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Research Article

Accuracy of the Financial Distress Model in Transportation Firms: Altman, Springate and Grover Model

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Abstract
This study analyzes the comparison of financial distress prediction models in transportation firms listed on the Indonesia Stock Exchange during 2018–2020. Using a quantitative approach and secondary data, the study focuses on a sample of 7 firms selected through purposive sampling from a population of 27 firms. The analysis evaluates the Altman, Springate, and Grover models for their accuracy and error rates. Results show that the Altman and Springate models exhibit identical accuracy and error rates, with an accuracy level of 42.56% and an error rate of 57.14%. In contrast, the Grover model demonstrates superior performance with an accuracy level of 85.71% and an error rate of 14.29%. These findings establish the Grover model as the most accurate tool for predicting financial distress among the models tested. Managerial implications highlight the importance of utilizing accurate financial distress prediction models to identify potential financial issues early. This can aid transportation firms in improving financial management and ensuring operational sustainability. By adopting effective prediction models like the Grover model, firms can strengthen their capacity to mitigate risks associated with financial instability.

Keywords: Financial Distress Prediction Model, Altman Model, Springate Model, Grover Model

JEL Classification: G33, L91, M91

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1. Introduction

A firm is an organizational entity established by either an individual or a group of individuals, with its operational activities primarily focused on generating profit through the management of various resources, including raw materials, human capital, and financial assets. Among the multitude of firms that have operated in Indonesia, not all can sustain themselves and effectively compete, leading to eventual bankruptcy (Fifriani & Santosa, 2019; Melina and Susetyo, 2021). In times of declining revenue, firms face the challenge of managing increasing expenses (Sari and Ariyani, 2022).

Bankruptcy occurs when a firm encounters financial difficulties that render it incapable of conducting its operational activities. Analyzing bankruptcy is crucial, given that the failure of a public firm can adversely affect many stakeholders, including investors holding shares or bonds, creditors facing defaults, employees at risk of termination (PHK), and the firm's management itself (Peter et al., 2021).

One of the essential tools that companies can utilize to evaluate their condition and performance is the financial report generated for each reporting period. Reliable financial reports offer valuable information to various stakeholders, including managers, investors, creditors, and government entities. The trust that users place in financial reports is often contingent upon the confirmation of their reliability by independent auditors (Robiansyah et al., 2022). Bankruptcy prediction models are particularly significant for companies, investors, creditors, and governmental organizations, as these groups tend to respond to distress signals. Such signals may include a decline in company profits, an increase in debt levels, and the cessation of problematic financing, among others (Fifriani & Santosa, 2019; Kusumanisita and Musdalifah, 2021).

Extensive research has been conducted on bankruptcy detection tools; however, this study focuses on four specific methods: the Altman, Springate, Zmijewski, and Grover models. These four methods share similar calculation ratios, making them suitable for this analysis. By utilizing these models, the study aims to assess and enhance a firm's condition prior to the potential risk of bankruptcy (Santosa et al., 2020; Robiansyah et al., 2022).

The recent economic conditions have experienced a shock due to various problems that have occurred and the impacts are felt by almost all countries in the world. One of them was in early 2020, when the world, including Indonesia, was shocked by the spread of COVID-19, which made businesses face the threat of bankruptcy. One of the firms experiencing this threat is a transportation firm where turnover has decreased, which has an impact on the firm's cash flow. This happens in all sectors of the firm including transportation firms, both land, sea, and air. The transportation sector has an important role in national economic development. In economic life, the smoother the transportation system of a region will indicate the economic health of the region. Road transportation, for example, has experienced a decrease in passengers from 75 percent to 100 percent. Meanwhile, sea and air transportation experienced a decrease in performance of around 15 percent due to a decrease in distribution.

Analysis is needed to see and predict financial conditions and evaluate firm performance. The analysis is useful for anticipating bankruptcy in the future. According to Edi and May Tania (2017), a firm's financial condition shows how healthy the firm's finances are and to find out these conditions, financial report analysis is needed. Financial reports reflect business activities in a firm. At the end of each period, financial reports are prepared to report funding and investment activities, and to summarize operating activities during the previous period. Financial reports are useful for most report users in decision-making. Many foreign investors invest their capital in Indonesia. Investment is one of the external factors that influences bankruptcy, the depreciation of the rupiah against the dollar that occurs is due to the influence of this investment (Agarwal & Taffler, 2008).

Financial Distress is a financial condition of a firm that is heading toward an unhealthy condition or experiencing a critical financial condition, and this condition occurs when the firm has not yet gone bankrupt (Rahmayanti & Hadromi, 2017). If the firm has been seen to have a financial distress condition from the start, it can be overcome by means of corrective actions so that the firm can avoid this or even bankruptcy. Early indications that show that a firm is in financial distress are the firm's ability which tends to decline and does not fulfill its obligations, especially in short-term liquidity obligations and obligations in the solvency category (Koh, 2015).

Sari et al. (2020) and Pham et al. (2022) state financial distress is a condition where a firm is in an unhealthy state. A firm is said to be in financial distress because there are several problems that occur in the firm. This financial distress occurs because there are several factors, one of which is

the amount of liabilities that are too large and the firm's activities experience losses. This makes the firm have to really pay attention to the problems that occur in its firm because if this financial distress occurs, the firm will go bankrupt. According to (Prasandri, 2018), bankruptcy is an essential problem that firms must be aware of. Because if the firm is already experiencing financial distress, then the firm is really experiencing business failure or bankruptcy. Therefore, the firm must carry out various analyses as early as possible, especially analyses concerning the bankruptcy of a firm. By conducting an analysis, it is very useful for the firm to anticipate or increase awareness that can reduce or avoid the risk of bankruptcy.

Rismawati (2022) and Kyriazopoulos (2017) find that bankruptcy prediction methods can also be analyzed using several models. This bankruptcy prediction model is used to assess when a firm will go bankrupt and combines a group of financial ratios that will later provide an overview of the firm's financial condition and performance. In order for a firm to be able to operate, it depends on the firm's financial condition. The firm's finances must be able to support the firm's operations for a certain period. One model for analyzing bankruptcy can use the Altman Z-score and Springate models.

Rahmawati et al. (2018) explained that a decline in firm performance will occur if the firm is unable to face competition with other firms. This certainly threatens the firm to experience financial distress, which, if not addressed properly, can cause the firm to go bankrupt permanently. Thus, bankruptcy potential analysis is one of the important efforts that need to be made by the firm as a form of alertness to potential bankruptcy. The firm can also anticipate av,oid, or reduce the level of bankruptcy risk from the analysis it has carried out (Soebyakto et al., 2018). In addition to being an early warning system, bankruptcy potential analysis can also help firms in determining firm policies in an effort to overcome the situation before the firm falls into a state of bankruptcy (critical). Altman developed several examples of bankruptcy analysis models in 1968, Springate (1978), Zmijewski (1984), Fulmer (1984) and Grover in 2001 (Parquinda and Azizah, 2019).

Because of its important significance in the national and international economies, the transportation sector was selected as the study's focus. In order to ensure that economic systems function properly, transportation is essential for enabling trade, logistics, and people mobility. The performance of the sector frequently serves as a gauge of the state of the economy as a whole. Furthermore, one of the industries most negatively affected by economic downturns, like the COVID-19 epidemic, has been transportation. Revenue from road, sea, and air transportation fell precipitously as a result of mobility restrictions, decreased passenger volumes, and a decline in the demand for commodities transportation. This drop in performance emphasizes how susceptible the transportation sector is to outside shocks and how crucial it is to assess and forecast the financial health of this sector. Since the stability of the transportation sector has a ripple impact on broader economic recovery and growth, policymakers, as well as stakeholders in these sectors, must understand the risk of bankruptcy. By concentrating on this area, the study offers insightful information on how businesses in this crucial sector might identify financial problems early and take corrective measures to prevent bankruptcy.

2. Literature Review and Hypothesis

Bankruptcy

Bankruptcy is a condition that occurs when a firm's funds or capital are insufficient to drive its business activities (Salim and Sudiono, 2017). Agarwal and Patni (2019) explain that bankruptcy is a legally stated condition where a firm experiences a decline in its ability to pay its obligations. Bankruptcy is a threat that occurs when a firm's finances decline, and on the other hand, the firm's ability to carry out its operational activities is doubtful (Januri, Sari and Diyanti, 2017).

Financial statements

Toto Prihadi (2020) Financial statements are the result of recording all financial transactions in a firm. Financial statements describe transactions classified into several large groups according to their economic characteristics. These large groups are elements of financial statements. Elements directly related to measuring financial position are assets, liabilities, and equity, while elements

related to measuring performance in the income statement are income and expenses. The statement of changes in financial position usually reflects various elements of the income statement and changes in various elements of the balance sheet. Thus, this framework does not specifically identify elements of the statement of changes in financial position.

Financial Distress

Ratna and Marwati (2018) stated that financial distress is a condition where a firm experiences a phase of declining profits and business activities that are not comparable to the obligations to be borne, so that the firm experiences losses if the firm continuously experiences this condition and cannot be handled, then the firm will cause bankruptcy. A firm can be seen to be experiencing financial distress if it experiences the following such as facing negative net operating profit for two consecutive years, cessation of dividend payments, financial restructuring, and reducing employee workforce.

Financial Distress Prediction Model

Due to their solid theoretical underpinnings, empirical support, and unique yet complimentary traits in assessing bankruptcy risk, the Altman Z-Score, Springate, and Grover models were selected for financial distress prediction. Every approach has distinct benefits that complement the goals of comprehending and forecasting financial distress situations within the transportation industry.

Altman Z-Square Model

The Altman Z-Score method, developed by Professor Edward I. Altman in 1968, is one of the most well-known and widely used methods for analyzing a firm's bankruptcy risk. This method combines several key financial indicators into one score that indicates the likelihood of future bankruptcy. The Springate bankruptcy model analysis (Springate, 1978) produces a bankruptcy prediction model by following the Altman model procedure. This bankruptcy prediction model uses 4 financial ratios selected based on 19 financial ratios in various literature.

Because of its innovative role in bankruptcy prediction and its demonstrated efficacy across a range of industries, including manufacturing and transportation, the Altman Z-Score model was chosen. It evaluates a firm's financial health by combining several financial ratios into a single score, which makes it a powerful tool for early distress detection. Its capacity to assess operational effectiveness, liquidity, solvency, and profitability offers a comprehensive picture of a business's performance. With modifications for different industries and economies, this model has endured over time, proving its adaptability and applicability.

Springate Model

The bankruptcy analysis of the Springate model was developed in 1978 by Gorgon LV Springate, who conducted a study on manufacturing firms by classifying them into distressed and non-distressed firms (Peter & Yoseph, 2011). Springate initially used 19 financial ratios to predict the financial distress conditions of the firms, having conducted statistical multiple discriminant analysis.

Because of its simplicity and emphasis on financial measures that are most suggestive of financial trouble, the Springate model was selected. Its application in situations demanding simple yet efficient analysis is ensured by its refinement and focus on four important financial ratios out of a total of 19, which is derived from discriminant analysis. It is particularly pertinent to our study because of its development in the manufacturing sector, which has operational parallels with transportation (such as high fixed costs and sensitivity to economic situations). Its capacity to generate unambiguous distress classifications also gives stakeholders more practicality when making decisions.

Grover Model

Parquinda and Azizah (2019) explained that the Grover model is a modification or redesign of the Altman Z-Score financial distress test model. This Grover method was developed by Jeffrey S. Grover in 2001 using a sample of 70 firms. The Grover model was chosen as an improvement on

the Altman Z-Score because of its revised approach and capacity to adjust to contemporary financial circumstances. This model, which was created more recently in 2001, incorporates information from more recent datasets and takes into account more recent economic situations. Its increased precision in assessing financial performance is consistent with the shifting financial environments that the transportation industry faces. It offers a sophisticated method of reliably predicting distress by incorporating improvements and referencing the strong Altman foundation.

3. Data and Method

Research Strategy

The author uses a research strategy to answer research problems. This study uses quantitative descriptive research, a data analysis method that emphasizes numerical assessments of the phenomena being studied.

Population and Sample

Population is the entirety of the characteristics of the measurement results that are the object of research. The population in this study is the transportation sector firms listed on the Indonesia Stock Exchange in 2018-2020. The sample is part of the overall characteristics of the population to be studied. This sampling is based on the criteria for which this sampling uses purposive sampling. The population of transportation sector firms listed on the Indonesia Stock Exchange in the 2018-2020 period is 27 firms. After selecting samples using the purposive sampling technique, a sample of 7 firms was obtained.

Data and Data Collection Methods

The data used in this study is secondary data, which is data obtained indirectly through intermediary media (obtained and collected by other parties). The data required in this study are financial reports of transportation firms listed on the Indonesia Stock Exchange (IDX) for the period 2018-2020.

Data Analysis Techniques

The data collected will then be analyzed to provide answers to the problems in this study. In analyzing the data, the author uses the Microsoft Excel program. Input and process data using Microsoft Excel to calculate financial distress with the model. The results of the calculation of the research model are then analyzed using the formula from the Altman, Springate and Grover models. From these results, it can be seen which firms are experiencing financial distress.

4. Results

Altman Z-Square Model Calculation

Table 1. Altman Z-Square Model Calculation

Code	Score					
	2018		2019		2020	
ASSA	0.31	Financial distress	0.41	Financial distress	0.14	Financial distress
BPTR	(0.01)	Financial distress	(0.07)	Financial distress	(0.01)	Financial distress
HELI	1.48	Grey area	5.25	Non-distress	1.73	Grey area
MIRA	(7.76)	Financial distress	(9.15)	Financial distress	(11.24)	Financial distress
NELY	15.57	Non-distress	10.78	Non-distress	10.96	Non-distress
ACTION	2.62	Non-distress	3.21	Non-distress	2.26	Grey area
TAXI	(10.51)	Financial distress	(20.66)	Financial distress	(34.19)	Financial distress

Source: Processed Financial Report (2020)

Based on Table 1 above, using the Altman Z-Score model, it can be concluded that in 2018, there are 4 firms predicted to go bankrupt, namely PT. Adi Sarana Armada Tbk, PT. Batavia Prosperindo Trans Tbk, PT. Mitra International Resources, and PT. Express Transindo Tbk. Meanwhile, 2 firms predicted to be in a healthy or non-distress condition are PT. Pelayaran Nelly Dwi Putri Tbk and PT. Maming Enam Sembilan Mineral Tbk. Other firms are included in the grey area category, namely, PT. Jaya Trishindo Tbk.

In 2019, four firms, PT. Adi Sarana Armada Tbk, PT. Batavia Prosperindo Trans Tbk, PT. Mitra International Resources and PT were predicted to go bankrupt. Express Transindo Tbk. Meanwhile, three firms predicted to be in a healthy or non-distress condition are PT. Jaya Trishindo Tbk, PT. Pelayaran Nelly Dwi Putri Tbk and PT. Maming Enam Sembilan Mineral Tbk.

In 2020, four other firms, PT. Adi Sarana Armada Tbk, PT. Mitra International Resources is predicted to go bankrupt. Batavia Prosperindo Trans Tbk and PT. Express Transindo Tbk. Meanwhile, PT is predicted to be healthy or non-distress. Pelayaran Nelly Dwi Putri Tbk. Other firms are included in the grey area category, namely PT. Maming Enam Sembilan Mineral Tbk and PT. Jaya Trishindo Tbk.

Springate Model Value Calculation

Table 2. Springate Model Calculation

Code	Score					
	2018		2019		2020	
ASSA	0.40	Financial distress	0.35	Financial distress	0.29	Financial distress
BPTR	0.23	Financial distress	0.19	Financial distress	0.13	Financial distress
HELI	0.87	Non-distress	1.87	Non-distress	0.39	Financial distress
MIRA	0.59	Financial distress	0.28	Financial distress	(0.20)	Financial distress
NELY	2.37	Non-distress	2.28	Non-distress	2.04	Non-distress
ACTION	1.36	Non-distress	1.44	Non-distress	1.07	Non-distress
TAXI	(1.90)	Financial distress	(2.86)	Financial distress	(2.10)	Financial distress

Source: Processed Financial Report (2020)

Based on Table 2 above, using the Springate model, it can be concluded that in 2018, four firms, PT, Adi Sarana Armada Tbk., PT. Batavia Prosperindo Trans Tbk., PT. Mitra International Resources and PT are predicted to go bankrupt. Express Transindo Tbk. Meanwhile, three firms predicted to be in a healthy or non-distress condition are PT. Jaya Trishindo Tbk, PT. Pelayaran Nelly Dwi Putri Tbk and PT. Maming Enam Sembilan Mineral Tbk.

In 2019, four firms, PT, Adi Sarana Armada Tbk., PT. Batavia Prosperindo Trans Tbk., PT. Mitra International Resources and PT are predicted to go bankrupt. Express Transindo Tbk. Meanwhile, three firms, PT, are predicted to be in a healthy or non-distress condition. Jaya Trishindo Tbk, PT. Pelayaran Nelly Dwi Putri Tbk and PT. Maming Enam Sembilan Mineral Tbk.

In 2020, five firms, PT, Adi Sarana Armada Tbk, PT. Batavia Prosperindo Trans Tbk, PT. Jaya Trishindo Tbk, PT. Mitra International Resources and PT are predicted to go bankrupt. Express Transindo Tbk. Meanwhile, two firms, PT and PT, are predicted to be in a healthy or non-distress condition. Pelayaran Nelly Dwi Putri Tbk and PT. Maming Enam Sembilan Mineral Tbk.

Grover Model Calculation

Table 3. Grover Model Calculation

Code	Score 2018		2019		2020	
ASSA	0.62	Non-distress	0.61	Non-distress	0.52	Non-distress
BPTR	0.52	Non-distress	0.47	Non-distress	0.44	Non-distress
HELI	0.93	Non-distress	1.58	Non-distress	0.79	Non-distress
MIRA	1.22	Non-distress	0.80	Non-distress	0.53	Non-distress
NELY	1.39	Non-distress	1.29	Non-distress	1.24	Non-distress
ACTION	1.23	Non-distress	1.40	Non-distress	1.03	Non-distress
TAXI	(1.66)	Financial Distress	(3.05)	Financial Distress	(3.58)	Financial Distress

Source: Processed Financial Report (2020)

Based on Table 3 above, using the Grover model, it can be concluded that in 2018, 6 firms, namely PT. Mitra International Resources, PT, is predicted to be in a healthy or non-distress condition. Pelayaran Nelly Dwi Putri Tbk and PT. Maming Enam Sembilan Mineral Tbk. Meanwhile, other firms, namely PT, are predicted to go bankrupt. Express Transindo Tbk.

In 2019, 6 firms are predicted to be in a healthy or non-distress condition, namely PT. Adi Sarana Armada Tbk., PT. Meanwhile, other firms are predicted to go bankrupt, namely PT. Express Transindo Tbk.

In 2020, 6 firms are predicted to be in a healthy or non-distress condition, namely PT. Adi Sarana Armada Tbk., PT. Meanwhile, other firms are predicted to go bankrupt, namely PT. Express Transindo Tbk.

Accuracy and Error Level of Altman Model

Table 4. Accuracy and Error Levels of the Altman Model

	Altman's prediction results		
Number of Firms	**Non-distress**	**Distress**	**Total**
	3	4	7
Accuracy Level		**42.86%**	
Error Level		**57.14%**	

Source: Processed Financial Report (2020)

Based on the results above, it can be concluded that the Altman Z-Score model predicts (see table 4.4) that 3 out of 7 samples are correctly or in a healthy or safe condition. The Altman Z-Score model predicts that 4 other samples will go bankrupt. From these data, the accuracy level of the Altman Z-Score model in predicting financial distress in transportation firms is 42.86%, with an error rate of 57.14%.

Springate Model Accuracy and Error Levels

Table 5. Accuracy and Error Levels of the Springate Model

Number of Firms	Altman's prediction results		
	Non-distress	Distress	Total
	3	4	7
Accuracy Level		**42.86%**	
Error Level		**57.14%**	

Source: Processed Financial Report (2020)

Based on the results above, it can be concluded that the Springate model predicts (see table 4.5) that 3 out of 7 samples are correctly or in a healthy or safe condition and that 4 other samples will go bankrupt. From these data, the accuracy level of the Springate model in predicting financial distress in transportation firms is 42.86%, with an error rate of 57.14%.

Accuracy and Error Level of Grover Model

Table 6. Accuracy and Error Levels of Grover's Model

Number of Firms	Altman's prediction results		
	Non-distress	Distress	Total
	6	1	7
Accuracy Level		**85.71%**	
Error Level		**14.29%**	

Source: Processed Financial Report (2020)

Based on the results, it can be concluded that the Grover model predicts (see table 4.6) 6 out of 7 samples correctly or in a healthy or safe condition. The Grover model predicts 1 other sample going bankrupt. From these data, the Grover model's accuracy level in predicting financial distress in transportation firms is 85.71%, with an error rate of 14.29%.

5. Discussion

The calculation results on transportation firms listed on the Indonesia Stock Exchange using the financial distress prediction model resulted in the Altman model and the Springate model having the same level of accuracy and error. In contrast, the Grover model had a high level of accuracy. This difference is because each model has different variables and classification values. Furthermore, the Grover model, which is an enhancement of the earlier model, has extra elements, such as variable robots that are tailored to contemporary business circumstances and more specialized operational efficiency. Because of this, the Grover model is more susceptible to even minor shifts in the business's financial status. Because each model has the capacity and ability to reflect the complexity of a firm's financial condition fully, this difference suggests that when assessing financial distress, the model should be chosen with consideration for the industry context, data characteristics, and the analysis's aim. In a dynamic and multimodal business context, a model with a higher accuracy threshold, such as Grover, may offer more relevant insights to enhance strategic planning for transportation organizations.

Based on the results of this study, it can be concluded that several firms fall into the non-distress and financial distress categories using the Altman Z-Score, Springate and Grover model calculations. Firms that fall into the gray area category are only found in the Altman Z-Score model calculation. This highlights the unique feature of the Altman model, which uses a specific score to identify the financial state of businesses in the gray region state, where it is impossible to clearly determine the sustainability of businesses.

Gray areas in the Altman Z-Score model offer consistently challenged benefits. In one sense, this category helps identify businesses in a transitional state between stable and distressed, allowing management to implement preventative measures. However, in other cases, gray areas may create uncertainty because businesses in this category require additional analysis to determine the true state of their finances.

Grover's model has a high level of accuracy and a low level of error. According to this study's results, it is the best model for predicting financial distress in transportation firms listed on the Indonesia Stock Exchange.

6. Conclusion

Based on the results of the research that has been conducted, the study's findings highlight how crucial it is to choose a prediction model that is specific to the data's properties, industrial context, and analytical goals. The application of highly accurate models, like Grover, can enhance strategic planning for transportation organizations by offering more pertinent insights into complex business dynamics. Furthermore, integrating current models can offer a more thorough viewpoint for identifying financial distress risks, reducing possible losses, and enhancing the competitiveness of businesses operating in the transportation industry.

Recommendation

In analyzing the level of accuracy of the financial distress model in transportation firms listed on the Indonesia Stock Exchange, it is recommended that researchers or practitioners choose a model that is in accordance with the characteristics of the transportation industry, which has a high-cost structure and dependence on fixed assets. The Grover model, which shows high accuracy, can be the main choice, but adjustments need to be made to local data to increase the relevance of the prediction. In addition, this analysis should be supplemented with an evaluation of financial report trends, macroeconomic indicators, and specific transportation sector data, such as fleet utilization rates or fuel cost fluctuations, in order to obtain more comprehensive results.

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