# EVALUATION OF THE ACCURACY OF THE ALTMAN, SPRINGATE, ZMIJEWSKI MODEL IN THE CASE OF DELISTING ON THE INDONESIAN STOCK EXCHANGE

**Achmad Darul Farochi Shofiyanto[1]**
**Rahmat Agus Santoso[2]**
**Muhammad Rosyihuddin[3]**
**Hadi Ismanto[4]**

[1,2,3,4]Universitas Muhammadiyah Gresik

[1]achmaddarulfarochishofiyanto@gmail.com, [2]ra_santoso@umg.ac.id,
[3]muhammad.rosyihuddin@umg.ac.id, [4]hadi_ismanto@umg.ac.id

**Abstact**: *The forced delisting incident on the Indonesia Stock Exchange (IDX) in 2025 illustrates that several issuers had already shown signs of financial distress before their removal from trading. This condition emphasizes the relevance of reliable prediction models that function as early warning instruments for investors, regulators, and corporate decision makers. This study investigates the predictive accuracy of three financial distress models Altman Z-Score, Springate S-Score, and Zmijewski X-Score in identifying distress among companies that were forcibly delisted from the IDX in 2025. The research adopts a quantitative descriptive-comparative approach using a purposive sampling method and consists of eight delisted companies. The analysis relies on the firms' most recent financial statements before delisting and classifies their conditions according to the criteria of each model. The results show that the Altman Z-Score and Springate S-Score models both achieved an identical accuracy rate of 87.5%, while the Zmijewski X-Score model recorded only 12.5% accuracy. The finding suggests that the Altman and Springate models are more responsive to short-term distress signals related to liquidity, profitability, and operational performance, whereas the Zmijewski model is less sensitive to short-term deterioration. Overall, the analysis confirms that Altman and Springate serve as more effective early warning tools for detecting potential financial distress in the Indonesian capital market. The study provides an empirical reference for developing improved early detection mechanisms to support risk mitigation and strengthen financial decision-making for stakeholders.*
*Keywords: Financial distress, Altman Z-Score, Springate, Zmijewski, delisting*

**Abstrak**: Fenomena forced delisting di Bursa Efek Indonesia (BEI) pada tahun 2025 menunjukkan bahwa sejumlah emiten sudah mengalami indikasi financial distress sebelum dikeluarkan dari bursa. Situasi tersebut menegaskan perlunya model prediksi yang akurat sebagai sistem peringatan dini bagi investor, regulator, serta pihak manajemen perusahaan. Penelitian ini bertujuan untuk menilai ketepatan tiga model prediksi financial distress Altman Z-Score, Springate S-Score, dan Zmijewski X-Score dalam mengidentifikasi kondisi distress pada perusahaan yang terdampak forced delisting di BEI tahun 2025. Penelitian menggunakan pendekatan kuantitatif deskriptif–komparatif dengan metode purposive sampling yang melibatkan delapan perusahaan. Data yang dianalisis berupa laporan keuangan terakhir sebelum delisting, kemudian diklasifikasikan sesuai standar kategori masing-masing model. Hasil penelitian menunjukkan bahwa Altman Z-Score dan Springate S-Score memiliki

tingkat akurasi yang sama, yaitu 87,5%, sedangkan Zmijewski X-Score hanya mencapai akurasi 12,5%. Temuan ini mengindikasikan bahwa Altman dan Springate lebih sensitif terhadap penurunan kinerja jangka pendek yang tercermin dalam rasio likuiditas, profitabilitas, dan aktivitas perusahaan, sementara model Zmijewski kurang tanggap terhadap penurunan kinerja operasional jangka pendek. Dengan demikian, kedua model tersebut lebih efektif digunakan sebagai alat pendeteksi awal potensi financial distress dalam konteks pasar modal Indonesia. Hasil penelitian ini diharapkan dapat menjadi dasar pengembangan sistem peringatan dini untuk mendukung mitigasi risiko dan pengambilan keputusan keuangan bagi para pemangku kepentingan.

*Kata Kunci: Kesulitan keuangan, Altman Z-Score, Springate, Zmijewski, delisting*

## INTRODUCTION

The capital market holds a crucial role as a facility that maintains economic balance and stimulates national economic development. In addition to serving as a medium for companies to obtain long-term funding, the capital market also functions as an indicator of a country's economic health. Through stock trading activities, investors are able to allocate capital to productive sectors, while companies gain access to financial resources to expand their operational activities. According to Tandelilin (2017), the capital market acts as a mechanism for channeling funds from parties with excess capital to those who require financing to conduct productive activities. This is consistent with a report by the Financial Services Authority (OJK, 2024), which states that the increase in stock trading activity contributes to economic stability and growth through efficient capital allocation. In Indonesia, this function is carried out by the Indonesia Stock Exchange (IDX) as the official institution responsible for regulating, supervising, and ensuring transparency in market activities.

However, the capital market is not exempt from risk. One of the major risks is delisting, referring to the removal of a company's stock from the exchange listing. Delisting may occur at the company's own request (voluntary delisting) or due to violations of the regulations set by the Indonesia Stock Exchange, such as failure to comply with reporting requirements, severe financial problems, or the inability to sustain operational activities (forced delisting). In many cases, forced delisting is associated with economic distress, a condition in which a company faces financial pressure that weakens its ability to meet both short-term and long-term obligations. This condition is also reinforced by several studies that indicate financial distress can be detected through certain financial ratios before the crisis occurs (Inayah et al., 2025).

The year 2025 marks an important phase in the history of the Indonesian capital market. According to an official report from Kompas.com (2024), the Indonesia Stock Exchange removed eight listed companies from the exchange, with the delisting scheduled to take effect on July 21, 2025. The affected companies were PT Mas Murni Indonesia Tbk (MAMI), PT Forza Land Indonesia Tbk (FORZ), PT Hanson International Tbk (MYRX), PT Grand Kartech Tbk (KRAH), PT Cottonindo Ariesta Tbk (KPAS), PT Steadfast Marine Tbk (KPAL), PT Prima Alloy Steel Universal Tbk (PRAS), and PT Nipress Tbk (NIPS). Most of these companies experienced forced delisting due to their inability to comply with the regulations established by the Indonesia Stock Exchange, particularly regarding financial reporting and operational

conditions. This phenomenon is noteworthy because the majority of these companies had shown signs of economic distress before delisting, such as declining profits, weakened cash flows, and the inability to meet liabilities. Based on the researcher's observations of the financial statements of the eight issuers that underwent forced delisting, most of the companies exhibited downward profit trends and negative cash flows before the removal from listing occurred.

Research on financial distress has long attracted the attention of scholars. Beaver (1966) was one of the pioneers in employing financial ratios to detect bankruptcy. This study was later advanced by Altman (1968) through the development of the Z-score model, which evaluates bankruptcy potential based on five key financial ratios. Subsequent developments introduced several alternative prediction models, such as Springate (1978), which simplified Altman's model into four ratios, and Zmijewski (1984), which employed a probit analysis approach to estimate the probability of financial distress. These three models have become the most widely used analytical tools across various contexts and countries. Nevertheless, the accuracy level of each model differs across economic environments. Recent studies further emphasize that the three models may produce varying results depending on the degree of financial pressure experienced by a company, making the selection of the appropriate model a crucial factor in evaluating the potential for distress (Rachmandhika & Prabowo, 2024). More recent comparative studies also highlight significant differences in accuracy levels among prediction models, including evidence from Paired Sample T-Test analyses that reveal variations in the results between the Altman, Springate, and Grover models (Natania & Suhartono, 2024).

In Indonesia, research findings on the accuracy of distress prediction models also vary. Mulyati and Ilyasa (2020) found that the Altman and Springate models produced high accuracy levels in the mining sector. Aryo Nareswara and Dewiyanti (2023) further asserted that companies with a strong reliance on imported raw materials are more vulnerable to financial distress when exchange rate fluctuations occur. Meanwhile, Matanga and Holman (2024), within the context of South Africa, revealed that the Altman model has limitations in emerging markets due to differences in economic structures and accounting standards. Other studies have also shown that the accuracy gap between models can be highly significant; for instance, the Springate model achieved an accuracy rate of 80.7%, while the Grover model recorded 66.67% in a comparative study (Natania & Suharton, 2024).

The global economic conditions during the 2023–2025 period further worsened the financial situation of many companies. Bank Indonesia (2024) reported that the rise in international interest rates and the depreciation of the rupiah increased corporate debt burdens, particularly for firms with foreign currency borrowings. The IMF (2024) also recorded a decline in global demand that affected the retail, manufacturing, and property sectors. Jacob et al. (2023) revealed that during this period, the retail and property sectors were the most vulnerable to financial distress. Fedorova et al. (2022) emphasized that economic policy uncertainty can amplify the risk of bankruptcy, especially for companies with high debt burdens.

The 2025 delisting cases indicate that most companies had experienced financial distress long before their removal from the exchange. PT Forza Land Indonesia Tbk (FORZ) and PT Cottonindo Ariesta Tbk (KPAS) faced liquidity pressure due to

declining market demand, while PT Steadfast Marine Tbk (KPAL) struggled to repay its debts as a result of project delays. This aligns with the findings of Prameswari et al. (2018), which emphasized that most companies delisted from the Indonesia Stock Exchange during 2011–2015 were already in a state of financial distress before removal, and that such conditions had been successfully identified through bankruptcy prediction models. A study by Paoki et al. (2019) on companies delisted during 2016–2018 also discovered a similar pattern, showing that the majority of firms had recorded financial scores within the danger zone before being expelled from the exchange. These cases demonstrate the weakness of early detection systems among listed companies.

Several studies have previously examined companies that were delisted, such as Prameswari et al. (2018), who investigated the causes of distress among issuers delisted from the Indonesia Stock Exchange, and Risnanti et al. (2019), who applied the Altman model to companies placed under suspension before delisting. However, most of those studies (1) relied on only one prediction model, (2) focused on periods before 2020, and (3) did not conduct a simultaneous comparison of the three models. Furthermore, no study has been found that specifically analyzes the eight issuers that experienced forced delisting in 2025, a year that recorded the highest number of delistings in recent years. Therefore, this research offers novelty in terms of the research objects, observation period, and the comparative approach among financial distress prediction models.

Referring to the aforementioned issues, this study aims to evaluate the accuracy level of three financial distress early warning models—Altman Z-Score, Springate S-Score, and Zmijewski X-Score—among companies that experienced forced delisting from the Indonesia Stock Exchange in 2025. Unlike previous studies, which predominantly used active companies as research samples, this study focuses on firms that actually underwent delisting. The findings of this research are expected to provide a theoretical contribution to the development of financial distress studies in emerging economies, while also offering practical value for investors, market authorities, and corporate management in designing early warning systems to minimize the potential for bankruptcy.

## LITERATURE REVIEW
### Capital Market and Delisting

The capital market is a vital component of a country's economic system. Through the presence of the capital market, companies are able to obtain long-term sources of financing to support their business activities, while the public gains access to a medium for investing their funds and earning returns on those investments. Brigham (2019) states that the capital market functions as a bridge between parties with surplus funds and those requiring financing, thereby supporting the effectiveness of financial resource allocation within the economy. Thus, the capital market not only serves as a financial intermediation institution but also acts as an indicator of public confidence in the business sector.

In Indonesia, this function is carried out by the Indonesia Stock Exchange (IDX), which serves as the institution responsible for organizing securities trading as well as acting as a regulator for the listed issuers. The IDX plays a crucial role in maintaining

market stability, ensuring information transparency, and enforcing the principles of good corporate governance. However, a company's presence on the exchange is not permanent. If a company no longer meets the requirements set by the IDX, the exchange has the authority to conduct a delisting or remove the company's shares from listing.

Delisting can be classified into two forms, namely voluntary delisting and forced delisting. Voluntary delisting occurs when a company voluntarily withdraws its shares from the exchange, typically for strategic reasons such as mergers, acquisitions, or privatization. Conversely, forced delisting is imposed by the IDX when a company fails to meet the required regulations, for example, delays in financial reporting, continuously deteriorating performance, involvement in legal cases, or prolonged financial distress (Jacob et al., 2023).

The delisting phenomenon reflects the ongoing dynamics of the capital market. Zhao et al. (2024) state that delisting is a natural part of the business cycle, as not all companies are able to maintain financial performance and corporate governance in the long term. Macroeconomic conditions, market volatility, and regulatory policies are key factors that determine the sustainability of issuers in the stock exchange.

**Financial Distress**

Financial distress is a phase in which a company's financial condition begins to deteriorate and, if not handled properly, may lead to potential bankruptcy. This situation is characterized by declining profits, weakening operating cash flows, increasing debt, and decreasing levels of confidence from both investors and creditors regarding the company's ability to meet its obligations (Jacob et al., 2023). In the context of the capital market, distress reflects a company's inability to maintain financial stability, which ultimately results in a decline in stock prices and the possibility of delisting.

Distress conditions are generally caused by two groups of factors, namely those originating within the company and those driven by the external environment. From the internal aspect, the main causes may include errors in strategic planning, managerial inefficiency, and suboptimal capital structure management. From the external perspective, global economic pressure, high interest rates, and shifts in fiscal and monetary policies further exacerbate a company's financial position. For instance, the post-COVID-19 period (2023–2025) posed major challenges for the manufacturing and service sectors in Indonesia, where many listed companies recorded profit declines and liquidity difficulties.

According to Zhao et al. (2024), companies that fail to adapt to macroeconomic changes are more likely to enter the financial distress phase more quickly. Meanwhile, Altman (2018) emphasizes that the early indicators of distress can be detected through financial ratio analysis, such as working capital, retained earnings, EBIT, and market value of equity, as these variables reflect the company's ability to maintain operational continuity and capital structure. From a theoretical perspective, several approaches can be used to explain why financial distress occurs within a firm.

1. Signaling Theory explains that a decline in financial performance serves as a negative signal to the market. When profitability decreases, investors respond by selling shares, which puts downward pressure on stock prices and further worsens the company's position (Cassim & Swanepoel, 2021). This performance

deterioration is directly reflected in liquidity, profitability, and activity ratios used in the Altman and Springate models, making both models sensitive to early signs of distress. Meanwhile, the Zmijewski model captures distress signals through changes in ROA, leverage, and liquidity ratios, which also react to market pressures.

2. Agency Theory highlights the conflict of interest between management and shareholders. Manipulation of financial statements or delays in reporting have become a common cause of distress in Indonesia (Santoso & Pamesty, 2021). Such agency conflicts affect ratio components such as EBIT, retained earnings, and ROA, which are core variables in the Altman, Springate, and Zmijewski models. Therefore, these models are able to capture the negative impact of managerial practices that weaken a company's financial performance.

3. Trade-Off Theory and Pecking Order Theory emphasize that a capital structure that relies too heavily on debt increases the risk of distress, especially when a company's cash flow declines. This is consistent with the construction of the Zmijewski model, which highlights the debt ratio and current ratio as key indicators, as well as the Altman model, which measures risk based on capital structure through the market value of equity to liabilities ratio. Therefore, these models are theoretically capable of reflecting distress risks arising from corporate financing policies.

Financial distress represents a progressively developing phase that leads toward bankruptcy and can be identified through various financial performance indicators. Therefore, predictive models capable of providing early warning signals are crucial to detect the potential emergence of distress at an early stage. Models that are widely used for this purpose include the Altman Z-Score, Springate S-Score, and Zmijewski X-Score, which are designed to assess the likelihood of financial distress before a company reaches the point of failure.

**Prediction Models Altman, Springate, dan Zmijewski**

Studies on financial distress prediction have been conducted for more than five decades, with the primary objective of enabling management, investors, and regulators to detect potential bankruptcy at an early stage. Among the various models that have been developed, the approaches introduced by Altman, Springate, and Zmijewski are regarded as the three most widely applied classical models in prior research (Mulyati & Ilyasa, 2020).

1. Altman Z-Score

The model introduced by Altman in 1968 employs multivariate discriminant analysis by combining five key financial ratios, namely the ratio of working capital to total assets, retained earnings to total assets, EBIT to total assets, market value of equity to total liabilities, and sales to total assets. This combination of ratios captures a company's liquidity, profitability, leverage, and operational efficiency. Although originally developed in the United States, the model has been widely applied across various countries with diverse results. Boďa & Úradníček (2016) found that the Z-Score model remains accurate in Eastern Europe, yet requires adjustments to align with local conditions. In the Indonesian context, this model continues to be widely utilized to identify companies that are potentially at risk of delisting due to financial pressure.

## 2. Springate S-Score

Springate (1978) developed a more concise version of the Altman model by utilizing four financial ratios, namely the ratio of working capital to total assets, EBIT to total assets, EBT to current liabilities, and the ratio of sales to total assets. This model is easy to apply and is widely used in studies on manufacturing companies. According to Mulyati & Ilyasa (2020), Springate is effective in detecting short-term distress, although its accuracy level is slightly lower compared to the Altman model.

## 3. Zmijewski X-Score

Zmijewski (1984) designed a financial distress prediction model based on probit regression that relies on three main financial indicators, namely return on assets (ROA), debt ratio, and current ratio. Its main advantages are simplicity in calculation and its ability to perform well on large samples. According to Ningsih (2023), the Zmijewski model is quite effective in detecting distress in Indonesia's non-cyclical sector. Khakwani et al. (2018) also showed that the X-Score can compete with other classical models in predicting bankruptcy in emerging markets.

The Zmijewski model uses a probit analysis approach that places strong emphasis on the variables of leverage, profitability, and the company's ability to pay short-term obligations. Several previous studies have shown that this model often produces more accurate predictions for companies facing severe solvency pressure. Gupita et al. (2020) found that the Zmijewski model has excellent distress detection capability in companies with high debt burdens, and in some samples even outperformed both Altman and Springate. This indicates that the Zmijewski model tends to be more suitable for companies in a critical financial condition.

## RESEARCH METHODS

This study employs a quantitative approach with a descriptive comparative research design. The selection of a quantitative approach is based on the research focus, which relies on the processing and measurement of financial data in numerical form so that it can be analyzed objectively. This descriptive comparative study aims to explain and compare the predictive ability of three financial distress models — Altman Z-Score, Springate S-Score, and Zmijewski X-Score — in companies that experienced forced delisting from the Indonesia Stock Exchange (IDX) in 2025. The population in this study includes all companies that underwent forced delisting from the IDX in 2025. All of these companies were designated as research samples using a purposive sampling method, namely a sampling technique based on specific criteria relevant to the research objectives. The sampling criteria include: (1) Companies that were forced delisted from the IDX in 2025, (2) having the latest published financial statements before delisting, and (3) having complete financial data required to calculate ratios for the Altman, Springate, and Zmijewski models. The data used in this study consists of secondary data obtained from the latest audited financial statements before the company's removal from the IDX. Systematically, the stages of analysis in this study are presented as follows:

**Financial Statements → Calculation of Financial Ratios → Calculation of Z, S, and X Scores → Classification of Company Condition → Measurement of Model Accuracy**

At the scoring stage, each model is used to classify companies into distress or non-distress categories based on the cut-off values determined by each respective model. Furthermore, the prediction results are compared with the actual condition of the companies before delisting. The accuracy level is calculated by comparing the number of predictions that match the actual condition with the total research sample. This study employs three financial distress prediction models, each of which generates a score that serves as the basis for classifying a company's condition.

**1. Model Altman Z-Score (1968)**

This model uses five financial ratios combined into a single formula as follows:

$$Z = 1.2\,X_1 + 1.4\,X_2 + 3.3\,X_2 + 0.6\,X_4 + 1.0\,X_5$$

Description:

$X_1$ = Working Capital / Total Assets
$X_2$ = Retained Earnings / Total Assets
$X_3$ = EBIT / Total Assets
$X_4$ = Market Value of Equity / Book Value of Debt
$X_5$ = Sales / Total Assets

Interpretation of values:

$Z < 1{,}81$ **= Distress**
$1{,}81 \leq Z \leq 2{,}99$ **= grey area**
$Z > 2{,}99$ **= Non-distress**

**2. Model Springate S-Score (1978)**

Springate developed a simplified version of the Altman model using four main financial ratios, which are formulated as follows:

$$S = 1.03A + 3.07B + 0.66C + 0.4D$$

Description:

A = Working Capital / Total Assets
B = EBIT / Total Assets
C = EBT / Current Liabilities
D = Sales / Total Assets

Interpretation of values:

$S < 0{,}862$ = Distress
$S \geq 0{,}862$ = Non-distress

**3. Model Zmijewski X-Score (1984)**

The Zmijewski model employs a probit regression approach with three financial ratios that represent profitability, leverage, and liquidity. The formula used is as follows:

$$X = -4.3 - 4.5\,X_1 + 5.7\,X_2 - 0.004\,X_3$$

Description:

$X_1$ = Net Income / Total Assets
$X_2$ = Total Liabilities / Total Assets
$X_3$ = Current Assets / Current Liabilities

Interpretation of values:

$X > 0$ = Distress
$X < 0$ = Non-distress

The calculated scores from each model are then compared with the actual condition of the companies prior to delisting. The accuracy level is measured using the following formula:

**Accuracy = Number of Correct Predictions / Total Sample × 100%**

The model with the highest accuracy value is considered the most effective in detecting the potential for financial distress among companies in Indonesia.

## RESULTS AND DISCUSSION

The research objects consist of eight companies that were subjected to forced delisting by the Indonesia Stock Exchange (IDX) in 2025. The delisting occurred because the companies no longer met the operational sustainability and financial reporting requirements set by the IDX. The financial statement data were taken from the last reporting year before the companies were officially removed from the stock exchange listing. The analysis process in this study was conducted by applying three financial distress prediction models, namely the Altman Z-Score, Springate S-Score, and Zmijewski X-Score.

The calculation results are presented in the following table:

**Table 1. Calculation Results of the Altman Z-Score Model on Forced Delisting Companies**

| Stock Code | Z-Score | Category |
|---|---|---|
| MAMI | 1.7027 | Distress |
| FORZ | -3.0471 | Distress |
| MYRX | 0.4660 | Distress |
| KRAH | 0.5057 | Distress |
| KPAS | 0.5573 | Distress |
| KPAL | -0.2922 | Distress |
| PRAS | 3.1267 | Non-Distress |
| NIPS | 1.4524 | Distress |

**Source**: Processed data, 2025.

Based on these results, seven out of eight companies were identified as being in financial distress, while only one company (PRAS) fell into the non-distress category. Thus, the Altman model's accuracy in predicting the financial distress of delisted companies is 87.5%.

These results indicate that the Altman model is effective in detecting financial distress, particularly for companies experiencing declining profits and low liquidity. However, the model is also sensitive to differences in industry sectors, so some companies with strong capital structures (such as PRAS) may be categorized as non-distress even if they are eventually delisted. The results of the Springate model calculations are as follows:

**Table 2. Springate S-Score Calculation Results for Forced Delisting Companies**

| Stock Code | Z-Score | Category |
|---|---|---|
| MAMI | 0.2303 | Distress |
| FORZ | 0.1353 | Distress |
| MYRX | 0.3913 | Distress |
| KRAH | 0.3596 | Distress |
| KPAS | 0.0475 | Distress |
| KPAL | -0.1154 | Distress |

| | | |
|---|---|---|
| PRAS | 1.1726 | Non-Distress |
| NIPS | 0.5668 | Distress |

**Source**: Processed data, 2025.

As shown, seven companies were indicated as being in distress, while one company (PRAS) was classified as non-distress. The predictive accuracy of the Springate model for the actual condition of delisted companies is 87.5%, identical to that of the Altman model.

This indicates that the Springate model is effective in detecting declines in financial performance for companies facing liquidity challenges and decreasing sales. The model is well-suited for emerging markets like Indonesia, where many companies are vulnerable to cash flow fluctuations and declining operating margins. The Zmijewski model assesses the potential for financial distress based on three key ratios: profitability (ROA), leverage (Debt Ratio), and liquidity (Current Ratio). The calculation results are as follows:

**Table 3. Zmijewski Z-Score Calculation Results for Forced Delisting Companies**

| Stock Code | Z-Score | Category |
|---|---|---|
| MAMI | -3.8209 | Non-Distress |
| FORZ | -3.3208 | Non-Distress |
| MYRX | -4.0248 | Non-Distress |
| KRAH | -1.3621 | Non-Distress |
| KPAS | -2.3325 | Non-Distress |
| KPAL | 0.4938 | Distress |
| PRAS | -2.7927 | Non-Distress |
| NIPS | -1.8118 | Non-Distress |

**Source**: Processed data, 2025.

Only one company (KPAL) was classified as distressed, while the other seven were non-distressed. Thus, the Zmijewski model's accuracy in predicting the actual condition of delisted companies is 12.5%.

The low accuracy is due to the Zmijewski model placing greater emphasis on long-term profitability and leverage, whereas many delisting cases in Indonesia occur because of liquidity issues and short-term operational difficulties. This indicates that the Zmijewski model is less adaptive to the characteristics of a volatile domestic market. The comparison of accuracy among the models is as follows:

**Table 4. Comparison of Accuracy Levels of Altman, Springate, and Zmijewski Models**

| Model | Number of Accurate Predictions | Accuracy (%) |
|---|---|---|
| Altman Z-Score | 7 dari 8 | 87,5% |
| Springate S-Score | 7 dari 8 | 87,5% |
| Zmijewski X-Score | 1 dari 8 | 12,5% |

**Source**: Processed data, 2025.

From the comparison results, the Altman and Springate models demonstrate similar capabilities in identifying companies experiencing financial distress, whereas the Zmijewski model shows significantly lower accuracy.

The Altman and Springate models are considered more relevant for detecting financial difficulties in Indonesian companies, as they account for liquidity and activity ratios, which better reflect short-term financial conditions.

In contrast, the Zmijewski model is more suitable for stable markets with large companies and high leverage ratios, where profitability serves as the primary indicator of financial health.

**Discussion**

The findings of this study indicate that the Altman Z-Score and Springate S-Score have relatively comparable capabilities in identifying financial distress in companies undergoing forced delisting. Both models demonstrated an accuracy of 87.5%, indicating that the majority of predictions align with the actual financial conditions of troubled companies. In contrast, the Zmijewski X-Score showed a very low accuracy of only 12.5%, confirming that this model is not fully suitable for the Indonesian economic context, which is often influenced by liquidity crises and short-term market volatility.

These results are consistent with previous studies concluding that the Altman and Springate models tend to provide higher accuracy in predicting financial distress in emerging markets. The performance of both models, reaching 87.5%, supports the findings of Mulyati & Ilyasa (2020) and Matanga & Holman (2024), both of which emphasize that liquidity- and profitability-based models are more effective in detecting short-term financial pressure. Conversely, the low accuracy of the Zmijewski model in this study aligns with the findings of Jacob et al. (2023), which indicate that the model is less responsive to rapidly deteriorating liquidity conditions. Therefore, this study reinforces evidence that the characteristics of the Indonesian market are better analyzed using models sensitive to cash flow changes and operational performance.

The findings of this study have practical implications for various stakeholders in the Indonesian capital market. For investors, the results provide an empirical basis that the Altman and Springate models can be used as early warning tools to identify companies potentially facing financial difficulties. By recognizing signs of financial distress early, investors can make more cautious investment decisions and avoid risks associated with deteriorating company performance. For company management, these results can serve as indicators to strengthen liquidity policies and operational efficiency before financial conditions worsen. Additionally, regulators and stock exchange authorities can utilize these models as supplementary instruments for regularly monitoring the financial health of listed companies.

Although the Altman and Springate models both demonstrated an accuracy of 87.5%, the Springate model is more sensitive to short-term changes in liquidity and profitability, making it better suited for the dynamic and often volatile context of the Indonesian capital market. In contrast, the Zmijewski model exhibits low accuracy because it is unable to effectively capture short-term signs of financial distress.

Signaling Theory, declines in liquidity ratios, sales, and profitability send negative signals to the market, making distress conditions easier to detect for models sensitive to short-term performance changes (Cassim & Swanepoel, 2021). This explains why the Altman and Springate models, which emphasize working capital ratios, EBIT, and sales, are more capable of capturing early signals of financial

deterioration compared to the Zmijewski model, which focuses on long-term leverage variables. Furthermore, Agency Theory suggests that companies with governance issues, such as delayed financial reporting or inaccurate reporting practices, tend to exhibit deteriorating financial ratios (Santoso & Pamesty, 2021). These ratios are directly reflected in the predictive variables of Altman, Springate, and Zmijewski, so the inaccuracy of the Zmijewski model in the Indonesian context is also influenced by distress characteristics dominated by liquidity problems rather than long-term leverage (Jacob et al., 2023). Meanwhile, Trade-Off Theory and Pecking Order Theory explain that companies with suboptimal capital structures, particularly those heavily reliant on debt, enter distress more quickly when cash flows begin to weaken (Khakwani et al., 2018). This supports the relevance of the Zmijewski model under certain conditions, but not in most delisting cases in Indonesia, which stem primarily from short-term operational failures.

Moreover, these findings reflect the distinctive characteristics of the Indonesian capital market. Many delisted companies are relatively small to medium-sized, have concentrated ownership structures, and possess governance systems that are not yet fully robust. Issues such as delays in financial reporting, sharp declines in sales, and difficulties maintaining operational cash flow are the primary causes of short-term delisting (Prameswari et al., 2018). These conditions make liquidity-sensitive models like Altman and Springate more appropriate. In contrast, the Indonesian market does not exhibit distress patterns consistent with long-term, high-solvency predictions as assumed by the Zmijewski model (Ningsih, 2023).

Another important finding is the anomaly observed in the company PRAS, which was classified as non-distress by all models, while actual results show that it was still subjected to forced delisting. This indicates that, in some cases, delisting is not solely triggered by financial weaknesses but can also result from non-financial factors such as regulatory sanctions, non-compliance with exchange regulations, or governance issues. Therefore, financial scores do not always capture the managerial dynamics and administrative compliance that contribute to delisting decisions. This finding underscores the need for regulators and investors to combine quantitative models with monitoring of non-financial aspects when assessing bankruptcy risk.

## CONCLUSION

This study aims to evaluate the accuracy of three financial distress prediction models—Altman Z-Score, Springate S-Score, and Zmijewski X-Score—in analyzing eight companies that underwent forced delisting by the Indonesia Stock Exchange (IDX) in 2025. The results indicate that the Altman Z-Score has strong predictive capability, achieving an accuracy of 87.5%. The model can detect financial distress through a combination of liquidity, profitability, and asset efficiency indicators. However, its sensitivity to variations in industry structure may lead to misclassification of companies with high market equity that are, in fact, experiencing financial pressure.

Additionally, the Springate S-Score achieved the same accuracy level of 87.5%. This approach is considered more responsive to short-term liquidity dynamics and profit-generating capacity, making it particularly relevant in the fluctuating Indonesian economic context, where companies often face cash flow pressures and

operational challenges. In contrast, the Zmijewski X-Score exhibited the lowest accuracy at 12.5%. The model's low predictive performance is due to its focus on long-term profitability and leverage, rendering it less sensitive to liquidity disruptions and declines in operational activity—two conditions that frequently trigger financial distress in Indonesian companies.

Overall, the findings of this study confirm that the Altman and Springate models are more representative in predicting potential bankruptcy in the Indonesian capital market compared to the Zmijewski model. Both models can serve as early warning tools for investors, company management, and regulators in evaluating the financial health of listed companies. With consistent application, the predictive results from these models have the potential to help prevent delisting risks caused by financial crises that go undetected at an early stage.

## BIBLIOGRAPHY

Altman, E. I. (2018). Applications of distress prediction models: What have we learned after 50 years from the z-score models? International Journal of Financial Studies, 6(3). https://doi.org/10.3390/IJFS6030070

Aryo Nareswara, F., & Dewiyanti, S. (2023). Bankruptcy Risk and Its Effect on Earnings Management of Indonesian Firms. E3S Web of Conferences. https://doi.org/10.1051/e3sconf/202342602100

Bank Indonesia. 2024. Tinjauan Kebijakan Moneter – Desember 2024. Tersedia pada https://www.bi.go.id/id/publikasi/laporan/Pages/TKM-Desember-2024.aspx (Diakses: 29 November 2025).

Brigham, E. F., & Houston, J. F. 2019. Financial Management: Theory and Practice, edisi 15th. Cengage Learning.

Boďa, M., & Úradníček, V. (2016). The portability of Altman's Z-score model to predicting corporate financial distress of Slovak companies. Technological and Economic Development of Economy, 22(4), 532–553. https://doi.org/10.3846/20294913.2016.1197165

Cassim, R. J., & Swanepoel, M. J. (2021). The bankruptcy prediction approach: An empirical study of comparison between the emerging market score model and bankruptcy prediction indicators approach in the Johannesburg Stock Exchange. Journal of Economic and Financial Sciences, 14(1). https://doi.org/10.4102/JEF.V14I1.539

Fedorova, E., Ledyaeva, S., Drogovoz, P., & Nevredinov, A. (2022). Economic policy uncertainty and bankruptcy filings. International Review of Financial Analysis, 82(April), 102174. https://doi.org/10.1016/j.irfa.2022.102174

Gupita, N., Soemoedipiro, S. W., & Soebroto, N. W. (2020). Analisis Perbandingan Model Altman Z-Score, Springate, Zmijewski Dan Grover Dalam Memprediksi Financial Distress (Studi Pada Perusahaan Sektor Infrastruktur Yang Terdaftar Di Bei Periode 2015-2019). Jurnal Aktual Akuntansi Keuangan Bisnis Terapan, 3(1), 145–162.

Inayah, N. N., Patmasari, E. K., & Prasetyo, A. (2025). Analisis Financial Distress dengan Model Altman , Springate , dan Zmijewski di BEI. JMIK : Jurnal Manajemen Dan Inovasi Kewirausahaan, 1(2).

International Monetary Fund. 2024. World Economic Outlook Update: 2024. Tersedia

pada https://www.imf.org/ (Diakses: 29 November 2025).

Jacob, B., Huazheng, H., & Congzhao, H. (2023). Financial Distress Analysis Using Altman Z-Score, Springate, and Zmijewski in Retail Companies on the IDX. Journal Markcount Finance, 1(1), 1–12. https://doi.org/10.55849/jmf.v1i1.53

Khakwani, M. S., Irshad, S., Qureshi, A., Saba, I., & Ishaque, S. (2018). Predicting Bankruptcy Using Z-Score and Z Double Prime (Z"): A Study of Pakistan Stock Exchange. Journal of Accounting and Finance in Emerging Economies, 4(1), 47–62. https://doi.org/10.26710/JAFEE.V4I1.344

Matanga, N., & Holman, G. (2024). Adapting Altman Z-score models for early warning signals: Evidence from delisted mining stocks on the Johannesburg Stock Exchange. Investment Analysts Journal, 53(3), 249–261. https://doi.org/10.1080/10293523.2024.2397892

Mulyati, S., & Ilyasa, S. (2020). The Comparative Analysis of Altman Z-Score, Springate, Zmijewski, And Internal Growth Rate Model in Predicting the Financial Distress (Empirical Study on Mining Companies Listed on Indonesia Stock Exchange 2014-2017). KINERJA, 24(1), 82–95. https://doi.org/10.24002/KINERJA.V24I1.3231

Natania, C., & Suhartono, S. (2024). Analisis Perbandingan Akurasi Model Prediksi Financial Distress pada Perusahaan Manufaktur Sektor Consumer Cyclical ( Studi Kasus Subsektor Tekstil dan Garmen di BEI 2020-2022 ). Jurnal Manajemen, 13(2), 82–101.

Ningsih, M. E. D. (2023). Analisis Financial Distress Menggunakan Metode Zmijewski X-ScorePada Sektor Consumer Non-Cyclical Yang Terdaftar Di Bursa EfekIndonesia (Bei) Periode 2019-2022. Jurnal Ilmu Manajemen Dan Kewirausahaan, 3(1), 118–125.

Nur Jamal Shaid. 2024, December 21. BEI delisting 8 emiten, efektif mulai 21 Juli 2025. Tersedia pada https://money.kompas.com/read/2024/12/21/000355726/bei-delisting-8-emiten-efektif-mulai-21-juli-2025 (Diakses: 29 November 2025).

Otoritas Jasa Keuangan. 2024. Fact Book Pasar Modal 2024. Tersedia pada https://ojk.go.id/id/Publikasi/Roadmap-dan-Pedoman/Pasar-Modal/Documents/Fact%20Book%20Pasar%20Modal%202024.pdf (Diakses: 29 November 2025).

Paoki, T. T., Mangantar, M., Tulung, J. E., Metode, A., Dan, A. Z., Pada, S. S., Paoki, T. T., Mangantar, M., & Tulung, J. E. (2019). Analisis Metode Altman Z-Score Dan Springate S-Score Pada Perusahaan Yang Telah Delisting Di Bursa Efek Indonesia Tahun 2016-2018. Jurnal EMBA: Jurnal Riset Ekonomi, Manajemen, Bisnis Dan Akuntansi, 7(4), 5137–5146.

Prameswari, A., Yunita, I., & Azhari, M. (2018). Prediksi Kebangkrutan Dengan Metode Altman Z-Score, Springate Dan Zmijewski Pada Perusahaan Delisting Di Bursa Efek Indonesia (Bei). Jrak, 10(1), 8–15. https://doi.org/10.23969/jrak.v10i1.1056

Rachmandhika, B., & Prabowo, T. J. W. (2024). Analisis Perbandingan Dengan Tingkat Akurasi Metode Penilaian Financial Distress Perusahaan. DIPONEGORO JOURNAL OF ACCOUNTING, 13, 1–13.

Risnanti, P., Kustiyah, E., & Widayanti, R. (2019). Analisis Kebangkrutan Perusahaan yang Terancam Delisting di Bursa Efek Indonesia. Jurnal Maksipreneur:

Manajemen, Koperasi, Dan Entrepreneurship, 9(1), 1. https://doi.org/10.30588/jmp.v9i1.432

Santoso, R. A., & Pamesty, N. (2021). Discretionary Accrual Public Companies in Indonesia. ATLANTIS PRESS, 585, 322–328.

Sugiyono, P. D. (2019). Metode Penelitian Kuantitatif Kualitatif dan R&D. ALFABETA.

Tandelilin, E. (2017). Pasar Modal : Manajemen Portofolio & Investasi. //slims-terpadu.unri.ac.id/index.php?id=69125&keywords=&p=show_detail&utm_source

Wahyuni, S. F., & Robiyah. 2021. Analisis financial distress menggunakan metode Altman Z-Score, Springate, Zmijeski dan Grover pada perusahaan sektor perkebunan yang terdaftar di Bursa Efek Indonesia. Maneggio: Jurnal Ilmiah Magister Manajemen, 4(1), 62–72.

Zhao, J., Ouenniche, J., & De Smedt, J. (2024). Survey, classification, and critical analysis of the literature on corporate bankruptcy and financial distress prediction. Machine Learning with Applications, 15, 100527. https://doi.org/10.1016/j.mlwa.2024.100527