Comparison Of Financial Distress Prediction Models: A Literature Review Of Altman, Springate, Zmijewski, Grover, Ohlson, Dan Zavgren

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ABSTRACT
Financial distress is a condition that shows a company's financial pressure and can be an early indication of financial difficulties. This study aims to review and compare the characteristics and findings of previous research on the Altman, Springate, Zmijewski, Grover, Ohlson, and Zavgren models in predicting financial distress. The research uses a descriptive approach with a literature review method. Data are in the form of secondary sources, especially relevant scientific articles and previous research. The analysis was carried out in a descriptive-comparative manner by comparing the characteristics of the model, financial indicators, and prediction results reported in previous studies. The results of the study showed that the six models had different variables and approaches in identifying financial distress. Previous research also showed that there were differences in prediction results between models related to industry characteristics, observation periods, company conditions, variables used, and financial distress criteria. Therefore, the use of prediction models needs to be adjusted to the characteristics of the object and the research context and supported by other financial analyses. This study provides an overview of the use of various prediction models as early warning instruments in identifying the company's financial condition.

Keywords: financial distress, Altman, Springate, Zmijewski, Grover, Ohlson, Zavgren.

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3rdInternational Conference Epicentrum of Economic Global Framework (ICEEGLOF)
Theme: Cross-Sector and Cross-Disciplinary Strategies for Achieving the SDGS
https://proceeding.pancabudi.ac.id/index.php/ICEEGLOF

INTRODUCTION

Property and real estate companies are one of the business sectors that have the characteristics of business activities in the form of the construction and development of housing, offices, apartments, and various other types of buildings (Anjarwati & Resmi, 2023). This sector has the characteristics of relatively large capital needs and a long period of return on investment. These conditions cause property and real estate companies to face the need to maintain healthy financial conditions, especially in maintaining liquidity, profitability, and the ability to meet financial obligations (Nirmalasari, 2018). In addition to internal company factors, the development of the property sector is also influenced by economic conditions, people's purchasing power, interest rates, and government policies.

Uncertainty in economic conditions can increase the challenges faced by companies in maintaining their financial performance. The slowdown in global economic growth in a certain period can put pressure on investment activities and purchasing power, which can ultimately affect company activities in various sectors, including property and real estate (Kasmir, 2017). In these conditions, the company's ability to identify changes in financial conditions is important because a continuous decline in performance can lead to financial distress.

Financial distress is a condition when a company experiences financial difficulties that can interfere with the company's ability to carry out operational activities and fulfill its obligations (Kristanti, 2019). This condition can be the initial stage before the company experiences more serious conditions, including bankruptcy. Therefore, early identification of financial distress has an important meaning for various interested parties (Nasri et al., 2020). For management, information about financial conditions can be used as a basis for evaluating and corrective actions. Meanwhile, for investors and creditors, this information can be one of the considerations in understanding the company's financial condition and risk (Nirmalasari, 2018).

One of the widely used approaches to detect the possibility of financial distress is the analysis of financial statements through prediction models. Various models have been developed using a combination of financial ratios and different statistical approaches. Some of the models that are widely used in financial distress research include the Altman, Springate, Zmijewski, Grover, Ohlson, and Zavgren models. Each model uses different variables and formulas in producing a classification of the company's financial condition. The difference in the components of the ratio, formula, and classification limits allows a company to obtain different prediction results when analyzed using different models (Nisa et al., 2022).

Conceptually, these models have different characteristics. The Altman model uses the Multiple Discriminant Analysis approach in developing the Z-Score, while the Springate uses four financial ratios that produce distress and non-distress classifications. The Zmijewski model integrates aspects of performance, leverage, and liquidity. Meanwhile, the Grover model is a development related to the Altman model, the Ohlson model uses a number of variables related to the characteristics and financial condition of the company, while the Zavgren model is developed with a logit analysis approach. These differences in approaches show that the ability of each model to identify financial hardship conditions can produce different findings on different objects and characteristics of different companies (Pratama, 2021).

Differences in results between models were also seen in previous studies. Fahma and Setyaningsih (2021), for example, compared the Altman, Springate, Zmijewski, Grover, Ohlson, and Zavgren models in predicting bankruptcy in retail sector companies.

The study showed that there was a difference in the level of accuracy between models and found that the results of the model's predictive ability could differ according to the characteristics of the research object. The findings showed that the selection of the prediction model could not be separated from the characteristics of the sector and the condition of the company that was the object of analysis.

In addition to this research, research on *financial distress* also shows that a comparison of several models is needed to understand the differences in the ability of each approach to classify a company's financial condition. Thus, the study of *the Altman*, *Springate, Zmijewski, Grover, Ohlson*, and Zavgren models is relevant to provide a more comprehensive understanding of the characteristics, variables, approaches, and findings of previous research related to financial distress predictions. This kind of study can also be a conceptual basis for researchers in determining appropriate models when conducting empirical research on certain sectors and periods.

Based on this description, a study is still needed that presents a systematic comparison of the six *financial distress* prediction models , not only based on the formula used, but also based on the characteristics of the variables, analysis approaches, classification criteria, and accuracy findings reported in previous studies. Therefore, this proceedings article aims to review and compare the *Altman, Springate, Zmijewski, Grover, Ohlson*, and *Zavgren* models in predicting financial distress based on the results of previous research. This study is expected to provide an understanding of the differences in the characteristics of each model and become a conceptual reference for future research on financial *distress* predictions, especially in property and *real estate companies*.

THEORETICAL FOUNDATION

2.1 *Financial Distress*

Financial distress is a condition when a company experiences financial difficulties that can interfere with the company's ability to carry out operational activities and fulfill its obligations (Anjarwati & Official, 2023). This condition needs attention because it can develop into more serious financial problems if corrective action is not taken. Therefore, early identification of financial distress is necessary so that the company has the opportunity to evaluate and take corrective action.

Financial distress prediction also has relevance for various interested parties. For management, information about potential financial difficulties can be used to evaluate performance and determine improvement steps. For investors and creditors, this information can be one of the considerations in understanding the company's condition and risk. Thus, the ability to detect financial distress can function as an *early warning system* against the possibility of deteriorating the company's financial condition (Fahma & Setyaningsih, 2021).

One approach to predicting financial distress is to use financial ratio-based models. These financial ratios are then combined through certain formulas to produce scores or indicators that are used in classifying companies into distress and non-distress conditions. Differences in ratios, formulas, and classification criteria cause each model to produce different predictions for the same company.

2.2 Financial Distress *Model*

Various models have been developed to predict the likelihood of financial distress. In this study, the models that are the focus of discussion are Altman, Springate, Zmijewski, Grover, Ohlson, and Zavgren. The six models use a combination of different financial indicators and have their own approach characteristics.

2.3 Altman

The Altman model is one of the financial hardship prediction models developed by Edward I. Altman. This model uses the Multiple Discriminant Analysis (MDA) approach in developing the Z-Score. The approach combines several financial ratios to produce a score that is used in identifying the company's condition (Gupita et al., 2020).

In the previous research draft, the Altman model used consisted of several indicators related to working capital, retained earnings, EBIT, total assets, equity, and debt. The results of the calculation were then used to classify the company into non-distress, grey area, or distress conditions. The main characteristic of the Altman model in the context of this study is the use of a combination of financial ratios to produce an index that describes the company's financial condition.

2.4 Springate

The Springate model is a financial distress prediction model developed by Gordon L. V. Springate using an approach that is also related to Multiple Discriminant Analysis. This model uses four financial ratios selected from a number of ratios used in the development of the model (Gupita et al., 2020).

The Springate model produces an S-Score which is used to classify companies into distress and non-distress conditions. In the research draft, the model components include working capital to total assets, EBIT to total assets, EBT to current liabilities, and sales to total assets. Thus, the Springate model emphasizes a combination of indicators related to working capital, profitability, ability to meet short-term liabilities, and asset utilization efficiency.

2.5 Zmijewski

The Zmijewski model is one of the financial distress prediction models that uses a combination of company performance, leverage, and liquidity indicators. This model was developed based on research that uses financial indicators to identify companies experiencing financial difficulties (Fahma & Setyaningsih, 2021).

In the draft research, the Zmijewski model uses Return on Assets (ROA), Debt Ratio, and Current Ratio. The three indicators represent aspects of profitability, liability structure, and the company's ability to meet short-term liabilities. The results of the model's calculation produce an X-Score which is then used to determine the classification of distress or non-distress. This model thus provides a relatively focused approach on the relationship between asset performance, debt levels, and liquidity in identifying potential financial difficulties.

2.6 Grover

The Grover model was developed by Jeffrey S. Grover and deals with the development and reassessment of the Altman model. This model uses a combination of several financial ratios to generate the G-Score as the basis for classifying the condition of the company.

In the research draft, the Grover model uses working capital to total assets, EBIT to total assets, and ROA. The results of the combination of these indicators produce a G-Score that is used to identify non-distress or distress conditions. The characteristics of the Grover model show attention to working capital, the ability to generate profits from assets, and the efficiency of the company in generating profits (Fahma & Setyaningsih, 2021).

2.7 Ohlson

The Ohlson model is a financial distress prediction model developed by considering a number of financial characteristics of a company. This model has nine variables that cover various aspects of the company's financial condition.

In the research draft, the variables used in the Ohlson model include company size, total liabilities to total assets, working capital to total assets, current liabilities to current assets, total liabilities to total assets, net income to total assets, operating cash flow to total liabilities, net profit conditions, and changes in net profit.

These characteristics indicate that the Ohlson model has a relatively broad scope of indicators because it considers not only profitability and liability structure, but also company size, liquidity, operating cash flow, and changes in profit conditions.

2.8 Zavgren

The Zavgren model was developed to calculate financial distress risk using a logical analysis approach. The development of the model involves financial indicators related to the characteristics of the company's assets, liabilities, profitability, and activities. In the draft research, the Zavgren model uses several indicators, including inventory to sales, accounts receivable to inventory, cash to total assets, current assets to current liabilities, net profit to total asset difference and current liabilities, long-term liabilities to total asset difference and current liabilities, and sales to working capital and fixed assets.

These characteristics show that Zavgren's model considers several aspects of the company's activities, liquidity, profitability, and liability structure in producing financial distress risk indicators.

2.9 Conceptual Comparison of *Financial Distress Prediction Models*

Table 1. Conceptual Comparison of Financial Distress Prediction Models

els	**Approach**	**Focus indicator**	**utput**
n	*e Discriminant Analysis*	g capital, retained earnings, EBIT, equity and debt	
ate	*e Discriminant Analysis*	g capital, profitability, current es, sales	
vski	ased prediction models	bility, *leverage*, liquidity	*e*
	pment/reassessment of the model	g capital, EBIT, ROA	*e*
	ion model with nine variables	ny size, liabilities, liquidity, profit, ow, changes in profit	*e*
n	nalysis	es, liquidity, profitability, es	

RESEARCH METHODS

This study uses a descriptive qualitative approach with a literature review method. The data used are in the form of secondary sources, especially journal articles and previous research relevant to financial distress as well as the Altman, Springate, Zmijewski, Grover, Ohlson, and Zavgren models. The literature was selected based on its suitability with the focus of the study.

The analysis was carried out in a descriptive-comparative manner by comparing the characteristics of the models, financial indicators, approaches used, and previous research findings regarding the predictive ability of each model. The results of various literature were then synthesized to obtain an overview of the similarities, differences, and relevance of the use of the six models in predicting financial distress.

RESEARCH RESULTS

The results of the literature review show that the Altman, Springate, Zmijewski, Grover, Ohlson, and Zavgren models have different characteristics and approaches in predicting financial distress. These differences are mainly seen in the type of financial ratios used, model development methods, and classification criteria for company conditions.

The Altman model uses a combination of several financial ratios through the Multiple Discriminant Analysis approach and generates a Z-Score. The Springate model also uses a discriminant approach with four financial ratios and generates an S-Score. Meanwhile, Zmijewski focuses on profitability, leverage, and liquidity through X-Score. The Grover model is a development related to the Altman model and generates the G-Score. Furthermore, Ohlson uses nine variables that include company size, liabilities, liquidity, profitability, and cash flow, while Zavgren uses a logit approach with indicators related to activity, liquidity, profitability, and liabilities (Rahmawati et al., 2024).

Studies of previous research also show that the prediction results and accuracy level of the model can differ from one study to another. These differences can be influenced by industry characteristics, observation periods, company conditions, variables used, and characteristics of the data analyzed (Edi & Tania, 2019). The research of Fahma and Setyaningsih (2021), for example, compared the six models in retail companies and showed that there was a difference in the level of accuracy between models.

Overall, the results of the study show that there is no single model that can be separated from the context of the object and characteristics of the research. Therefore, the use of the financial distress prediction model needs to consider the characteristics of the company's sector, financial condition, observation period, and analysis objectives. The comparison of several models can provide a broader perspective in understanding the potential for financial distress compared to using only one model.

Table 2. Summary of the Results of the Financial Distress Prediction Model Study

earcher	**ject/Period**	**Models**	**Key Findings**
& ngsih (2021)	ompanies	, Springate, rski, Grover, Ohlson, n	re differences in predictive between models
Tania (2018)	mpany, 016	, Springate, rski, Grover	r models can be used; the of different predictive ities
ati & l (2023)	y & *real* 2021	, Zmijewski, ıte, Grover	s a difference in accuracy n models
et al. (2020)	frastructure, 019	, Springate, rski, Grover	re differences in prediction between models

From these results, it can be understood that the difference in components and approaches of each model is one of the factors that cause differences in financial distress prediction results. These findings reinforce the importance of comparative studies of prediction models before determining the model to be used in empirical research.

DISCUSSION

6.1 Comparison of Characteristics of Financial Distress Prediction Models

Based on the results of the literature review, the six financial distress prediction models, namely Altman, Springate, Zmijewski, Grover, Ohlson, and Zavgren, have

different characteristics in identifying the company's financial hardship conditions. These differences are mainly seen in the type of financial ratios used, the statistical approach underlying the model's formation, and the indicators that are of concern in assessing the company's condition.

The Altman model uses a combination of several ratios that represent the liquidity, profitability, operating activities, and financial structure of the company. The Springate model has relatively similar characteristics because it uses several financial ratios to distinguish between companies that are experiencing financial distress and companies that are in good health. Meanwhile, Zmijewski emphasizes the aspects of profitability, leverage, and liquidity in identifying the possibility of financial distress.

The Grover model is a development related to the Altman model with the use of indicators that focus on working capital, operating profitability, and the ability of assets to generate profits. In contrast to these models, Ohlson uses a number of variables that include company size, liability structure, liquidity, profitability, and cash flow. Zavgren uses a logit approach by considering ratios related to the company's activities, liquidity, profitability, and liabilities.

The difference in these indicators shows that financial distress is a condition that can be seen from various dimensions. Companies not only face the risk of distress due to low profits, but can also experience pressure due to liquidity problems, high liabilities, low ability to generate cash flow, and imbalances in the financial structure.

6.2 Comparison of Findings of Previous Research

The results of a study of previous research show that the level of predictive ability of the six models does not always produce the same findings. Fahma and Setyaningsih (2021), for example, compared six financial distress prediction models in retail companies using Altman, Zmijewski, Grover, Springate, Ohlson, and Zavgren. The results of the study showed that there was a difference in the level of accuracy between models.

These findings are in line with the research of Edi and Tania (2018) who compared the Altman, Springate, Zmijewski, and Grover models. The difference in prediction results shows that the use of certain models can result in different classifications of financial conditions for the same company. Thus, the predictive results of financial distress are closely related to the characteristics of the financial ratios used by each model.

In the property and real estate sectors, Anjarwati and Resmi (2023) also show that different financial distress prediction models can provide different classification results. This condition is important because the property and real estate sectors have business characteristics related to relatively large capital needs, long-term investment, and dependence on economic conditions and the company's ability to manage liabilities.

Meanwhile, research by Gupita et al. (2020) comparing the Altman, Springate, Zmijewski, and Grover models in the infrastructure sector also showed differences in results between models. This reinforces the view that the effectiveness of a model cannot be separated from the characteristics of the industry and the research period used.

Thus, the results of previous research do not show that there is a single model that consistently produces the same classification across companies and sectors. These differences in results actually show the importance of considering the company context when using the financial distress prediction model.

6.3 Factors Affecting Differences in Prediction Results

The difference in prediction results between models can be explained through several factors. First, the difference in the variables used. Each model has a different

combination of financial ratios so that one model can be more sensitive to changes in liquidity, while other models emphasize profitability or leverage.

Second, industry characteristics can affect the results of the classification. Property and real estate companies, for example, have different characteristics of assets, liabilities, business cycles, and funding needs than retail or infrastructure companies. Therefore, the same financial ratio can have different meanings when applied to different sectors. Third, the research period also affects the predicted results. Economic conditions, interest rates, people's purchasing power, government policies, and market conditions can change from time to time. Changes in the business environment can affect the company's financial ratios and ultimately affect the results of the model classification.

Fourth, the characteristics of the sample and the financial distress criteria used in the study can also produce differences. Studies that use certain distress criteria can produce different levels of accuracy from studies that use definitions or other distress indicators. Therefore, differences in the level of model accuracy in various studies do not only indicate differences in model quality, but can also reflect differences in the research object, observation period, industry characteristics, variables used, and financial distress classification criteria.

6.4 The Relevance of Financial Distress Prediction Models in Property and Real Estate Companies

A literature review shows that the use of financial distress prediction models is relevant for property and real estate companies because the company's financial condition needs to be monitored on an ongoing basis. The prediction model can be used as one of the early warning instruments to identify indications of financial distress before the condition develops into a more serious problem.

The use of several models at the same time can also provide a broader perspective because each model uses different financial indicators. If the results of several models show the same classification, this information can be an additional consideration in evaluating the company's financial condition. On the other hand, if the results between models are different, the differences need to be further analyzed by looking at the company's financial ratios and characteristics.

Thus, the financial distress prediction model should not be seen as the only basis for determining the company's condition. The results of the model need to be combined with the analysis of financial statements, industry conditions, economic developments, and relevant non-financial information.

CONCLUSION

Based on the results of the literature review, it can be concluded that Altman, Springate, Zmijewski, Grover, Ohlson, and Zavgren have different characteristics and approaches in predicting financial distress. These differences are mainly found in the financial variables used, the approach to model formation, and the aspects of financial conditions that are of concern to each model.

The results of previous research show that the predictive ability of the six models can produce different classifications. These differences are influenced by the characteristics of the company, industry sector, observation period, economic conditions, variables used, and criteria in determining financial distress. Thus, the results of the study do not show that one model can be used universally for all companies and conditions.

In property and real estate companies, the financial distress prediction model can be used as an early warning instrument in identifying indications of financial stress.

However, the prediction results should not be used alone, but should be considered together with the analysis of financial statements, industry characteristics, economic conditions, and other relevant information.

Academically, this study shows that the selection of financial distress prediction models needs to be adjusted to the purpose of the analysis, the characteristics of the research object, and the context of the observation period. The study can further expand the research by conducting empirical testing of the six models in the property and real estate sectors and comparing them with newer prediction approaches.

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