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Bankruptcy Prediction Analysis Using the Grover, Zmijewski, and Springate Models in the Banking Sector Listed on the Indonesia Stock Exchange in 2023 & 2024

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Abstract
This study aims to analyze the accuracy level of bankruptcy prediction models: Grover, Zmijewski, and Springate, within the banking sector listed on the Indonesia Stock Exchange (IDX) during 2023 and 2024. A quantitative method with a descriptive approach was used. The research sample consisted of 60 banking companies with complete financial reports for 2023 and 2024. Data were analyzed using the three bankruptcy prediction models and compared based on their prediction accuracy. The results indicate that the Grover model has the highest accuracy in predicting financial distress, followed by the Zmijewski model, and lastly the Springate model. These findings are expected to assist companies, investors, and other stakeholders in anticipating bankruptcy risk earlier by selecting the most appropriate prediction model.

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1. BACKGROUND

The banking sector plays a crucial role in the national economy as it functions as an intermediary institution, channeling funds from those with surplus funds to those in need (Dalimunthe & Lubis, 2023). As financial institutions listed on the Indonesia Stock Exchange (IDX), banks aim to obtain additional funds, increase stock liquidity, and strengthen investor confidence. By the end of 2024, 87 banking companies were listed on the IDX, including BTJM, NISP, BTPS, BMRI, BNII, BDMN, MEGA, and BBRI (IDX, 2024). The stability of the banking sector directly impacts the stability of the national financial system. Bankruptcy not only impacts internal performance but also public trust and economic stability (OJK, 2021). Throughout 2022, several major banks, including BBRI, BBNI, BBTN, and BMRI, showed signs of recovery. *Financial distress due* to low current *ratio which* reflects the inability to meet short-term obligations (Mulya et al., 2024).

The Financial Services Authority (OJK) and the Deposit Insurance Corporation (LPS) have taken steps to supervise and restore the health of these problematic banks. The results of the banking sector's financial reports for the 2023–2024 period show fluctuations in performance, with several banks, such as BGTG and NOBU, experiencing increases in revenue and net profit, while BBYB and BINA experienced significant declines. This situation demonstrates the importance of a company's ability to detect potential financial distress early to avoid bankruptcy (Rahma, 2020) & (Fardiman et al., 2021). Various studies examining this issue *financial distress* The results show that the accuracy levels of bankruptcy prediction models vary. According to (Armenda et al., 2023), the Grover model

has the highest accuracy at 72.22%, followed by Zmijewski at 38.89%, and Springate at 16.67%. Meanwhile, research by Zatira et al. (2022) shows that the Zmijewski and Grover models have the highest accuracy levels at 35%. (Farha, 2022) found that the Zmijewski model achieved 84% accuracy, Grover at 82%, and Springate at 78%.

2. LIBRARY STUDY

Financial distress is a serious liquidity problem that cannot be resolved without changing the company's size or structure. This condition serves as an early warning sign of possible bankruptcy, requiring management to take swift and appropriate action (Mentary & Ikhsan, 2021). *Financial distress* financial distress is not a direct cause of bankruptcy, but rather a factor in corporate failure, which occurs when liabilities exceed total assets (Saputra et al., 2022). This financial distress can erode the trust of stakeholders, such as creditors and investors, in the company. According to Platt & Platt (2022), *financial distress occurs* when the company's operating cash flow is insufficient to meet obligations, so corrective action is required such as reducing or eliminating dividends. Costs arising from *financial distress* poses negative risks for the company, especially due to increased debt which can affect relationships with consumers, suppliers, employees and creditors (Pinastiti et al., 2023).

In these conditions, management often focuses more on short-term cash flow improvements than on maintaining long-term financial health, while indirect costs such as loss of market confidence can outweigh direct costs such as lawyer fees. *Financial distress* can be seen from the elimination of dividends, negative cash flow, declining operating profit, layoffs, restructuring, or breach of debt covenants, all of which indicate potential future bankruptcy. To predict these conditions, several analytical methods are used, such as the Grover, Zmijewski, and Springate models, applied to banking companies listed on the Indonesia Stock Exchange in 2023–2024. These models serve to assess a company's financial health and identify potential bankruptcy early.

Model Grover (G-Score):

G = 1.650X1 + 3.404 X2 − 0.016X3 + 0.057X4 + 0.041, with the value *cut-off* of 0.01. If the value **G < 0,01**, then the company has the potential to experience financial *distress*, whereas if **G > 0,01**, the company is classified as healthy (Arini, 2021).

Model Zmijewski:

Z = −4.336 − 4.513X1 + 5.679X2 + 0.004X3, with *cut-off on* value **Z = 0**. If **Z > 0**, then the company has the potential to experience financial *distress*, whereas if **Z < 0**, the company is considered healthy (Arini, 2021).

Model Springate:

S = 1.03X1 + 3.07X2 + 0.66X3 + 0.4X4, with the value *cut-off* as big as**0,862**. If **S > 0,862**, the company is estimated to be in a healthy condition, whereas if**S < 0,862**, the company has the potential to experience bankruptcy or financial *distress* three models are important tools for analyzing a company's financial health and providing an early indication of bankruptcy risk, allowing management to take early preventative measures to ensure business continuity.

3. RESEARCH METHODS

The research method used is quantitative research, namely a method used to examine a population or sample, collect data, and analyze the data with the aim of testing hypotheses (Sugiyono, 2020). Three models are used in predicting financial *distress in* banking sector companies including: *Grover, Zmijewski,* And *Springate* the sample studied consisted of 87 banking companies listed on the Indonesia Stock Exchange (www.idx.co.id) over a two-year observation period, from 2023 to 2024. The sample selection method used was *purposive sampling* resulted in 60 companies meeting the sample requirements. The data used was secondary data obtained from official documents published by the Indonesia Stock Exchange, including financial reports of companies listed on the Indonesia Stock Exchange for the 2023-2024 banking sub-sector.

The analysis process is carried out through several stages, including descriptive statistical analysis to provide an overview or description of data seen from the average value (*mean*), standard deviation, *variants*, maximum, minimum, sum, range, kurtosis, and skewness, and the Prediction Model Accuracy test. The purpose of this test is to determine how accurately the dependent variable/variable to be measured groups companies into categories of *financial distress* And *non-financial distress.*

4. RESULTS AND DISCUSSION

Descriptive Statistics

Table 1 Descriptive Statistical Analysis

Descriptive Statistics

TAHUN		N	Minimum	Maximum	Mean	Std. Deviation	Variance
2023	GROVER	30	-2.23	1.92	-.5007	.77671	.603
	ZMIJEWSKI	30	-3.81	.80	-.5817	1.41006	1.988
	SPRINGATE	30	-.95	7420.24	247.0147	1354.80604	1835499.408
	Valid N (listwise)	30					
2024	GROVER	30	-2.08	2.07	-.5603	.73083	.534
	ZMIJEWSKI	30	-4.32	.81	-.4030	1.27462	1.625
	SPRINGATE	30	-.78	6884.53	229.0943	1257.01116	1580077.062
	Valid N (listwise)	30					

Source: Output SPSS 21

The results of the descriptive statistical analysis show that the average value ***G-score*** in the 2023 Grover model was 5,007 and in 2024 it was 3,040, both of which are in the category financial *distress in* the banking sector. Furthermore, the average value of ***Z-score*** on the model of ***Zmijewski*** in 2023 amounting to 5,817 indicates the condition of ***financial distress***, while in 2024 it increased to 1,63255, indicating a relatively healthy financial condition. Meanwhile, the average of ***S-score*** on the model of *Springate* in 2023 it was 247.0147 and in 2024 it was 229.0943, indicating that banking companies are generally in a healthy condition and are not experiencing any problems of *financial distress.*

Model Accuracy *Grover* Test

Table 2 Model Accuracy Results of *Grover*

GROVER			
Year	Sample	Correct Prediction	Type I False Prediction
2023	30	5	25
2024	30	5	25
Amount	60	10	50
Accuracy Level		16.67%	83.33%

Source: Processed data

Based on the calculation results in Table 2, the model of *Grover* able to predict conditions *non-financial distress* precisely in 10 of the 60 samples or with an accuracy rate of 16.67%, while the other 50 samples were predicted to be inaccurate (*financial distress*) with an error rate of 83.33%, which reflects the low effectiveness of the model of *Grover* in predicting the financial condition of the banking sector during the 2023–2024 period.

Model Accuracy Test of *Zmijewski*

Table 3 Model Accuracy Test Results of *Zmijewski*

ZMIJEWSKI			
Year	Sample	Correct Prediction	Type I False Prediction
2023	30	13	17
2024	30	15	15
Amount	60	28	32
Accuracy Level		46.67%	53.33%

Source: Processed data

Based on the analysis results in the table above, the model of *Zmijewski* able to predict conditions *non-financial distress* precisely in 28 of the 60 samples with an accuracy rate of 46.67%, while the other 32 samples were predicted to be inaccurate (*financial distress*) with an error rate of 53.33%, which indicates that this model has moderate predictive ability in identifying the potential bankruptcy of banking companies during the 2023–2024 period.

Springate Model Accuracy Test

Table 4 Springate Model Accuracy Test Results

GROVER			
Year	Sample	Correct Prediction	Type I False Prediction
2023	30	2	28
2024	30	2	28
Amount	60	4	56
Accuracy Level		6.67%	93.33%

Source: Processed data

Based on the calculation results, the Springate model is only able to predict conditions *non-financial distress* precisely in 4 of 60 samples with an accuracy rate of 6.67%, while the other 56 samples were predicted to be inaccurate (*financial distress*) with an error rate of 93.33%, which indicates that this model has low predictive ability in identifying the financial conditions of the banking sector during the 2023–2024 period.

5. CONCLUSION

In accordance with the formulation of the problem, this research aims to find out which model is the most accurate of the three models (Grover, Zmijewski, and Springate) in predicting bankruptcy in the banking sector listed on the Indonesia Stock Exchange in 2023 & 2024, it can be concluded that the Zmijewski model has the highest level of accuracy in predicting bankruptcy in banking companies with an accuracy level of 46.67%, followed by the Grover model with an accuracy level of 16.67%, and the last is the Springate model with an accuracy level of 6.67%.

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