BIJMT : Brilliant International Journal Of Management And Tourism

E-ISSN: 2827-8380
P-ISSN: 2810-076X

Research Article

Bankruptcy Prediction of E-Commerce Companies on IDX Using Altman Z-Score, Springate, and Zmijewski

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Abstract: The growth of Indonesia's e-commerce sector has been accompanied by significant challenges related to financial sustainability. Despite rapid expansion, several technology-based companies in the e-commerce subsector have recorded persistent losses, raising concerns about bankruptcy risks. This study aims to assess the probability of bankruptcy among e-commerce technology companies listed on the Indonesia Stock Exchange (IDX) by applying three analytical models: Altman Z-Score, Springate, and Zmijewski. The research employs a descriptive quantitative approach using documentation analysis of published financial statements. Findings reveal that each model produces varying levels of sensitivity in identifying financial distress. The Altman Z-Score and Zmijewski models emphasize capital structure and liquidity aspects, making them more effective in capturing solvency-related issues. In contrast, the Springate model prioritizes operational efficiency, offering a different perspective in evaluating financial performance. The analysis indicates that PT Goto Gojek Tokopedia Tbk and PT Global Niaga Tbk are consistently categorized within the bankruptcy zone across most models, while PT Bukalapak.com Tbk presents fluctuating outcomes depending on the model applied. These results highlight the importance of employing multiple predictive tools to strengthen the accuracy of bankruptcy assessments. The combined use of the three models serves as an early warning mechanism that provides valuable insights for both corporate management and external stakeholders. Furthermore, the study underscores the role of bankruptcy prediction in testing the going concern assumption, thereby assisting decision-makers in formulating preventive strategies and risk management policies to safeguard financial stability within Indonesia's e-commerce sector.

Keywords: Altman Z-Score; Bankruptcy; E-Commerce; Springate; Zmijewski

Received: 01 September, 2025
Revised: 18 September, 2025
Accepted: 04 October, 2025
Published: 06 October, 2025
Curr. Ver.: 06 October, 2025

1. Introduction

The rapid development of digital technology and the increasing number of internet users in Indonesia have driven the adoption of digital innovations, particularly in e-commerce or electronic trading. The Covid-19 pandemic during the 2020–2021 period became a major catalyst that accelerated digital adoption and significantly transformed consumer behavior toward online transactions. This digital revolution has shifted traditional retail businesses toward more dynamic and efficient digital platforms, such as e-commerce marketplaces in Indonesia including Tokopedia, Bukalapak, Blibli, Shopee, and Lazada.

Consumer behavior patterns in utilizing online transactions are further supported by the massive penetration of smartphones, which in turn drives the growth of national e-commerce. The Indonesian E-Commerce Association (idEA) reported that the country's e-commerce sector is projected to continue growing by approximately 20%–25% in 2025 (kontan.co.id, 2025). Between 2019 and 2024, Indonesia has experienced consistent growth in e-commerce transaction activities (kontan.co.id, 2024).

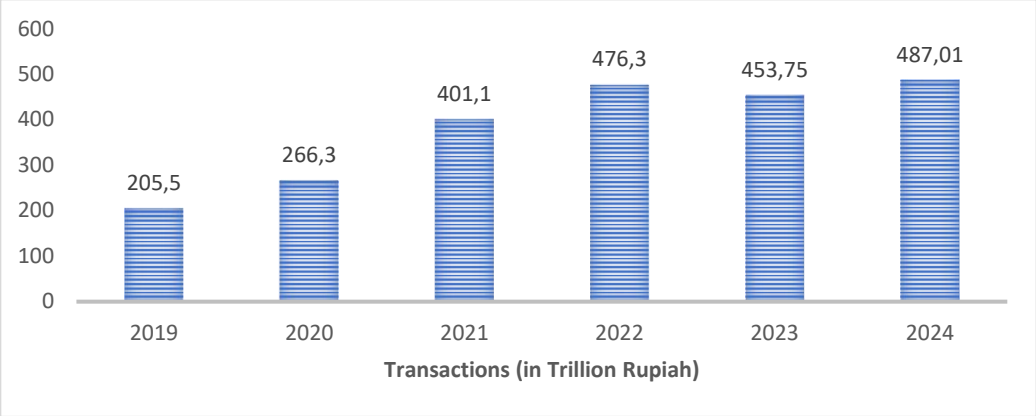

Figure 1. The Growth and Development of E-Commerce Activities in Indonesia (2019–2024). Source: www.kontan.co.id.

In 2019, the total value of e-commerce transactions in Indonesia was recorded at IDR 205.5 trillion. In 2020, the value increased by 29.6% to IDR 266.3 trillion, followed by a significant surge in 2021, rising by 50.7% to IDR 401.1 trillion. This pattern demonstrates that the Covid-19 pandemic influenced consumer behavior in Indonesia, reinforced by the widespread use of smartphones and government policies to reduce physical interaction during the pandemic. The growth trend continued in 2022, with an increase of 18.7% compared to 2021, reaching IDR 476.3 trillion. However, in 2023, the industry experienced a decline of 4.7%, totaling IDR 453.75 trillion. Despite this decline, the e-commerce sector rebounded in 2024 with a positive growth of 7.3%, reaching IDR 487.01 trillion.

Although the sector shows significant positive growth, not all technology companies, particularly those in e-commerce, are able to maintain financial stability. Increasing competition among e-commerce firms in Indonesia, combined with extreme operational challenges, has made several companies vulnerable to bankruptcy. Elevenia, Blanja.com, Zenius, Pegi-Pegi, and JD.ID are among the e-commerce firms that have ceased operations in Indonesia. In addition, Bukalapak officially closed its physical e-commerce services in 2025 (Romys Binekasri, 2025). Furthermore, PT Gojek Tokopedia Tbk (GoTo) reported a net loss of IDR 367 billion in the first quarter of 2025, highlighting the difficulties in achieving profitability (Saumi, 2025). Speculation about a possible Grab–GoTo merger, which attracted wide public attention before being denied by Grab (Rakhmayanti, 2025), further illustrates the uncertainty faced by technology firms in the e-commerce subsector.

These phenomena indicate that while the Indonesian e-commerce market continues to expand rapidly, individual companies remain at serious risk of bankruptcy. The gap between overall national e-commerce growth and the inability of specific companies to achieve sustainable profitability underscores the importance of anticipatory measures. Predicting bankruptcy at an early stage is essential for companies to design strategic plans, enabling stakeholders to implement timely and effective mitigation measures.

Bankruptcy prediction can be carried out using financial statement analysis supported by performance measurement tools. The Altman Z-Score, Springate, and Zmijewski models are internationally recognized methods for evaluating and identifying potential bankruptcy, providing early detection of financial distress before greater losses occur. These empirically tested models offer valuable insights for both internal and external stakeholders in assessing corporate health and risks.

This study offers several unique contributions. First, it focuses specifically on technology companies within the e-commerce subsector listed on the Indonesia Stock Exchange. Although this sector shows strong growth in digital transactions, many companies still struggle with financial stability and bankruptcy risk. Second, this study employs a comparative approach by examining multiple bankruptcy prediction models—Altman Z-Score, Springate,

and Zmijewski—simultaneously, a method rarely applied in the Indonesian digital industry context. Third, the results are not only presented in numerical terms but are also analyzed through signaling theory and the going concern principle, providing deeper perspectives on corporate sustainability and future prospects. Through this approach, the study is expected to contribute practically for management and investors, as well as academically in enriching financial literature in the digital era.

2. Literature Review

Bankruptcy Theory

Bankruptcy is a condition that reflects a severe financial failure within a company. According to Law No. 4 of 1998, an entity may be declared bankrupt by a court ruling if it has more than two creditors and fails to fulfill at least one obligation that has matured and is collectible. In general, bankruptcy refers to a situation in which a business entity is unable to meet its financial obligations to creditors within the stipulated timeframe. Bankruptcy represents the extreme form of financial distress, namely a financial pressure that leads to a company's inability to continuously fulfill its short-term obligations (Rahmat, 2020). The earlier a company receives warning signs of potential bankruptcy, the greater its opportunity to take corrective actions promptly and appropriately (Peter et al., 2021). Bankruptcy can, in fact, be predicted before a company actually collapses, with a tolerance range of two to five years to forecast performance decline that may ultimately lead to bankruptcy (Viciwati, 2020).

Bankruptcy generates significant impacts on both internal corporate operations and external stakeholders. For the company, consequences may include termination of operational activities, layoffs, asset seizures, and even liquidation. Loss of reputation and market trust also becomes an unavoidable consequence. For investors, bankruptcy carries the risk of substantial capital losses. Stock prices tend to decline as the market perceives the company to be in worsening financial condition. In the long run, this phenomenon may affect the overall performance of investment portfolios (Sukriani et al., 2025).

Signaling Theory

Signaling theory, initially introduced by Michael Spence in 1973, explains that when company management provides information regarding the sustainability value of a firm, such information can be used by shareholders as a basis for assessing the company's future prospects (Putri & Challen, 2021). This theory is widely applied in accounting and auditing studies, where management delivers signals about the entity through various aspects of financial information. Signaling theory can also be interpreted as a mechanism by which management, as the holder of internal information, sends signals to external parties or investors that may influence the perception and decision-making related to the entity (Subroto & Endaryati, 2024).

Going Concern Principle

The going concern principle assumes that a company will continue its operations in the foreseeable future, as reflected in its financial statements, and that it does not face threats to its financial health or risks of discontinuing operations (Yunita, 2022). The going concern principle also describes a situation in which auditors identify significant uncertainties that raise doubts about the company's ability to sustain its operations. When auditors conclude that there is material doubt regarding the continuity of a company's business activities, they may issue a going concern audit response either through a modified audit opinion or by adding an explanatory paragraph (Chairani et al., 2024).

E-Commerce

E-commerce refers to the process of buying and selling goods or services by utilizing electronic facilities connected to virtual networks, conducted through computers or smartphones. E-commerce activities involve the buying and selling of products or services where marketing is carried out through electronic media, primarily web-based platforms. With the presence of e-commerce technology, consumers can more easily find the products they need; despite the physical distance between buyers and sellers, transactions can still be conducted effectively through e-commerce platforms. This activity also contributes to a country's economy by increasing revenue, employment opportunities, and tax income (Hendricks & Mwapwele, 2024).

E-commerce services play a significant role for businesses due to shifting consumer behavior, as consumers increasingly prefer online shopping over offline alternatives (Yusuf et al., 2022). The key characteristics of e-commerce include transactions that transcend time and geographic boundaries, interactions conducted electronically, convenience in reducing operational costs, and efficiency in facilitating business processes. However, e-commerce also faces several challenges, such as frequent data security threats in the digital sphere, intense competition, widespread fraudulent practices, the need for adequate infrastructure such as high-speed internet and reliable smartphones, as well as the rapid pace of innovation driven by volatile market conditions (Jain et al., 2021).

Altman Z-Score Method

Altman, since 1968, has been recognized as the pioneer who introduced the Multiple Discriminant Analysis (MDA) approach in financial analysis (Altman, 1968). This technique is carried out through the integration of various financial ratios that play a significant role in financial statements, which are then compared using different approaches (Abadi & Misidawati, 2023). The Altman Z-Score method has been widely applied both in manufacturing and non-manufacturing companies, including private and public firms, and has consistently demonstrated a high level of accuracy above 0.90 (Altman et al., 2017). According to Rahmat (2020), the Altman Z-Score can be calculated using the following formula:

$$Z = 6{,}56\ X1 + 3{,}36\ X2 + 6{,}72\ X3 + 1{,}05\ X4$$

Where:

Z = Bankruptcy Index

X1 = Working Capital to Total Assets Ratio

X2 = Retained Earnings to Total Assets Ratio

X3 = EBIT to Total Assets Ratio

X4 = Book Value of Equity to Book Value of Debt Ratio

The categorization of results can be classified as follows:

If $Z < 1.22$, the company is categorized into the Bankruptcy Zone.

If $1.22 < Z < 2.90$, the company is categorized into the Grey Zone.

If $Z > 2.90$, the company is categorized into the Safe Zone.

Springate Method

The Springate method was first introduced in 1978 by Gordon L.V. Springate through the Multiple Discriminant Analysis (MDA) approach, involving a sample of 40 companies in his study (Springate, 1978). Initially, Springate tested 19 financial ratios, but after comparative analysis with ratios previously tested by Altman, four ratios were selected as the most significant in distinguishing between healthy companies and those facing bankruptcy (Rahmat, 2020). The predictive accuracy of the Springate method ranges from a maximum of 100% to as low as –9.23% (Hadityo & Indrawati, 2024). The Springate formula is as follows:

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

Where:

S = Bankruptcy Index

A = Working Capital to Total Assets Ratio

B = Earnings Before Interest and Taxes (EBIT) to Total Assets Ratio

C = Earnings Before Taxes (EBT) to Current Liabilities Ratio

D = Sales to Total Assets Ratio

The classification criteria of this model are as follows:

If S > 0.862, the company is categorized into the Safe Zone.

If S < 0.862, the company is categorized into the Bankruptcy Zone.

Zmijewski Method

In 1983, Mark E. Zmijewski introduced a new approach in bankruptcy prediction through the application of a Multivariate Logit Model (Zmijewski, 1984). His study analyzed a sample of 75 financially distressed firms and 73 financially stable firms, with financial ratios based on data from the period 1972–1978 (Muzanni & Yuliana, 2021). The Zmijewski model demonstrated an accuracy rate of up to 90%, which is considered higher compared to the Altman Z-Score method (Viciwati, 2020). The formula of the Zmijewski model is presented as follows:

X = -4.3 – 4.5X1 + 5.7X2 - 0.004X3

Where:

X = Bankruptcy Index

X1 = Net Income to Total Assets Ratio

X2 = Total Debt to Total Assets Ratio

X3 = Current Assets to Current Liabilities Ratio

The interpretation of the model is as follows:

If X < 0, the company is categorized into the Safe Zone.

If X ≥ 0, the company is categorized into the Bankruptcy Zone.

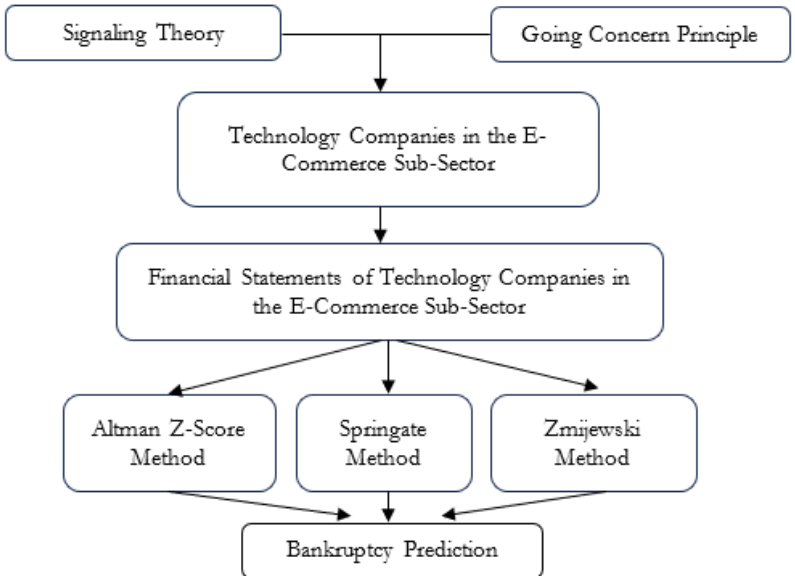

Figure 1. Theoretical Framework Model.
Source: Processed Data (2025).

3. Method

Population and Sample

Sugiyono (2020) defines population as a form of generalization that encompasses a region consisting of objects or subjects. Population is not only understood as the total number of objects or subjects, but also as the entirety of characteristics or traits that naturally attach to those objects or subjects. In this study, the population consists of all financial statements of technology companies in the e-commerce sub-sector listed on the Indonesia Stock Exchange during the period 2022–2024.

Sugiyono (2020) further explains that a sample is a subset of the entire population distinguished by certain characteristics. In other words, a sample represents a portion of the objects or subjects that are considered capable of representing the population. The sample in this study includes all members of the population, or what is referred to as a total sample, whereby this technique uses all members of the population as part of the sample. Thus, it can be concluded that the sample of this study comprises all financial statements of technology companies in the e-commerce sub-sector listed on the Indonesia Stock Exchange throughout the 2022–2024 period.

Data Collection Technique

This study utilizes historical financial statement data of technology companies in the e-commerce sub-sector published by the Indonesia Stock Exchange as well as the official websites of each company for the period 2022–2024. The research applies documentation techniques as the primary method of data collection, supported by a literature study. The documentation method was conducted by gathering various documents related to the research object, where the data were obtained indirectly from the companies. Meanwhile, the literature study involved reviewing relevant literature and books related to the research topic, particularly studies concerning bankruptcy prediction using the Altman Z-Score, Springate, and Zmijewski methods, sourced from journal articles and previous research.

Analysis Method

This study employs financial statement data from technology companies in the e-commerce sub-sector listed on the Indonesia Stock Exchange during the 2022–2024 period. The data were analyzed using several methods to estimate bankruptcy, namely the Altman Z-Score, Springate, and Zmijewski models, and conclusions were drawn based on the results of the analysis obtained.

Operational Variables

According to Sugiyono (2020), research variables are attributes, characteristics, or values of an object that may vary and are determined by the researcher to be analyzed and concluded. In this study, the operational variable used is bankruptcy prediction in technology companies within the e-commerce sub-sector listed on the Indonesia Stock Exchange.

a. Dependent Variable:
   Bankruptcy Index
b. Independent Variables:
   Financial Ratios

Table 1. Operational Definition of Research Variables.

Variables	Model	Scale
S = Bankruptcy Index A = Working Capital to Total Assets Ratio B = Earnings Before Interest and Taxes (EBIT) to Total Assets Ratio C = Earnings Before Taxes (EBT) to Current Liabilities Ratio D = Sales to Total Assets Ratio	Springate	Ratio
X = Bankruptcy Index X1 = Net Income to Total Assets Ratio X2 = Total Debt to Total Assets Ratio X3 = Current Assets to Current Liabilities Ratio	Zmijewski	Ratio
X1 = Working Capital to Total Assets Ratio X2 = Retained Earnings to Total Assets Ratio X3 = EBIT to Total Assets Ratio X4 = Book Value of Equity to Book Value of Debt Ratio	Altman Z-Score	Ratio

Source: Processed Data (2025).

4. Results and Discussion

Research Result

This study analyzes the financial ratios of technology companies in the e-commerce subsector listed on the Indonesia Stock Exchange during the period 2022–2024 using three comparative models, namely the Altman Z-Score, Springate, and Zmijewski methods. The following table presents the findings from the bankruptcy prediction analysis using the Altman Z-Score, Springate, and Zmijewski models.

Table 2. Calculation Results of the Altman Z-Score Method.

Company Name	Code	Year	6,56 X1	3,36 X2	6,72 X3	1,05 X4	Z-Score	Criteria
PT Bukalapak.com Tbk	Buka	2022	5,074	-0,900	0,431	30,645	35,250	Safe Zone
		2023	4,865	-0,945	-0,345	33,584	37,159	Safe Zone
		2024	4,448	-1,390	-0,681	22,743	25,119	Safe Zone
PT Goto Gojek Tokopedia Tbk	Goto	2022	1,038	-2,860	-1,464	7,813	4,527	Safe Zone
		2023	2,522	-12,977	-1,277	2,041	-9,691	Bankruptcy Zone
		2024	2,474	-16,651	-0,349	2,493	-12,032	Bankruptcy Zone
PT Global Niaga Tbk	Beli	2022	1,786	-4,739	-2,390	3,061	-2,281	Bankruptcy Zone
		2023	0,949	-6,148	-3,072	1,647	-6,623	Bankruptcy Zone
		2024	1,008	-5,410	-0,982	1,623	-3,761	Bankruptcy Zone

Source: Processed Data (2025)

Referring to the data in Table 2, the Altman Z-Score method indicates that PT Bukalapak.com Tbk consistently falls into the Safe Zone category over three consecutive years, from 2022 to 2024. Meanwhile, PT Goto Gojek Tokopedia Tbk is classified in the Safe Zone in 2022 but shifts to the Bankruptcy Zone during 2023–2024. In contrast, PT Global Niaga Tbk remains in the Bankruptcy Zone throughout the entire observation period, from 2022 to 2024.

Table 3. Calculation Results of the Springate Method.

Company Name	Code	Year	1,03 A	3,07 B	0,66 C	0,4 D	S-Score	Criteria
PT Bukalapak.com Tbk	Buka	2022	0,797	0,197	1,852	0,053	2,899	Safe Zone
		2023	0,764	-0,250	-1,096	0,068	-0,514	Bankruptcy Zone
		2024	0,698	-0,311	-0,984	0,072	-0,525	Bankruptcy Zone
PT Goto Gojek Tokopedia Tbk	Goto	2022	0,163	-0,669	-2,200	0,033	-2,673	Bankruptcy Zone
		2023	0,396	-0,583	-4,665	0,109	-4,743	Bankruptcy Zone
		2024	0,388	-0,159	-0,347	0,147	0,030	Bankruptcy Zone
PT Global Niaga Tbk	Beli	2022	0,280	-1,092	-1,267	0,434	-1,645	Bankruptcy Zone
		2023	0,149	-0,857	-0,597	0,458	-0,847	Bankruptcy Zone
		2024	0,158	-0,448	-0,320	0,414	-0,197	Bankruptcy Zone

Source: Processed Data (2025).

Referring to Table 3, the Springate method shows that PT Bukalapak.com Tbk falls into the Safe Zone in 2022 but shifts to the Bankruptcy Zone during the 2023–2024 period. Meanwhile, PT Goto Gojek Tokopedia Tbk is consistently classified in the Bankruptcy Zone over three consecutive years, from 2022 to 2024. Similarly, PT Global Niaga Tbk experiences the same condition as PT Goto Gojek Tokopedia Tbk, remaining in the Bankruptcy Zone throughout the observation period of 2022–2024.

Table 4. Calculation Results of the Zmijewski Method.

Company Name	Code	Year	-4,3	-4,5 X1	5,7 X2	0,004 X3	X-Score	Criteria
PT Bukalapak.com Tbk	Buka	2022	-4,300	-0,326	0,189	0,109	-4,546	Safe Zone
		2023	-4,300	0,235	0,173	0,113	-4,005	Safe Zone
		2024	-4,300	0,281	0,252	0,070	-3,837	Safe Zone
PT Goto Gojek Tokopedia Tbk	Goto	2022	-4,300	1,279	0,675	0,011	-2,357	Safe Zone
		2023	-4,300	7,519	1,936	0,010	5,145	Bankruptcy Zone
		2024	-4,300	0,537	1,689	0,010	-2,084	Safe Zone
PT Global Niaga Tbk	Beli	2022	-4,300	1,759	1,456	0,010	-1,095	Safe Zone
		2023	-4,300	1,276	2,219	0,006	-0,811	Safe Zone
		2024	-4,300	0,705	2,239	0,006	-1,362	Safe Zone

Source: Processed Data (2025).

Referring to Table 4, the Zmijewski method indicates that PT Bukalapak.com Tbk consistently remains in the Safe Zone throughout the 2022–2024 period. For PT Goto Gojek Tokopedia Tbk, the model places the company in the Safe Zone in 2022 and 2024, while in 2023 it shifts into the Bankruptcy Zone. Meanwhile, the analysis of PT Global Niaga Tbk using the Zmijewski method shows a stable position in the Safe Zone during the entire period of 2022–2024.

Discussion

Table 5. Results of Bankruptcy Prediction Using Three Methods.

Company Name	Year	Altman Z-Score	Criteria	Springate	Criteria	Zmijewski	Criteria
	2022	35,250	Safe Zone	2,899	Safe Zone	-4,546	Safe Zone
PT Bukalapak.com Tbk	2023	37,159	Safe Zone	-0,514	Bankruptcy Zone	-4,005	Safe Zone
	2024	25,119	Safe Zone	-0,525	Bankruptcy Zone	-3,837	Safe Zone
	Rata-rata	32,509	Safe Zone	0,620	Bankruptcy Zone	-4,129	Safe Zone
	2022	4,527	Safe Zone	-2,673	Bankruptcy Zone	-2,357	Safe Zone
PT Goto Gojek Tokopedia Tbk	2023	-9,691	Bankruptcy Zone	-4,743	Bankruptcy Zone	5,145	Bankruptcy Zone
	2024	-12,032	Bankruptcy Zone	0,030	Bankruptcy Zone	-2,084	Safe Zone
	Rata-rata	-5,732	Bankruptcy Zone	-2,462	Bankruptcy Zone	0,235	Bankruptcy Zone
	2022	-2,281	Bankruptcy Zone	-1,645	Bankruptcy Zone	-1,095	Safe Zone
PT Global Niaga Tbk	2023	-6,623	Bankruptcy Zone	-0,847	Bankruptcy Zone	-0,811	Safe Zone
	2024	-3,761	Bankruptcy Zone	-0,197	Bankruptcy Zone	-1,362	Safe Zone
	Rata-rata	-4,222	Bankruptcy Zone	-0,896	Bankruptcy Zone	-1,089	Safe Zone

Source: Processed Data (2025).

The analysis results using the three bankruptcy prediction methods reveal variations in the case of PT Bukalapak.com Tbk. Both the Altman Z-Score and Zmijewski models consistently classify the company within the Safe Zone throughout the 2022–2024 period. The Altman Z-Score produced an average value of 32.509, while the Zmijewski model generated an average of -4.129. These outcomes suggest that both models are highly sensitive to factors such as capital structure, profitability, liquidity, and leverage. This condition aligns with PT Bukalapak.com Tbk's initial public offering (IPO) achievement, one of the largest in the history of the Indonesia Stock Exchange, valued at IDR 21.90 trillion in 2021, which strengthened its capital structure. However, the Springate method paints a more concerning picture, showing that although the company was in the Safe Zone with a score of 2.899 in 2022, it declined into the Bankruptcy Zone in 2023–2024, with an average of 0.620. This divergence arises because the Springate model is more sensitive to operational efficiency and the firm's ability to generate profits. From the perspective of signaling theory, such differing results send ambiguous signals to stakeholders, particularly investors and creditors. The Springate findings suggest negative signals in 2023–2024, reflecting Bukalapak's suboptimal

profitability, which could threaten the company's going concern principle despite its relatively solid capital structure from the 2021 IPO.

The case of PT Goto Gojek Tokopedia Tbk illustrates the most concerning scenario among the three firms analyzed. Based on the Altman Z-Score, the company moved from the Safe Zone in 2022 into the Bankruptcy Zone in 2023 and 2024, with an average score of -5.732. The Springate model consistently predicted the firm to be in the Bankruptcy Zone across the three years, with an average of -2.462. Similarly, the Zmijewski model placed the company in the Bankruptcy Zone in 2023, with an overall average of 0.235 for 2022–2024, again indicating distress. The consistency of these findings provides strong negative signals to investors and creditors. Despite the firm's significant losses in 2023—mainly driven by goodwill impairment following Tokopedia's divestment to TikTok—the 2024 financial report still recorded a net loss of IDR 5.16 trillion. Such conditions threaten the company's going concern principle, even though the e-commerce sector in Indonesia continues to experience growth. This suggests that PT Goto Gojek Tokopedia Tbk has not yet been able to capitalize on market momentum effectively.

For PT Global Niaga Tbk, the predictions were mixed. Both the Altman Z-Score and Springate methods consistently classified the company within the Bankruptcy Zone, with average values of -4.222 and -0.896, respectively. In contrast, the Zmijewski model placed the firm in the Safe Zone for the entire period. This discrepancy can be explained by the company's ability to maintain sufficient total assets to meet its obligations, alongside relatively smaller net losses compared to PT Bukalapak.com Tbk and PT Goto Gojek Tokopedia Tbk. The contrasting outcomes from the three models create ambiguous signals for stakeholders. Altman and Springate highlight inefficiencies in asset management and operational profitability, while Zmijewski—focusing on capital structure—provides a more positive outlook. These findings serve as an early warning for the company to strengthen performance, ensuring the going concern principle remains valid and reducing the risk of potential bankruptcy.

This study contributes a fresh perspective to the bankruptcy prediction literature in Indonesia, particularly within the e-commerce sector, by applying three analytical models simultaneously: Altman Z-Score, Springate, and Zmijewski. Unlike previous studies that tend to rely on a single method or focus on traditional industries, this research integrates signaling theory and the going concern principle to provide a more comprehensive analysis. The findings not only enrich academic references but also hold practical implications for investors, market analysts, and policymakers in anticipating financial distress among digital companies in the post-pandemic era.

5. Conclusion

The findings of this study reveal variations in bankruptcy predictions when applying the Altman Z-Score, Springate, and Zmijewski models. These differences emphasize that each method has distinct sensitivities in capturing potential risks, making the combination of the three approaches more comprehensive in portraying the financial condition of e-commerce companies in Indonesia. PT Bukalapak.com Tbk is generally categorized within the Safe Zone under the Altman Z-Score and Zmijewski models, but the Springate method indicates negative signals during 2023–2024. PT Goto Gojek Tokopedia Tbk is consistently predicted to fall within the Bankruptcy Zone, while PT Global Niaga Tbk demonstrates conflicting outcomes depending on the method applied.

In relation to signaling theory, these results highlight that companies provide mixed signals to stakeholders. Positive signals appear when firms maintain strong capital structures, while negative signals emerge when operational efficiency and profitability are not achieved. Such inconsistencies in signals may influence investors' and creditors' perceptions of the

firms' future prospects. From the perspective of the going concern principle, the findings serve as an early warning that, despite the growing trend in e-commerce transactions in Indonesia, the operational sustainability of individual firms remains under threat. The inability to consistently generate profits, intense market competition, and recurring losses could raise doubts about the companies' ability to continue operating on an ongoing basis.

Therefore, this study not only contributes practically by assisting management and investors in understanding potential bankruptcy risks but also enriches the literature on the significance of financial signals and the going concern principle in assessing the financial health of technology-based enterprises in the digital era.

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