Research.

Comparative Analysis of Altman Z-Score, Springate, and Zmijewski Models in Predicting Financial Distress of Retail Sub-Sector Companies Listed on the Indonesia Stock Exchange

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Abstract. *This study aims to compare the accuracy of three financial distress prediction models, namely the Altman Z-Score, Springate, and Zmijewski models, applied to retail subsector companies listed on the Indonesia Stock Exchange for the 2019–2023 period. The sample was selected using a purposive sampling method, and analysis was conducted by calculating financial ratios based on each model's formula, followed by an accuracy test. The results show that the Altman model achieved an accuracy of 36.67%, Springate 56.67%, and Zmijewski 63.33%. Thus, the Zmijewski model is considered the most accurate in predicting potential bankruptcy in retail companies over the past five years.*

Key words: *Altman Z-Score; Financial Distress; Springate; Zmijewski*.

INTRODUCTION

Background

The retail industry in Indonesia has been facing significant challenges that have led to the closure of several major outlets. One of the retail companies that ceased operations and closed all of its stores in Indonesia in 2021 was Hypermarket Giant (Anggela, 2023). This was followed in 2022 by other retailers such as Transmart, Hypermart, Ace Hardware, Ramayana, and Matahari Department Store, which closed several of their stores over the past few years (Anggela, 2023). According to the Indonesian Employers Association, key factors contributing to the closure of modern hypermarket-type retail stores include shifts in consumer behavior and a decline in purchasing power (Liputan 6, 2023). These factors are largely driven by the emergence of e-commerce platforms in Indonesia, which have changed consumers' shopping patterns (Shofianti, 2021).

The freedom granted to foreign retail sectors in choosing store locations and the lack of regulations related to foreign investors have created opportunities for them to dominate the market (Sulistiyowati et al., 2017). Although Indonesia is considered one of the most liberal countries in terms of retail business, ironically, foreign control in this sector exceeds 13% (Sulistiyowati et al., 2017). In contrast, countries such as the UK, Japan, and South Korea, which also adopt liberal principles, still restrict foreign ownership in the retail sector by enforcing strict regulations, resulting in foreign market shares in the food sector of only around 1% to 3% (Sulistiyowati et al., 2017). This relatively high percentage in Indonesia has led to continuous expansion and growth of foreign retail chains such as Miniso, Mixue, MR D.I.Y., and others. The large number of companies in the primary goods

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retail subsector reflects their vital role in the economy and in meeting public needs, despite facing internal challenges such as narrow profit margins.
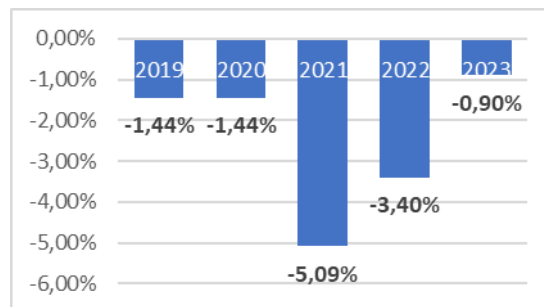
Source: Data processed by researcher
Chart 1: Average NPM of Primary Goods Retail Companies

The narrow profit margins in the retail industry are reflected in the negative Net Profit Margin (NPM) trend of companies in the primary goods retail subsector during 2019–2023. Kasmir (2018) states that an ideal NPM should be above 5%; therefore, a negative NPM indicates unhealthy financial performance. The negative average NPM reflects the companies' inability to generate net income, significantly contributing to financial distress (Susanto & Setiyowati, 2021). Additionally, financial pressure is worsened by high liabilities borne by some retail companies (Link UMKM, 2023; Utami & Cahyani, 2018). Financial pressure in primary goods retail companies can also be observed through their capital structure, especially by analyzing the Debt to Asset Ratio (DAR).
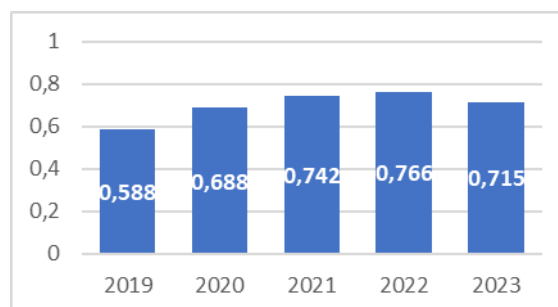
Source: Data processed by researcher
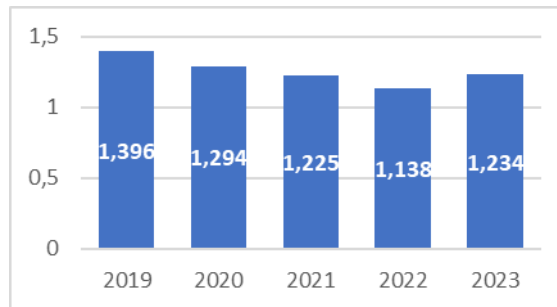**Chart 2: Average DAR of Primary Goods Retail Companies**

The Debt to Asset Ratio (DAR) in the primary goods retail industry shows a high tendency during the 2019–2023 period. Based on the processed data, the average DAR exceeds the ideal threshold of 0.35 as stated by Kasmir (2018), reaching 0.712 in 2023. This indicates a high dependency on debt to finance operations. According to Aslamiah et al. (2023), a high DAR significantly contributes to financial distress and can lead to a decline in the current ratio, which reflects the company's weakening liquidity capacity.

The current ratio in the primary goods retail industry has shown a declining trend from 1.43 in 2019 to 1.13 in 2022, with a slight increase to 1.23 in 2023. This decline reflects a surge in current liabilities or a reduction in current assets (Fransiska et al., 2015). Although there was some recovery in 2023, the current ratio has not returned to its initial level. Research by Septyanto & Welandasari (2020) states that the current ratio influences financial distress; thus, a decline in this ratio may serve as an early indicator of a liquidity crisis threatening business continuity.

Financial distress is a condition marked by financial difficulties faced by a company (Khairunnisa, 2021). As discussed earlier, such issues include low profit margins indicated

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by a low Net Profit Margin (NPM), high levels of debt reflected in the Debt to Asset Ratio (DAR), and a declining current ratio. These factors may lead to severe financial challenges and potentially result in bankruptcy. Companies can address financial distress by continuously monitoring their financial health and identifying early signs of distress using predictive analysis models (Khairunnisa, 2021). The Altman Z-Score, Springate, and Zmijewski models are examples of analytical tools used to assess the accuracy of financial distress predictions.

Source: Data processed by researcher
Chart 3: Current Ratio of Primary Goods Retail Companies

The Altman Z-Score model, introduced by Edward Altman in 1968, utilizes five key financial ratios and the Multiple Discriminant Analysis (MDA) method to predict financial distress. Several studies, such as those by Supitriyani et al. (2022) and Wahyuni & Rubiyah (2021), demonstrate the model's high accuracy, with figures of 85.75% and 76%, respectively. The Springate model, developed by Gordon L. V. Springate in 1978 as a simplified version of Altman's model, uses four financial ratios and the stepwise MDA method. Research by Jacob et al. (2024) and Gupita et al. (2020) found that the Springate model achieved even higher accuracy, at 87.88% and 83%, respectively. Meanwhile, the Zmijewski model, developed in 1984, employs only three key ratios (ROA, DAR, and CR), offering a more practical approach. Studies by Muzanni & Yuliana (2021) and Mulyati & Ilyasa (2020) support this model's effectiveness, with predictive accuracy of 87% and 88.89%, respectively. This establishes the Zmijewski model as one of the most accurate tools in predicting financial distress in retail companies. Based on the aforementioned conditions, the researcher is interested in identifying which retail companies are potentially or currently experiencing financial distress. These companies operate in the primary goods retail subsector and are listed on the Indonesia Stock Exchange. Furthermore, the researcher aims to compare the Altman Z-Score, Springate, and Zmijewski models in terms of their accuracy in analyzing the financial condition of retail industry companies.

Research Question

Based on the background described above, the formulation of the research problems in this study are as follows:
1. Is there any difference in the results of financial distress prediction using the Altman Z-Score, Springate, and Zmijewski models in retail companies listed on the Indonesia Stock Exchange during the 2019–2023 period?
2. Which model Altman Z-Score, Springate, or Zmijewski has the highest level of accuracy in predicting financial distress conditions in retail subsector companies listed on the Indonesia Stock Exchange during 2019-2023?

LITERATURE REVIEW

A. Financial Distress

Financial distress is the early stage of a company's financial deterioration before facing bankruptcy or liquidation (Platt & Platt, 2002). This condition is marked by the company's inability to meet its obligations, such as debt repayments (Brigham et al., 1996).

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Early detection of financial distress is crucial for stakeholders in making the right decisions. Altman et al. (2018) state that the prediction model is considered accurate if it achieves more than 80% accuracy, as it can identify financial risks with low error rates. Therefore, choosing the appropriate prediction model is key in establishing an early warning system for corporate financial crises.

B. Altman Z-Score

The Altman Z-Score was first introduced by Edward I. Altman in 1968 as a tool to predict financial distress using the Multiple Discriminant Analysis (MDA) technique. This model combines five financial ratios, namely: (X1) Working Capital to Total Assets; (X2) Retained Earnings to Total Assets; (X3) EBIT to Total Assets; (X4) Market Value of Equity to Book Value of Debt; dan (X5) Sales to Total Assets, with the following formula:

$$Z = 1{,}2X_1 + 1{,}4X_2 + 3{,}3X_3 + 0{,}6X_4 + 1{,}0X_5$$

Altman later refined this into the Z'-Score for private companies (replacing market equity value with book value) and the Z''-Score for non-manufacturing companies (omitting variable X5). The classification criteria are:
  a) Z < 1,81 = distress zone
  b) 1,81 < Z < 2,99 = grey area
  c) Z > 2,99 = safe zone (*non-distress*)

These five ratios represent aspects of liquidity, profitability, operational efficiency, solvency, and activity.

C. Springate

The Springate model was developed by Gordon L.V. Springate in 1978 as a modification of the Altman Z-Score, still using the MDA method to predict financial distress. This model incorporates four financial ratios: (A) Working Capital / Total Assets; (B) EBIT / Total Assets; (C) Net Profit Before Tax / Current Liabilities; (D) Sales / Total Asset, with the following formula:

$$S = 1{,}03A + 3{,}07B + 0{,}66C + 0{,}4D$$

Adapun kriteria klasifikasi model Springate, yaitu:
  a) S < 0,862 = Financial Distress
  b) 0,826 < S < 1,062 = Grey Area.
  c) S > 0,862 = Safe zone (Non-distress)

This model is considered simpler than Altman's but remains effective in identifying a company's financial trouble risk.

D. Zmijewski

The Zmijewski model was developed by Mark Zmijewski in 1984 to predict financial distress using a probit regression approach. This model utilizes three main financial ratios: profitability through *Return on Assets* (X1), solvency through Debt to Asset Ratio (X2), and liquidity through Current Ratio (X3). The equation used in the Zmijewski model is as follows:

$$X = -4{,}3 - 4{,}5X1 + 5{,}7X2 - 0{,}004X3$$

The classification criteria for the Zmijewski model are:
  a) X > 0 = The company is in financial distress
  b) X < 0 = The company is considered non-distress (safe zone)

This model is known for being simpler and more practical as it only uses three ratios that comprehensively reflect a company's financial condition.

E. Trade off Theory

The trade-off theory explains that a company's capital structure is the result of balancing the benefits of using debt such as tax savings against the costs of excessive debt, such as the risk of bankruptcy and agency costs (Baxter, 1967). The theory suggests that companies will continue to take on debt until they reach an optimal level where the tax benefits are equal to the risks incurred. An optimal capital structure is achieved when the company maximizes its value by balancing the benefits and sacrifices of using debt (Amro & Asyik, 2021). External factors such as interest rates and tax regulations also influence

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capital structure decisions.

F. Minsky's Financial Instability Theory

The Financial Instability Hypothesis proposed by Hyman P. Minsky (1992) asserts that financial instability is an inherent characteristic of capitalist systems, arising from speculative debt financing and uncertain profit expectations. Contrary to classical views that assume systems return to equilibrium, Minsky emphasized that prolonged economic expansion tends to shift economic actors from hedge finance (able to repay principal and interest) to speculative and ponzi finance, where debt repayments depend on acquiring new loans. As the number of ponzi units increases, so does the risk of systemic crisis. This theory also highlights the roles of regulation, financial innovation, and policy interventions in either exacerbating or stabilizing the system. In financial distress studies, this theory is relevant as a framework for understanding how debt structure and economic behavior contribute to internal vulnerability to crises.

RESEARCH METHODS

This study uses a quantitative method with a descriptive comparative approach. The design aims to compare the accuracy levels of three financial distress prediction models: Altman Z-Score, Springate, and Zmijewski. The type of data used is secondary data obtained from the annual financial statements of companies in the primary goods retail subsector during the 2019–2023 period. Data sources include official company websites and the Indonesia Stock Exchange (IDX). The data collection technique employed is a literature review, which involves examining various written sources such as books, documents, and other publications (Rosyada et al., 2024).

The population in this study consists of 13 companies in the primary goods retail subsector listed on the IDX from 2019 to 2023. The sampling method used is purposive sampling, which involves selection based on specific criteria relevant to the research objectives (Sugiyono, 2018). The sample criteria are as follows:

1. The company consistently publishes financial statements on the IDX during the 2019–2023 period,
2. The financial statements published are complete and audited for the period from December 31, 2019 to December 31, 2023,
3. The company has been listed since the beginning of the observation period and has not been delisted,
4. Companies with incomplete data are excluded from the sample.

Based on these criteria, 10 companies were selected as the research sample. The data analysis technique involves calculating the accuracy and error rate of each prediction model. The accuracy rate indicates the percentage of predictions that match the actual condition out of the total sample, while the error rate indicates the proportion of incorrect predictions.

RESULTS AND DISCUSSION

Altman Z-Score Model

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Table 1 Accuracy Test of Altman Model

Year	Correct Prediction	Sample
2019	0	6
2020	2	6
2021	3	6
2022	3	6
2023	3	6
Jumlah	11	30
Accuracy Rate	**36,67%**	

Source: Data processed by researcher

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Based on Table 1, the test results of 30 sample data from the retail subsector show that the Altman Z-Score model accurately predicted only 11 data points, equivalent to an accuracy rate of 36.67%. This accuracy was calculated from the number of companies whose prediction results matched their actual conditions, both in the distress and non-distress categories. Most accurate predictions came from companies with financial ratio structures (liquidity, profitability, solvency) that fell within Altman's classification thresholds.

Table 2 Error Rate of Altman Model

	Error Rate
Incorrect Predictions	19
Total Sample	30
Error Rate	**63,33%**

Source: Data processed by researcher

As shown in Table 2, the model made 19 incorrect predictions, resulting in an error rate of 63.33%. This indicates the Altman Z-Score model's limitation in capturing the unique financial dynamics of retail companies, such as low profit margins, high debt dependency, and cash flow volatility.

Model Springate

Table 3 Accuracy Test of Springate Model

Year	Correct Predictions	Sample
2019	3	6
2020	4	6
2021	4	6
2022	3	6
2023	3	6
Total	17	30
Accuracy Rate	**56,67%**	

Source: Data processed by researcher

According to Table 3, the Springate S-Score model shows an accuracy rate of 56.67% out of 30 total data samples, with 17 predictions matching the actual financial conditions. This indicates the model's moderate ability to identify companies experiencing financial distress based on financial ratios such as liquidity, profitability, and asset efficiency.

Table 4 Error Rate of Springate Model

	Error Rate
Incorrect Prediction	13
Total Sample	30
Error Rate	**43,33%**

Source: Data processed by researcher

An error rate of 43.33%, as recorded in Table 4, indicates that the model still has limitations. Some companies predicted to be in distress were actually financially healthy, reflecting classification errors.

Zmijewski

Based on Table 5, the Zmijewski X-Score model demonstrates the highest accuracy rate at 63.33% from a total of 30 retail company samples analyzed. A total of 19 companies were correctly predicted, indicating the model's strong ability to identify firms in financial distress based on profitability, leverage, and liquidity ratios.

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Table 5 Accuracy Test of Zmijewski Model

Year	Correct Prediction	Sample
2019	5	10
2020	4	10
2021	4	10
2022	3	10
2023	3	10
Total	19	30
Accuracy Rate	**63,33%**	

Source: Data processed by researcher

As shown in Table 6, an error rate of 36.67% indicates that there were still 11 samples misclassified by the model. These classification errors suggest that while the model performs well, Zmijewski still has limitations in capturing the complex financial dynamics of the retail industry.

Tabel 6 Error Rate of Zmijewski Model

	Error Rate
Incorrect Prediction	11
Total Sample	30
Error Rate	**36,67%**

Source: Data processed by researcher

Model Accuracy and Error Comparison

Table 7 Accuracy and Error Comparison of Prediction Models

Model	Accuracy Rate	Error Rate
Altman	36,67%	63,33%
Springate	56,67%	43,33%
Zmijewski	63,33%	36,67%

Source: Data processed by researcher

Table 7 shows that among the three models tested, the Zmijewski X-Score performs best, with an accuracy rate of 63.33% and the lowest error rate of 36.67%, outperforming the Springate model (56.67% accuracy) and the Altman Z-Score (36.67% accuracy). This indicates that the Zmijewski model has a better predictive ability in identifying financial distress in primary goods retail companies during the 2019–2023 period.

The superiority of the Zmijewski model can be attributed to its use of three core financial ratios relevant to retail industry characteristics:

1. Profitability (Return on Assets) – Measures asset efficiency in generating profit. In the retail sector, low ROA often indicates inefficient inventory or operational cost management.
2. Leverage (Debt to Asset Ratio) – Indicates the extent to which assets are financed by debt. A high ratio signals default risk, while too low may reflect a lack of aggressive expansion.
3. Liquidity (Current Ratio) – Measures the ability to meet short-term obligations. In retail, this ratio is crucial for maintaining smooth operations and supply chains.

The Zmijewski model is considered more sensitive to early warning signals of financial crises than the other two models, as it is not limited to the manufacturing sector and uses a probit analysis approach that adapts better to the financial structure of retail businesses (Zmijewski, 1984; Fadhlia, 2022).

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CONCLUSIONS AND SUGGESTIONS

Conclussions

This study examines the predictive capabilities of three different financial distress models: Altman Z-Score, Springate S-Score, and Zmijewski X-Score. The findings reveal that the Altman model performed the worst, with an accuracy rate of only 36.67%. It identified 11 companies in financial distress, while 19 were classified as non-distress. The model's prediction error rate of 63.33% indicates significant inaccuracy, suggesting that the Altman model may not be suitable for identifying distress in Indonesian retail companies. This may be due to structural changes in the industry and the model's assumptions not fully aligning with the characteristics of the retail subsector.

The Springate model ranks in the middle, with an accuracy rate of 56.67%. It predicted 17 companies in distress and 13 as non-distress. With a 43.33% error rate, its predictive performance is better than Altman's but not yet reliable enough to be used as a standalone tool. The model appears more effective in companies with certain financial characteristics, such as high EBITDA, but limited in representing primary retail conditions that are heavily influenced by liquidity and debt burdens.

The Zmijewski model demonstrated the best performance with an accuracy rate of 63.33%. This model classified 19 companies as being in financial distress and 11 companies as non-financial distress. Although it emerged as the best model in this study, it still carried an error margin of 43.33%, making it the most suitable model for predicting financial distress in companies within the primary goods retail subsector during the research period. This relatively high level of accuracy supports the hypothesis that the Zmijewski model has stronger classification capabilities in assessing company conditions, particularly in identifying financial distress signals based on the variables X1 (Return on Assets), X2 (Debt to Assets), and X3 (Current Ratio).

The Zmijewski model performs best, with an accuracy rate of 63.33%. It classified 19 companies as distressed and 11 as non-distressed. Although the model still has a 36.67% margin of error, it proves to be the most appropriate tool for predicting financial distress in the primary goods retail subsector during the study period. The high accuracy rate supports the hypothesis that the Zmijewski model offers better classification of company conditions, especially in identifying early signs of financial failure based on Return on Assets, Debt to Assets, and Current Ratio.

Suggestions

1. For Retail Companies: It is recommended that companies integrate financial distress prediction models particularly the Zmijewski model into their risk management systems. Implementation may include predictive internal audits, financial dashboards, and regular evaluations to support strategic decisions such as cost efficiency and debt management.

2. For Investors: Investors should use the Zmijewski model as part of fundamental analysis to assess a company's financial risk. This approach supports value-based investment strategies and risk mitigation by utilizing analytical technologies such as automated financial models.

3. For Future Research: Future studies are advised to expand the scope to include other sectors and consider macroeconomic variables as well as non-financial indicators. The use of advanced statistical methods, such as logistic regression or machine learning, could further improve prediction accuracy and support the development of early warning systems.

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