2023. These companies include PT. Batulicin Nusantara Maritim Tbk. (BESS), PT. Petrindo Jaya Kreasi Tbk. (CUAN), PT. Alfa Energi Investama Tbk. (FIRE), PT. Bukit Asam Tbk. (PTBA), PT. RMK Energy Tbk. (RMKE), PT. Sumber Global Energy Tbk. (SGER), PT. Golden Eagle Energy Tbk. (SMMT), PT. Transcoal Pacific Tbk. (TCPI), and PT. Dana Brata Luhur Tbk. (TEBE). A financially healthy condition reflects good company performance with a very low risk of financial distress. The main supporting factors are the positive Return on Assets (ROA), which indicates the company's efficiency in utilizing assets to generate profit; a low Debt Ratio, meaning the company does not rely too much on debt; and a high Current Ratio, indicating the company's ability to meet its short-term obligations.

On the other hand, there are 2 (two) companies that have experienced poor financial conditions or have fallen into the financial distress category for five consecutive years from 2019 to 2023, namely PT. Exploitasi Energi Indonesia Tbk. (CNKO) and PT. Dwi Guna Laksana Tbk. (DWGL). Companies that continuously remain in financial distress are at high risk of bankruptcy, especially if no significant improvements are made. This condition is caused by a low or negative ROA, which reflects the company's inability to utilize its assets to generate profits; a high Debt Ratio, indicating a heavy reliance on debt; and a low Current Ratio, signifying the company's weak ability to meet its short-term obligations.

For example, PT. Exploitasi Energi Indonesia Tbk. (CNKO) suffered losses in 2020 due to the COVID-19 pandemic and the impact of the trade war between the U.S. and China, which pressured the global economy and led to a decline in revenue. In 2023, despite an increase in coal demand, a significant drop in coal prices and high miscellaneous expenses caused the company continued recording losses. Meanwhile, PT. Dwi Guna Laksana Tbk. (DWGL) faced a decline in revenue in 2020 due to the pandemic, followed by a decrease in assets, even though its liabilities also declined. In 2023, although revenue increased, its short-term liabilities also rose due to business expansion, further worsening its financial condition.

A different condition is seen in PT. Artha Mahiya Investama Tbk. (AIMS), which has the highest X-Score among the other sample companies, which is 14.660. From 2019 to 2022, AIMS was in the non-financial distress category despite recording negative profits at one point. However, based on its Debt Ratio and Current Ratio, the company was still able to meet its obligations, both total liabilities and short-term liabilities. In 2023, AIMS experienced a significant decline in sales, from Rp32.54 billion in the previous year to only Rp9.76 billion. This decline occurred because the company was only able to record sales until the second quarter of 2023 due to the depletion of its coal reserves and the expiration of its contract with its partner. In addition, there was a decrease in current assets such as cash and accounts receivable, as well as a decline in non-current assets due to the decrease in the net value of other assets. Although the company's liabilities also decreased, this condition still reflects pressure on the company's performance.

On the other hand, PT. Bintang Samudera Mandiri Lines Tbk. (BSML) in 2019 and PT. Cakra Buana Resources Energi Tbk. (CBRE) from 2019 to 2021 were initially in a financial distress condition but managed to improve their performance, thus moving into the non-financial distress category in the following years.

The Zmijewski method uses three variables or financial ratios which influence the value of the X-Score in companies with the coal mining subsector. The first variable X1 (ROA) is a profitability ratio whose use is shown so that the company's capabilities can be measured when profits are created through the assets the company owns (Permatasari et al., 2019). The analysis results show that companies with low or negative ROA values, such as PT. Artha Mahiya Investama Tbk. (AIMS) with an ROA of -3.540, have a high X-Score value of 14.660. So it can be said that this is in line with the research carried out by (Surwanti et al., 2022) with the conclusions given that the potential for financial distress that occurs in a company is influenced by its profitability ratio.

In addition, there are two other ratios related to debt, namely X2 (Debt Ratio or DER) and X3 (Current Ratio). Explanation of the definition of DER, namely a leverage ratio by comparing total liabilities to total assets, so that it can reflect the company's ability to fulfill its obligations. The company's situation would be much better if this ratio had a low level (Permatasari et al., 2019). Data analysis shows that coal mining subsector companies experiencing financial distress tend to have a high Debt Ratio. This is supported by research from (Lutfiyyah & Bhilawa, 2021), (Dhany et al., 2022), and (Surwanti et al., 2022), which state that leverage ratios affect the level of financial distress risk.

Meanwhile, the definition of Current Ratio is a liquidity ratio that can show the company's ability to meet its short-term obligations by comparing current assets and liabilities (Permatasari et al., 2019). Current Ratio tends to be owned by companies whose finances are experiencing difficulties. So that this is in line with research carried out by (Lutfiyyah & Bhilawa, 2021), which states that liquidity ratios affect financial distress.

CONCLUSION

It has been shown through research that the majority of companies in the coal mining subsector listed on the Indonesian Stock Exchange in the period 2019 to 2023 are in groups whose financial condition can be said to be healthy or non-financially distressed, with only 2 (two) companies categorized as experiencing financial distress over the five-year study period, namely PT. Exploitasi Energi Indonesia Tbk. (CNKO) and PT. Dwi Guna Laksana Tbk. (DWGL). The Zmijewski method used to predict the potential for financial distress has an accuracy rate of 77% and an error rate of 23%. To address financial distress, companies can improve the ROA (Return On Asset) by optimizing operational costs, increasing production efficiency, renegotiating debts, and selling non-productive assets. They can also reduce the Debt Ratio by managing debts wisely, such as limiting the taking of new loans,

managing cash flows more effectively, and ensuring receivables are collected on time. Furthermore, companies need to increase the Current Ratio so that they can meet their short-term obligations, and managing current liabilities and receivables more effectively is also an important strategy to maintain financial stability.

The implications of this research indicate that the Zmijewski method can be used to analyze the potential for financial distress in companies within the coal mining subsector and serve as an early warning system for companies to anticipate financial problems. For healthy companies, the results of this research can be used to maintain financial performance, while companies experiencing financial distress need to immediately implement recovery strategies. However, this study has limitations as it only uses one prediction method, namely Zmijewski, and the sample size and study period are limited. Therefore, future research can expand the sector scope, use other prediction methods for comparison, such as Altman, Springate, Grover, Ohlson, Fulmer, Taffler, and extend the analysis period for more accurate results.

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