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A Comparative Analysis of Financial Distress Prediction Model Accuracy in the Textile and Garment Subsector Listed on the Indonesia Stock Exchange

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Abstract

This study aims to identify the potential for financial distress and compare the predictive accuracy of the Springate, Ohlson, Zmijewski, and Grover models in textile and garment subsector companies listed on the Indonesia Stock Exchange (IDX) during the 2019–2024 period. Financial distress prediction is important as an early warning tool that enables companies, investors, and other stakeholders to anticipate financial difficulties and make appropriate strategic decisions. This study applies a descriptive quantitative approach using secondary data obtained from annual financial statements. The sample was selected through purposive sampling, resulting in 7 companies and 42 observations. The analysis includes model score calculations, descriptive statistics, normality testing, the Kruskal–Wallis test, and accuracy and error testing. The results indicate that the four models produce different financial distress classifications. The Kruskal–Wallis test generated a significance value of less than 0.001, confirming significant differences among the prediction results of the models. The Springate model achieved the highest accuracy rate of 83%, followed by the Zmijewski and Grover models at 69%, while the Ohlson model recorded the lowest accuracy rate of 45%. These findings suggest that the predictive performance of financial distress models varies depending on the characteristics of the sample and industry. Therefore, the Springate model can be considered the most appropriate and reliable model for predicting financial distress in textile and garment companies listed on IDX.

1. Introduction

Every company is established to achieve clear business objectives, particularly to generate profit by providing goods or services that meet public needs [1–3]. To achieve these objectives, companies are expected to maintain optimal financial performance by utilizing their resources effectively and efficiently [4–6]. Previous research indicates that companies with strong financial performance are more likely to fulfill stakeholder needs, both through profit achievement and the effective use of available resources, which in turn contributes to the formation of corporate reputation in the future [7]. However, in an increasingly competitive business environment, companies are vulnerable to various risks, such as weak financial management, dependence on debt, cash flow pressure, declining market demand, and intense industry competition. These conditions may

Table 1. Net income of textile and garment subsector companies listed on IDX, 2019–2024 (in million rupiah).

Code	Company Name	2019	2020	2021	2022	2023	2024
BELL	PT Trisula Textile Industries Tbk	21.324	16.031	2.445	2.662	8.763	8.804
HDTX	PT Panasia Indo Resources Tbk	64.596	47.255	41.400	57.012	14.706	27.183
INOV	PT Inocycle Technology Group Tbk	22.534	9.235	27.323	36.392	27.557	48.331
MYTX	PT Asia Pacific Investama Tbk	232.446	111.104	134.716	20.525	339.612	72.885
POLU	PT Golden Flower Tbk	8.991	6.104	51.502	6.264	14.967	1.316
SSTM	PT Sunson Textile Manufacture Tbk	16.267	15.354	56.750	6.045	6.235	17.986
TRIS	PT Trisula International Tbk	796	10.611	4.671	34.161	38.089	46.768

Note: Processed by the author from annual financial statements published on IDX, 2019–2024 [13].

affect financial stability and increase the potential for bankruptcy, as shown in the case of PT Sri Rejeki Isman Tbk or Sritex [8].

The COVID-19 pandemic placed significant pressure on the global economy, including Indonesia, as it affected economic activities, public income, and overall economic growth [9]. The manufacturing sector, particularly the textile and garment subsector, continued to face various challenges due to global competition, rising production costs, changes in consumption patterns, fluctuations in raw material prices, and the long-term impacts of the pandemic [10]. Previous research indicates that financial distress in the textile and garment sector is closely related to capital structure, asset efficiency, debt management, and the company's ability to maintain financial prudence in a dynamic industry environment [11]. This condition has become increasingly evident, as reports show that around 60 textile factories collapsed during 2022–2024, resulting in approximately 250,000 layoffs [12].

Based on Table 1, the net income performance of selected textile and garment subsector companies listed on the Indonesia Stock Exchange (IDX) showed considerable fluctuations during 2019–2024, indicating unstable profitability across the industry. Most companies experienced a decline in 2020, reflecting financial pressure during the period, and several firms continued to record losses in the following years. MYTX consistently reported negative net income throughout the observation period, while HDTX suffered consecutive losses from 2020 to 2024, suggesting persistent financial difficulties. INOV and POLU also showed volatile performance, shifting between profits and losses across the years. In contrast, BELL demonstrated gradual recovery after its 2020 loss, while TRIS showed the strongest improvement, maintaining positive net income from 2021 to 2024. Overall, these findings indicate that the textile and garment subsector faced uneven financial recovery and profitability instability, which may serve as an early indication of potential financial distress among several companies [13].

Signaling theory explains that observable signals are used to communicate credible information about unobservable qualities to parties with incomplete information [14]. The theory emphasizes the relationship between signalers, signals, and receivers, in which parties with an information advantage communicate signals to parties with an information disadvantage to support decision-making [15]. In the context of this study, company management acts as the signal sender, financial statements function as the signal, and investors, creditors, and other stakeholders act as signal receivers who use financial information to assess the company's financial condition. Previous research also shows that information contained in financial statements, particularly earnings quality, discretionary accruals, and leverage, can reflect financial health and signal the early stage of financial distress [16].

Financial statements serve as an important medium for communicating a company's financial condition, business activities, and performance to external users [6, 17, 18]. Prior studies state that reliable financial statements support managerial accountability and provide relevant information for stakeholders, including investors, creditors, and regulators [19–21]. Through financial statement analysis, stakeholders can assess financial stability, operational effectiveness, and performance trends. A decline in profitability, liquidity constraints, increasing leverage, and inefficient asset utilization may indicate a weakening financial condition. Therefore, financial statement analysis is relevant as an initial basis for identifying potential financial distress [22].

Financial distress occurs when a company faces financial constraints that limit its ability to meet its financial obligations, often due to insufficient revenue to cover operational costs [23–25]. This condition may lead to insolvency, liquidation, or bankruptcy, and can negatively affect company operations, investor confidence, borrowing costs, and long-term growth potential [26]. Although financial distress does not necessarily indicate that a company will ultimately fail, a significant and persistent decline in financial performance may eventually lead to bankruptcy and cause financial losses

Table 2. Sample selection process.

No.	Criteria	Total
1	Textile and garment manufacturing subsector companies listed on the IDX during 2019–2024	21
2	Companies that did not meet the sample selection criteria	14
3	Companies that met all sample criteria	7
4	Total observations (7 companies x 6 years)	42

Table 3. List of sample companies.

Code	Company Name
BELL	PT Trisula Textile Industries Tbk
HDTX	PT Panasia Indo Resources Tbk
INOV	PT Inocycle Technology Group Tbk
MYTX	PT Asia Pacific Investama Tbk
POLU	PT Golden Flower Tbk
SSTM	PT Sunson Textile Manufacture Tbk
TRIS	PT Trisula International Tbk

for investors and creditors. Therefore, stakeholders need to identify potential indicators of financial distress in order to protect their interests and anticipate possible financial difficulties [27]. In this context, financial distress prediction models are used as early warning tools to detect potential financial problems before they become more severe. These models generally use information from financial statements because financial data can reflect a company's performance, financial position, and signs of declining financial condition [28]. In this study, the Springate, Ohlson, Zmijewski, and Grover models are used because each model has different characteristics in assessing financial distress.

The Springate, Ohlson, Zmijewski, and Grover models are used in this study because they provide complementary approaches to predicting financial distress based on financial statement information. Conceptually, these models rely on accounting-based indicators that reflect a company's liquidity, profitability, leverage, cash flow, asset efficiency, and overall financial performance. The Springate model applies a multiple discriminant analysis approach and combines several financial ratios with different weights to distinguish financially distressed and non-distressed companies [29, 30]. The Ohlson model uses accounting-based variables related to leverage, liquidity, profitability, cash flow, and loss indicators, and provides a probabilistic assessment of potential financial distress [31, 32]. Meanwhile, the Zmijewski model focuses on profitability, leverage, and liquidity through return on assets, debt ratio, and current ratio to identify potential financial distress [33, 34]. The Grover model, which was developed by redesigning and re-evaluating the Altman Z-Score model, also uses financial ratios such as working capital to total assets, earnings before interest and taxes to total assets, and return on assets to assess a company's financial condition [35, 36]. Therefore, the use of these four models provides a more comprehensive comparative framework for evaluating financial distress prediction in textile and garment companies.

Previous comparative studies on financial distress prediction have shown that different models may produce different assessment results because each model uses different financial ratios, cut-off values, and classification approaches. Utama and Hamidah [37], for example, found significant differences among financial distress prediction models in Islamic commercial banks. However, prior studies have mostly focused on different sectors and periods, so their findings cannot be directly generalized to textile and garment subsector companies. Therefore, a new comparison is needed to examine which model provides the most accurate prediction in the textile and garment subsector during the 2019–2024 period, particularly because this period reflects financial pressure, profitability fluctuations, and post-pandemic business challenges. Based on these phenomena and research gaps, this study aims to analyze the potential for financial distress and compare the accuracy of the Springate, Ohlson, Zmijewski, and Grover models in predicting financial distress among textile and garment subsector companies listed on IDX.

2. Materials and Methods

2.1. Research Design and Data

This study employs a descriptive quantitative approach because it analyzes numerical data from financial statements and applies financial distress prediction models to compare company financial conditions. The data used are secondary data obtained from the annual financial statements of textile and garment subsector companies listed on IDX during the 2019–2024 period. The data were collected from IDX website and the official websites of the respective companies [13]. This period was selected to capture company financial conditions before, during, and after the COVID-19 pandemic, as well as during a period of economic pressure and industry uncertainty.

2.2. Population and Sample

The population of this study consisted of 21 textile and garment subsector companies listed on the Indonesia Stock Exchange (IDX) during the 2019–2024 period. The

Table 4. Financial distress prediction models.

Model	Formula	Criteria
Springate	S = 1.03X1 + 3.07X2 + 0.66X3 + 0.4X4	S < 0.862 = distress; S > 0.862 = non-distress
Ohlson	O = -1.32 - 0.407X1 + 6.03X2 - 1.43X3 + 0.0757X4 - 2.37X5 - 1.83X6 + 0.285X7 - 1.72X8 - 0.521X9	O > 0.38 = distress; O < 0.38 = non-distress
Zmijewski	X = -4.3 - 4.5X1 + 5.7X2 + 0.004X3	X > 0 = distress; X < 0 = non-distress
Grover	G = 1.650X1 + 3.404X2 - 0.016X3 + 0.057	G < -0.02 = distress; G > 0.01 = non-distress

Table 5. Financial ratios and indicators for model calculation.

Ratio / Indicator	Measurement	Financial aspect	Used in model
WCTA	(Current assets - current liabilities) / total assets	Liquidity	Springate, Ohlson, Grover
EBITTA	Earnings before interest and taxes / total assets	Profitability	Springate, Grover
EBTCL	Earnings before tax / current liabilities	Earning capacity / solvency	Springate
SATA	Sales / total assets	Asset efficiency	Springate
SIZE	Log (total assets / GNP price-level index)	Company size	Ohlson
TLTA	Total liabilities / total assets	Leverage	Ohlson, Zmijewski
CLCA	Current liabilities / current assets	Short-term liquidity risk	Ohlson
OENEG	1 if total liabilities exceed total assets; 0 otherwise	Solvency indicator	Ohlson
NITA	Net income / total assets	Profitability	Ohlson, Zmijewski, Grover
FUTL	Operating cash flow / total liabilities	Cash flow capacity	Ohlson
INTWO	1 if net income is negative for the last two years; 0 otherwise	Loss indicator	Ohlson
CHIN	Change in net income	Profitability trend	Ohlson
CACL	Current assets / current liabilities	Liquidity	Zmijewski

sample was selected using a purposive sampling technique, in which companies were chosen based on criteria relevant to the objectives of the study [38]. The criteria included companies that were continuously listed on the IDX during the study period, consistently published annual financial statements, and presented their financial statements in Indonesian rupiah. Based on these criteria, 14 companies were excluded because they did not meet the sample requirements, while 7 companies fulfilled all criteria and were included as the final sample. Therefore, this study obtained 42 firm-year observations, calculated from 7 companies over 6 years. The sample selection process is presented in Table 2, while the list of companies included in the final sample is shown in Table 3.

2.3. Financial Distress Prediction Models

This study uses four financial distress prediction models, namely the Springate, Ohlson, Zmijewski, and Grover models. Each model applies different financial ratios, formulas, and cut-off criteria to classify companies into financial distress or non-distress conditions. The use of these four models allows this study to compare the prediction results across models and determine which model provides the highest accuracy in predicting financial distress among textile and garment subsector companies. The formulas and classification criteria for each financial distress prediction model are presented in Table 4.

2.4. Operational Definition of Variables

The operational definitions of the variables in this study include prediction scores, predicted financial conditions, actual financial conditions, and model accuracy measurements. The prediction scores were calculated using the Springate, Ohlson, Zmijewski, and Grover models, and the predicted conditions were classified as financial distress or non-distress based on each model's cut-off point. The actual financial condition was determined using net income, where observations with negative net income were classified as financial distress, while observations with non-negative net income were classified as non-distress. This classification is consistent with Puspita et al. [39], who used net income as the actual condition to evaluate financial distress prediction model accuracy. Net income was used as a practical accounting-based proxy because it reflects a company's ability to generate earnings during the observation period. However, since net income does not fully represent overall financial health, this study also applies four prediction models that capture broader financial dimensions, including liquidity, profitability, leverage, cash flow capacity, and asset efficiency. Accuracy and error rates were measured by comparing correct and incorrect predictions with the total number of observations. The financial ratios and indicators used to calculate the prediction scores are presented in Table 5.

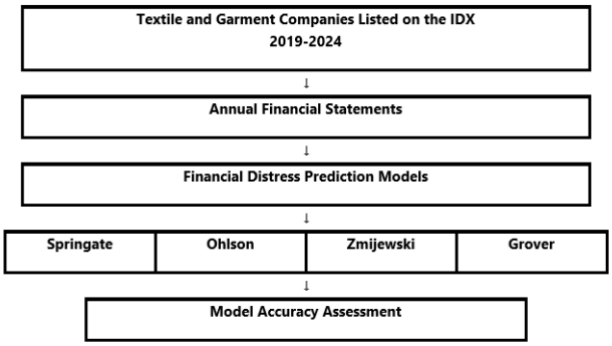

Figure 1. Conceptual framework.

Table 6. Summary of prediction results.

Model	Distress	Non-distress
Springate	23	19
Ohlson	37	5
Zmijewski	13	29
Grover	15	27

2.5. Conceptual Framework

In this study, signaling theory explains that financial statement information can serve as a signal of a company's financial condition. The financial ratios used in the Springate, Ohlson, Zmijewski, and Grover models represent signals related to liquidity, profitability, leverage, cash flow, and asset efficiency. These signals are used to classify companies into financial distress or non-distress conditions and can help investors, creditors, and other stakeholders assess potential financial difficulties.

Based on the conceptual framework shown in Figure 1, the hypotheses of this study are formulated as follows:

H_1: There are significant differences in the financial distress prediction results generated by the Springate, Ohlson, Zmijewski, and Grover models among textile and garment subsector companies listed on IDX during the 2019–2024 period.

H_2: There is one financial distress prediction model with the highest accuracy in predicting financial distress among textile and garment subsector companies listed on IDX during the 2019–2024 period.

3. Results and Discussion

3.1. Financial Distress Prediction Results

The calculation results show that each financial distress prediction model produced different classifications. As presented in Table 6, the Springate model classified 23 observations as distressed and 19 observations as non-distressed, with HDTX and MYTX consistently identified as distressed companies. The Ohlson model produced the highest number of distress classifications, with 37 observations categorized as distress and only 5 observations categorized as non-distress. Meanwhile, the Zmijewski and Grover models tended to classify more observations as non-distress, with 29 and 27 non-distress observations, respectively. These differences indicate that each model has a different level of sensitivity in assessing financial distress among textile and garment subsector companies.

3.2. Descriptive Statistics

Descriptive statistics were used to provide an overview of the prediction score characteristics for each financial distress model. The analysis includes the minimum value, maximum value, mean, and standard deviation of the Springate, Ohlson, Zmijewski, and Grover models. The descriptive statistics results are presented in Table 7.

The descriptive statistics show that each model has different score characteristics. The Springate model has a mean value of 0.482, which is below its cut-off point, indicating a general tendency toward financial distress. The Ohlson model shows the widest score range, from -5.550 to 11.645, and the highest standard deviation of 3.051, indicating greater variation in prediction scores. Meanwhile, the Zmijewski and Grover models have mean values of -0.373 and 0.484, respectively, suggesting that both models generally tend to classify the sampled companies as non-distressed. Overall, these differences indicate that each model produces distinct prediction score patterns, supporting the need to compare their prediction results and accuracy levels.

3.3. Normality Test

The normality test was conducted using the Kolmogorov–Smirnov and Shapiro–Wilk tests at a 5% significance level. Data were considered normally distributed when the significance value was greater than 0.05, and not normally distributed when the significance value was less than 0.05 [40]. The results of the normality test are presented in Table 8.

Table 7. Descriptive statistics.

Model	N	Min.	Max.	Mean	Std. Dev.
Springate	42	-1.585	2.565	0.482	1.145
Ohlson	42	-5.550	11.645	0.045	3.051
Zmijewski	42	-2.287	5.189	-0.373	1.987
Grover	42	-2.170	6.612	0.484	1.718

Table 8. Normality test results.

Model	*Kolmogorov–Smirnov**			*Shapiro–Wilk*		
	Statistic	**df**	**Sig.**	**Statistic**	**df**	**Sig.**
Springate	0.104	42	0.200**	0.956	42	0.110
Ohlson	0.163	42	0.007	0.943	42	0.037
Zmijewski	0.232	42	<0.001	0.826	42	<0.001
Grover	0.118	42	0.156	0.913	42	0.004

Note: * Lilliefors Significance Correction. ** The value represents a lower bound of the true significance.

Table 9. Kruskal–Wallis test results.

Model	Kruskal–Wallis H	Asymp. Sig.	Interpretation
Springate	36.290	<0.001	Significant difference
Ohlson	32.414	<0.001	Significant difference
Zmijewski	35.677	<0.001	Significant difference
Grover	37.014	<0.001	Significant difference

Based on the Kolmogorov–Smirnov test, the Springate and Grover models had significance values of 0.200 and 0.156, respectively, indicating that both data sets were normally distributed. Meanwhile, the Ohlson and Zmijewski models had significance values of 0.007 and <0.001, respectively, indicating that both data sets were not normally distributed. The Shapiro–Wilk test showed that only the Springate model was normally distributed, with a significance value of 0.110. In contrast, the Ohlson, Zmijewski, and Grover models had significance values of 0.037, <0.001, and 0.004, respectively, indicating that the data were not normally distributed. Although the Grover model showed different results between the two tests, the overall findings indicate that not all prediction score data met the normality assumption.

3.4. Kruskal–Wallis Test

Since the normality assumption was not fully met, a nonparametric statistical test was required. Therefore, the Kruskal–Wallis test was employed to examine whether there were statistically significant differences in financial distress prediction results among the four models. This test was selected because the study compared more than two prediction models, namely Springate, Ohlson, Zmijewski, and Grover, and the data were not entirely normally distributed. The variables compared in this test were the prediction scores produced by each model for each company-year observation. The null hypothesis states that there is no statistically significant difference in prediction scores among the models, while the alternative hypothesis states that at least one model produces a significantly different prediction score.

The results of the Kruskal–Wallis test are presented in Table 9. The findings show that all models produced significance values of <0.001. Since the significance values were lower than 0.05, the null hypothesis was rejected. This indicates that the prediction scores generated by the Springate, Ohlson, Zmijewski, and Grover models showed statistically significant differences. These differences may occur because each model applies different financial ratios, coefficient weights, and cut-off points in assessing corporate financial condition.

3.5. Accuracy and Error Tests

Accuracy testing was conducted by comparing the prediction results of each financial distress model with the actual condition of the sample companies. As presented in Table 10, the Springate model achieved the highest accuracy rate, with 35 correct predictions out of 42 observations, resulting in an accuracy rate of 83%. This model also recorded a Type I error rate of 12% and a Type II error rate of 5%, indicating that Springate had the strongest ability to classify distressed and non-distressed companies accurately.

In contrast, the Ohlson model produced the lowest accuracy rate, with only 19 correct predictions out of 42 observations, or 45%. The model also recorded the highest Type II error rate of 43%, showing that it tended to misclassify non-distressed companies as distressed. Meanwhile, the Zmijewski and Grover models achieved

Table 10. Accuracy and error test results.

Description	Springate	Ohlson	Zmijewski	Grover
Correct predictions	35	19	29	29
Incorrect predictions type I	5	5	13	12
Incorrect predictions type II	2	18	0	1
Total sample	42	42	42	42
Accuracy rate	83%	45%	69%	69%
Type I error	12%	12%	31%	29%
Type II error	5%	43%	0%	2%

the same accuracy rate of 69%, with 29 correct predictions each. However, Zmijewski produced no Type II error, while Grover recorded a relatively low Type II error rate of 2%, indicating slight differences in their classification performance.

Overall, the accuracy and error test results in Table 10 show that the predictive performance of financial distress models varies across the sample companies. Based on the comparison of accuracy rates and error levels, the Springate model demonstrated the best overall performance and can therefore be considered the most appropriate model for predicting financial distress among textile and garment subsector companies listed on the IDX.

3.6. Discussion

The results of this study show that the Springate, Ohlson, Zmijewski, and Grover models produced different financial distress prediction classifications. This finding supports the first hypothesis, which states that there are significant differences in the prediction results generated by the four models. These differences occur because each model uses different financial ratios, coefficient weights, and cut-off points in classifying companies into distress and non-distress conditions. Therefore, although the four models were applied to the same companies and observation period, the prediction results were not entirely the same. This finding is in line with Utama and Hamidah [37], who found significant differences among financial distress prediction models in Islamic commercial banks. It is also consistent with Salim and Ismudjoko [41], who reported that several financial distress prediction models produced significantly different results in the coal mining sector.

The Springate model achieved the highest accuracy rate of 83%, indicating that it is the most appropriate model in this study. This finding supports the second hypothesis, which states that there is one financial distress prediction model with the highest accuracy. The high accuracy of the Springate model can be explained by the ratios used in its formula, namely working capital to total assets, earnings before interest and taxes to total assets, earnings before tax to current liabilities, and sales to total assets. These ratios represent liquidity, profitability, earning capacity, and asset efficiency. In the textile and garment subsector, these aspects are important because company performance is strongly related to working capital availability, production cost efficiency, sales performance, and the ability to generate profit from available assets. Therefore, the Springate model is more relevant in capturing the financial condition of textile and garment companies.

This result is consistent with Pramesti and Yuniningsih [42], who found that the Springate model had the highest accuracy compared with the Zmijewski and Grover models. The similarity may occur because the Springate model includes profitability and sales-related ratios, making it more sensitive to changes in operating performance. In this study, the Springate model was able to classify companies such as HDTX and MYTX as experiencing financial distress, which is consistent with their repeated losses during the observation period. This indicates that the Springate model can capture financial pressure reflected in weak profitability and declining operating performance.

However, the findings of this study differ from several previous studies conducted in other sectors. Salim and Ismudjoko [41] found that the Modified Altman and Ohlson models had the highest accuracy in the coal mining sector, while the Springate model had the lowest accuracy. Utama and Hamidah [37] also found that the Grover model had the highest accuracy in Islamic commercial banks, whereas the Springate model had the lowest accuracy. These differences indicate that the most accurate financial distress prediction model may vary across sectors. A model that performs well in one industry may not necessarily produce the same result in another industry because each sector has different financial structures, business risks, and dominant financial indicators.

The Ohlson model produced the lowest accuracy rate in this study. Although this model uses more financial variables, including leverage, liquidity, profitability, cash flow, firm size, and loss indicators, the results show that a larger number of variables does not always produce better prediction accuracy. In this study, the Ohlson

model tended to classify most observations as distress, including several observations that were actually categorized as non-distress. This condition indicates that the Ohlson model may be more sensitive to leverage, cash flow, and loss indicators. As a result, the model produced a higher error rate and became less suitable for the textile and garment subsector during the 2019–2024 period.

The Zmijewski and Grover models showed the same accuracy rate of 69%. Both models were able to identify companies with severe financial problems, but they tended to classify more observations as non-distressed. This result indicates that the Zmijewski and Grover models may be more effective in detecting companies with strong indications of financial distress, but less sensitive in identifying companies with fluctuating financial performance. This condition may occur because both models place strong emphasis on profitability and leverage indicators, while financial pressure in textile and garment companies may also be influenced by sales fluctuations, production costs, inventory management, and working capital pressure.

From the perspective of signaling theory, the differences in prediction results among the four models indicate that each model interprets financial signals differently. Financial ratios such as working capital, profitability, leverage, cash flow, and asset efficiency provide signals about the company's financial strength or weakness. In this study, the Springate model was more effective in capturing negative financial signals in the textile and garment subsector, particularly signals related to weak profitability, limited working capital, and declining operating performance. These signals were reflected in companies such as HDTX and MYTX, which experienced repeated losses during the observation period. Therefore, the Springate model provides a more relevant signal for stakeholders in identifying potential financial distress in this subsector.

Overall, the findings indicate that the accuracy of financial distress prediction models depends on the suitability between the financial ratios used in the model and the characteristics of the sector being examined. In the textile and garment subsector, the Springate model is the most appropriate model because it reflects key financial dimensions that are highly relevant to manufacturing-based companies, particularly liquidity, profitability, earning capacity, and asset efficiency. From the perspective of signaling theory, these ratios serve as financial signals that help stakeholders assess whether a company is experiencing financial pressure. Nevertheless, the differences between this study and previous studies show that no single model can be considered universally superior for all sectors. Therefore, the use of more than one prediction model remains important to provide a broader and more comprehensive assessment of financial distress.

4. Conclusions, Implications and Limitations

Based on the analysis, textile and garment subsector companies listed on IDX during the 2019–2024 period showed indications of potential financial distress, although the classifications differed across the four prediction models. The Ohlson model tended to classify most observations as financial distress, while the Zmijewski and Grover models tended to classify most observations as non-distress. Meanwhile, the Springate model produced more balanced classifications that were more consistent with changes in the companies' financial ratios.

The Kruskal–Wallis test showed a significance value of <0.001, indicating significant differences in prediction results among the Springate, Ohlson, Zmijewski, and Grover models. Thus, the first hypothesis is supported. The accuracy test results also showed that the Springate model had the highest accuracy rate at 83%, followed by the Zmijewski and Grover models at 69%, while the Ohlson model recorded the lowest accuracy rate at 45%. Therefore, the second hypothesis is also supported, and the Springate model can be considered the most appropriate model for predicting financial distress in textile and garment subsector companies during the 2019–2024 period.

The findings of this study provide practical and academic implications. For corporate management, the results can serve as an early warning tool to evaluate working capital, profitability, asset efficiency, and debt structure to reduce the risk of financial distress. For investors and creditors, the findings provide additional information for assessing company financial conditions and potential risks before making investment or lending decisions. From the perspective of signaling theory, financial ratios and prediction model results function as financial signals that help stakeholders identify financial pressure. Academically, this study contributes to the financial distress literature by providing empirical evidence on the comparative accuracy of the Springate, Ohlson, Zmijewski, and Grover models in the textile and garment subsector listed IDX.

This study has several limitations. First, the research only focuses on textile and garment subsector companies listed on IDX, which may limit the generalizability of the findings to other industries. Second, the observation period is limited to 2019–2024, so the results may not fully capture financial distress conditions outside the

research period. Third, this study only compares four financial distress prediction models, namely Springate, Ohlson, Zmijewski, and Grover. Finally, the determination of actual company conditions is based on net income, which may not fully represent the overall financial health of a company. Therefore, future studies are encouraged to expand the research object to other sectors, extend the observation period, compare additional prediction models, and include external variables such as exchange rates, inflation, raw material prices, and industry conditions to obtain more comprehensive financial distress prediction results.

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