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JOURNAL

The Influence of Bankruptcy Predictions on Stock Returns in Mining Companies Listed on The Indonesia Stock Exchange in 2020-2023

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Abstract:
In 2022, a significant number of investors allocated their capital to companies within the mining sector. However, in 2023, the mining sector experienced a decline in financial performance. This downturn indicates the presence of financial distress, which, if persistent, could potentially lead to bankruptcy for these companies. Therefore, it is essential to develop analytical models to predict bankruptcy within the mining sector. Bankruptcy prediction assists investors in making informed investment decisions, specifically whether to continue or withdraw their investments. The objective of this study is to examine the influence of bankruptcy predictions using the Grover, Zmijewski, and Springate models on stock returns. The analysis in this research employs panel data regression, utilizing data from 2020 to 2023. The results indicate that bankruptcy predictions based on the Springate and Zmijewski models do not have a significant partial effect on stock returns, whereas bankruptcy predictions using the Grover model have a positive and significant effect on stock returns

Keywords:
Stock Returns, Grover, Zmijewski, Springate, bankruptcy prediction models

BACKGROUND

Optimizing the value of a company is the primary objective of managing a commercial organization or corporation (Kewal, 2020). One crucial element that supports the enhancement of corporate value is funding activities (Rabbani, 2024). In this context, investors play a vital role in the process of increasing company value. Investors allocate capital to selected companies with the aim of obtaining returns that align with the financial condition of those companies. According to the Investment Coordinating Board (2023), one of the sectors attracting significant investment is the mining sector, with realized investments amounting to IDR 33.5 trillion. However, in 2023, the performance of mining companies declined (Rhamadanty, 2024), with many mining firms experiencing reduced performance. Several mining companies reported deteriorating results, including in the metal and mineral subsector: PT Timah recorded a loss of IDR 487 billion in 2023, PT Trinitan Metals and Minerals continued to incur losses amounting to IDR 83 billion, and PT Aneka Tambang experienced a 19.45% decrease in net profit, falling to IDR 3.077 trillion from IDR 3.82 trillion previously.

This decline in performance inevitably affects investors, as research by Fachrudin and Ihsan (2021) indicates that the probability of financial distress and liquidity are key factors significantly influencing stock returns to investors. A decline in financial performance can indicate financial distress (Artamevia & Wahyuni, 2022). If financial distress persists continuously, companies may face the risk of bankruptcy. Therefore, it is necessary to develop

analytical models to predict bankruptcy in mining companies. Bankruptcy prediction assists investors in making informed investment decisions, whether to continue or withdraw their investments (Rahmah & Kamilah, 2022).

There are various analytical models available for predicting corporate bankruptcy, including the Altman Z-Score, Springate, Zmijewski, Grover, Ohlson, Foster, and others. In this study, the models utilized are the Grover, Zmijewski, and Springate models. These three models are characterized by their straightforward mathematical formulations and clear interpretative outcomes. Moreover, each model possesses distinct advantages that make them particularly well-suited to the characteristics of the mining sector (Ridhawati & Suryantara, 2023). The Grover model is a bankruptcy prediction model developed by Jeffrey S. Grover in 2008 (Pramesti & Santoso, 2021). This model predicts bankruptcy by analyzing a company's ability to generate profits from its assets (Pratiwi et al., 2023). It is particularly suitable for capital-intensive companies, where expenditures on fixed assets exceed other costs such as labor. Companies with this characteristic require substantial investment in fixed assets. For investors, it is important to assess a company's capability to maximize asset utilization to generate profits, ensuring that invested funds yield commensurate returns.

The second model used in this study is the Zmijewski model, developed by Mark E. Zmijewski in 1984 (Rabbani, 2024). This model predicts bankruptcy by evaluating a company's ability to meet its overall obligations (Hidayati et al., 2021). It is well-suited for companies vulnerable to debt, such as mining firms. Due to unstable commodity prices and expensive heavy equipment purchases, mining companies often rely heavily on debt financing. High debt dependence increases the risk of default. Therefore, investors should carefully examine a company's capacity to fulfill both short-term and long-term liabilities to avoid potential losses.

The third model applied in this research is the Springate model, created by Gordon L. V. Springate in 1978 (Melissa & Banjarnahor, 2020). Initially, Springate identified 19 widely used financial ratios for predicting financial distress. After testing similar to Altman's approach, Springate selected four financial ratios deemed most effective in distinguishing financially distressed companies from healthy ones (Putri et al., 2023). The Springate model predicts bankruptcy by analyzing a company's ability to generate sales and profits as well as its capacity to settle short-term liabilities (Paramitha, 2025). This model is also appropriate for capital-intensive companies, where it is crucial to determine whether the company efficiently manages its assets.

A decline in investor interest and confidence in investing in a company can trigger a decrease in the company's stock price, which subsequently impacts the reduction of the company's stock returns. This is consistent with the study conducted by Rabbani (2024), which shows that bankruptcy prediction using the Springate model has a positive and significant effect on stock returns. This indicates that a decline in stock returns often occurs in companies that, based on the Springate proxy, experience financial distress and are predicted to go bankrupt. Conversely, companies not predicted to go bankrupt by the Springate model tend to have higher stock returns because their strong financial performance increases investor confidence and signals favorable future prospects.

Based on the formulated problem statements, the objectives of this research are as follows:

1. To determine the effect of bankruptcy prediction results of the Grover models on stock returns.
2. To determine the effect of bankruptcy prediction results of the Zmijewski models on stock returns.
3. To determine the effect of bankruptcy prediction results of the Springate models on stock returns.

THEORETICAL FRAMEWORK

2.1 Signaling Theory

Signaling Theory was developed by Michael Spence in 1973 (Prakoso et al., 2022) and explains the transmission of signals from one party to another, especially in situations of uncertainty or information asymmetry between the two parties. Signals can take the form of specific disclosures that inform the receiver about the condition or characteristics of the signal sender (Qotimah & Kalangi, 2023). In this context, companies convey information related to stock returns, such as financial statements that include cash flow, profit, and book value. The information signals provided by the company will naturally elicit market reactions. One group that responds to these signals is investors. They may react to positive and negative signals in various ways, such as buying stocks being sold or adopting a wait-and-see strategy by delaying decisions until market developments become clearer (Susanto & Suryani, 2024)

2.2 Financial Distress

Financial distress is a condition in which a company's financial health is compromised or in crisis, threatening its operational continuity (Prakoso et al., 2022). Financial crises occur when a company faces liquidity or solvency difficulties, meaning it cannot generate sufficient cash flow to meet its financial obligations or fund its operations. There are two types of financial crises: a mild financial crisis causing temporary cash flow problems, and a severe financial crisis that can lead to failure or bankruptcy (Abadi & Misidawati, 2023). The severe financial crisis is the most concerning condition for both companies and investors.

2.3 Bankruptcy

Bankruptcy is a state in which a company lacks sufficient funds to continue its business activities, resulting in business closure or liquidation (Bahri & Widyawati, 2019). Bankruptcy is often equated with financial distress, but they are different. A company experiencing financial distress does not necessarily go bankrupt because its financial condition can still be improved with appropriate strategies. However, when a company goes bankrupt, it certainly has experienced financial distress (Wardani & Rachman, 2022). Bankruptcy is the worst outcome of financial difficulties. It does not occur suddenly; there are usually early indicators pointing toward bankruptcy. These indicators can be detected early through careful financial

statement analysis using specific methods (Abadi & Misidawati, 2023). Financial statements can be analyzed using financial ratios to indicate potential bankruptcy.

2.4 Stock Returns

Return is the gain or yield obtained by investors from investment activities over a certain period (Pramesti & Santoso, 2021). Stock returns can be classified into realized returns and expected returns. Realized return is the actual return calculated based on historical data and is important as an indicator of company performance. Expected return is the return investors anticipate receiving in the future. Unlike realized return, which has already occurred, expected return is a prediction or estimate (Wardono et al., 2023). This study uses realized return as the measure of return. The formula used to calculate return is as follows (Hertina & Tsaniya, 2022):

$$R_{it} = \frac{P_{it} - P_{it-1}}{P_{it-1}}$$

Note:

R_{it} : Stock return for stock i at period t

P_{it} : Stcok price at period t

P_{it-1} : Stock price at the previous period

2.5 Grover Model

The Grover model is a bankruptcy prediction model developed by Jeffrey S. Grover in 2008 (Pramesti & Santoso, 2021). The Grover model predicts bankruptcy by analyzing a company's ability to generate profit from its assets (Pratiwi et al., 2023). In predicting bankruptcy, the Grover model uses the following equation:

$$\text{G-}Score = 1{,}650X_1 + 3{,}404X_2 - 0{,}016X_3 + 0{,}057$$

Note:

X_1 : Working Capital / Total Assets

X_2 : Earnings Before Interest and Tax / Total Assets

X_3 : Net Income / Total Assets

The resulting G-Score from this formula is used to assess the likelihood of bankruptcy. If the G-Score ≤ -0.02, the company is predicted to be bankrupt. Conversely, if the G-Score ≥ 0.01, the company is predicted to be healthy and not at risk of bankruptcy (Abadi & Misidawati, 2023).

2.6 Zmijewski Model

The Zmijewski model was developed by Zmijewski in 1984 (Rabbani, 2024). This model predicts bankruptcy by analyzing a company's ability to meet its overall obligations (Hidayati et al., 2021). The Zmijewski model uses the following equation for bankruptcy prediction:

$$Z\text{-}Score = -4{,}3 - 4{,}5X_1 + 5{,}7X_2 - 0{,}004X_3$$

Note:

X_1 : Net Income / Total Assets

X_2 : Total Liabilities / Total Assets

X_3 : Current Assets / Current Liabilities

The Z-Score obtained from this formula is used to evaluate bankruptcy probability. If the Z-Score > 0, the company is predicted to be bankrupt. If the Z-Score < 0, the company is predicted to be healthy and not at risk of bankruptcy (Abadi & Misidawati, 2023).

2.7 Springate Model

The Springate model was developed by Gordon L. V. Springate in 1978 (Melissa & Banjarnahor, 2020). It predicts bankruptcy by analyzing a company's ability to generate sales and profits, as well as its capacity to settle short-term liabilities (Paramitha, 2025). The Springate model uses the following equation:

$$S\text{-}Score = 1{,}03X_1 + 3{,}07X_2 + 0{,}66X_3 + 0{,}4X_4$$

Note:

X_1 : Working Capital / Total Assets

X_2 : Earnings Before Interest and Tax / Total Assets

X_3 : Earnings Before Tax / Current Liabilities

X_4 : Sales / Total Assets

The S-Score resulting from this formula is used to assess bankruptcy likelihood. If the S-Score > 0.862, the company is categorized as healthy or not likely to go bankrupt. If the S-Score < 0.862, the company is predicted to have the potential to go bankrupt (Abadi & Misidawati, 2023).

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METHOD

The data analysis method used in this research is panel data regression analysis. The software used in this research is Eviews 13. With this method, it can be determined how the bankruptcy predictions results of Grover, Zmijewski, and Springate models affect stock returns.

$$SR = \alpha + \beta_1 GS_{it} + \beta_2 ZS_{it} + \beta_3 SS_{it} + e_{it}$$

Note:

SR = Stock Return

GS = Bankruptcy prediction results using the Grover models (G-*Score*)

ZS = Bankruptcy prediction results using the Zmijewski models (Z-*Score*)

SS = Bankruptcy prediction results using the Springate models (S-*Score*)

α = Constant

i = Cross Sectional Unit

t = time period

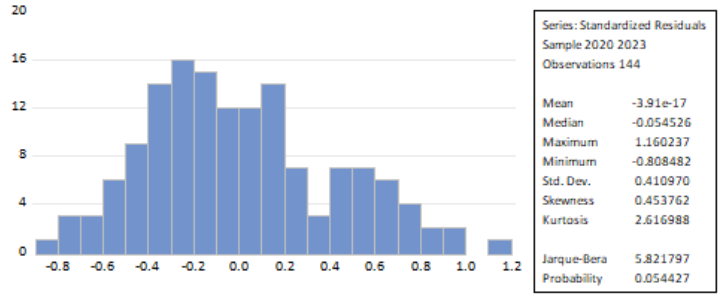
β = Regression Coefficient

e = *error*

RESULT

4.1 Results of Classical Assumption Tests

4.1.1 Normality Test



Based on the results of the normality test above, the probability value of Jarque-Bera is above 0.05. Therefore, it can be concluded that this study has no issues with normality.

4.1.2 Multicollinearity Test

	GS	ZS	SS
GS	1.000000	**-0,713009**	**0.782201**
ZS	-0,713009	1.000000	**-0.492560**
SS	0.782201	-0.492560	1.000000

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The results above were obtained using the Pairwise Correlations method, which indicates that the regression model in this study does not experience multicollinearity issues. This is evident from the partial correlation values of each independent variable, which are all below 0.80, meaning that the independent variables in the regression model do not have strong linear relationships with each other

4.2 Hypothesis Test

4.2.1 Panel Data Regression Analysis

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.243132	0.121270	2.004887	0.0469
GS	0.519566	0.232731	2.232469	0.0272
ZS	0.061247	0.065981	0.928258	0.3549
SS	-0.101869	0.118327	-0.860909	0.3908

Based on the management results above, the following conclusion can be drawn:

- The constant value of 0,2431 means that without the independent variables Bankruptcy Prediction Results Using the Grover Model (G-Score), Bankruptcy Prediction Results Using the Zmijewski Model (Z-Score), and Bankruptcy Prediction Results Using the Springate Model (S-Score) the Stock Return (SR) variable will have a positive value of 0,2431, assuming all independent variables are zero.
- The beta coefficient for the Bankruptcy Prediction Result Using the Grover Model (G-Score) variable is 0.5195, which is positive. This indicates that if the Grover model's bankruptcy prediction result increases, the Stock Return (SR) will also increase.
- The beta coefficient for the Bankruptcy Prediction Result Using the Zmijewski Model (Z-Score) variable is 0.0612, which is positive. This means that if the Zmijewski model's bankruptcy prediction result increases, the Stock Return (SR) will also increase.
- The beta coefficient for the Bankruptcy Prediction Result Using the Springate Model (S-Score) variable is 0.1018, which is negative. This indicates that if the Springate model's bankruptcy prediction result increases, the Stock Return (SR) will decrease.

4.2.2 F Test

F-statistic	3.938885
Prob (F-statistic)	0.009819

The feasibility of the regression model in this study is demonstrated by the F-test. The F-test results show that each variable has an F-statistic probability value of 0.009, which is less than 0.05. Each variable also has an F-count value of 3,9388, which is greater than the F-table value of 2,6692. Therefore, the regression model in this study is declared suitable for use.

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4.2.3 Determination Coeficiant

Adjusted R-squared
0.058074

Based on the results above, the Adjusted R-squared (R^2) value is 0.0580 or 5,80%. This coefficient of determination is considered low in explaining the company's value. This means that 5,80% of stock returns can be influenced by bankruptcy prediction results using the Grover model (G-Score), Zmijewski model (Z-Score), and Springate model (S-Score), while 94,20% is explained by other variables outside this study.

4.3.3 Test t

Variable	t-Statistic	Sig.
GS	2.232469	0.0272
ZS	0.928258	0.3549
SS	-0.860909	0.3908

The partial effects of the independent variables on the dependent variable and their interactions are as follows:

- The first hypothesis in this study states that the bankruptcy prediction results using the Grover Model (G-Score) have a positive and significant influence on stock returns. Based on the panel data regression results, the beta coefficient value of the bankruptcy prediction variable using the Grover Model (G-Score) is positive at 0.5195 and a probability of 0.0272, where the probability value is <0.05. The t-test results on the bankruptcy prediction variable using the Grover Model (G-Score) obtained a calculated t value of 2.232 > t table, which is 1.9771. This means that the bankruptcy prediction variable using the Grover Model (G-Score) has a positive relationship direction and has a significant influence on stock returns, these results are in line with the first hypothesis. Therefore, H1 can be accepted.

- The second hypothesis in this study states that the bankruptcy prediction results using the Zmijewski Model (Z-Score) have a negative and significant influence on stock returns. Based on the panel data regression results, the beta coefficient value of the bankruptcy prediction variable using the Zmijewski Model (Z-Score) is positive 0.0612 and the probability is 0.3549, where the probability value is > 0.05. The results of the t-test on the bankruptcy prediction variable using the Zmijewski Model (Z-Score) obtained a calculated t value of 0.9282 < t table of 1.9771. This means that the bankruptcy prediction variable using the Zmijewski Model (Z-Score) has a positive relationship direction and does not significantly influence stock returns, these results are not in line with the second hypothesis. Therefore, H2 is rejected.

- The third hypothesis in this study states that the bankruptcy prediction results using the Springate Model (S-Score) have a positive and significant influence on stock returns.

Based on the panel data regression results, the beta coefficient value of the bankruptcy prediction variable using the Springate Model (S-Score) is negative 0.1018 and the probability is 0.3908, where the probability value is > 0.05. The results of the t-test on the bankruptcy prediction variable using the Springate Model (S-Score) obtained a calculated t value of -0.8609 < t table, which is 1.9771. This means that the bankruptcy prediction variable using the Springate Model (S-Score) has a negative relationship direction and does not significantly influence stock returns, these results are not in line with the third hypothesis. Therefore, H3 is rejected.

DISCUSSION

4.3.1 The Influence of Bankruptcy prediction results using the Grover model on Stock Return

The acceptance of the G-Score hypothesis significantly influences stock returns, proving that investors pay more attention to profitability aspects in investing, particularly in managing company assets to generate maximum profits. The capital-intensive nature of mining companies makes investors more careful in assessing a company's ability to manage its assets, as this indicates the level of return on invested capital. Companies with good asset management capabilities to generate profits are less likely to go bankrupt. The average company predicted to go bankrupt by the Grover model is those with negative profits with large asset values or very small profits disproportionate to the amount of assets they own. Companies that are unable to manage their assets properly are considered less attractive and promising to investors due to the potential for small or even detrimental returns.

4.3.2 The Influence of Bankruptcy prediction results using the Grover model on Stock Return

The mean Z-Score variable was -1.904, indicating that the average mining company in 2020-2023 was healthy, with a good ability to pay off all its obligations, both long-term and short-term. However, the average stock return during 2020-2023 was 0.034, indicating that the average mining company in 2020-2023 only had a stock return of 0.034, a figure considered small for a healthy company. Therefore, it is indicated that the Z-Score value does not significantly affect stock returns. The results of this study align with research conducted by (Raja & Ardillah, 2022), which stated that the Zmijewski model proxied corporate bankruptcy predictions had no impact on stock returns. This is because investors tend to buy stocks that are currently in the spotlight without deeply evaluating them. Many investors have a Fear of Missing Out (FOMO) attitude, so afraid of missing out on market trends that they tend to ignore potential risks, including predictions of corporate bankruptcy.

4.3.3 The Influence of Bankruptcy prediction results using the Grover model on Stock Return

The mean S-Score (SS) variable was 1.066, indicating that the average mining company was healthy between 2020 and 2023. The company was able to manage its assets well to generate profits and sales, and to pay off its short-term liabilities. However, the stock return for mining companies during 2020 and 2023 was only 0.034, meaning that mining companies could only generate a stock return of 0.034, a figure that is relatively small for a healthy

company. Therefore, it is indicated that the S-Score (SS) does not significantly affect stock returns. Furthermore, in 2020-2022, there was a significant increase in global demand for mining products, such as gold, coal, nickel, and copper. This increase in global demand was a result of the conflict between Russia and Ukraine, as both countries are major producers and exporters of various energy resources and commodities. Consequently, the conflict between them disrupted the global supply chain. Consequently, much global demand shifted to mining companies from other countries, including Indonesia. This increase in demand impacted the performance of Indonesian mining companies, allowing them to maximize their production and sales. This situation is likely to attract more investor attention and interest, thus affecting mining companies' stock prices and stock returns.

CONCLUSION

This study was conducted to find empirical evidence on whether corporate bankruptcy prediction using the Grover, Zmijewski, and Springate models can partially influence the increase or decrease in stock returns. This study used secondary data derived from the financial reports of mining companies that have gone public or are listed on the Indonesia Stock Exchange (IDX) for four years (2020-2023). Based on the results of hypothesis testing, this study provides evidence that bankruptcy prediction using the Grover model (G-Score) has a significant positive effect on stock returns, bankruptcy prediction using the Zmijewski model (Z-Score) has no significant effect on stock returns, and bankruptcy prediction using the Springate model (S-Score) has no significant effect on stock returns.

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